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https://doi.org/10.15184/aqy.2026.10320

Research Article

Ashes from Pompeii: incense burners, residue analyses and domestic cult practices

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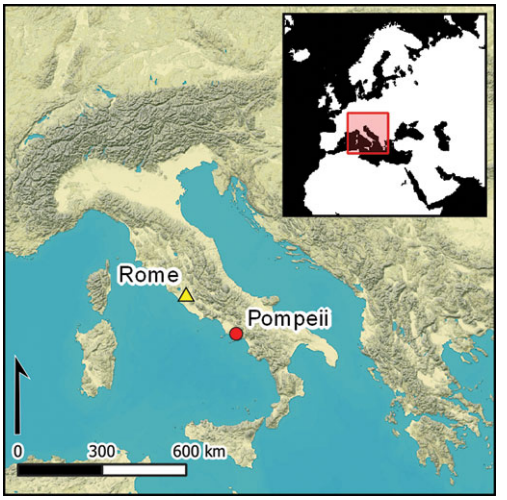

Incense burners are frequently excavated at Roman period sites, attesting to acts of combustion within domestic ritual practices, but what was burnt is still uncertain. Here, the authors use microscopy and spectrometry to analyse burnt residues contained within two censers from domestic contexts in Pompeii and a nearby *villa*. Their results indicate that woody plants were burnt in both censers, either as fuel or offerings, alongside stone fruit or laurel plants and possibly wine or grapes, while traces of Burseraceae resins, originating from Asia or sub-Saharan Africa, provide the first archaeological evidence of incense offerings in the Pompeian domestic cult.

Keywords: Mediterranean Europe, Italy, Roman, organic residue analysis, phytoliths, ash calcitic microremains

Introduction

In AD 79, the Roman city of Pompeii and its hinterland were buried beneath thick layers of ash and lapilli (small volcanic fragments) following the eruption of Mount Vesuvius. Beneath this volcanic cover, other types of ashes were also preserved, including

Received: 24 April 2025; Revised: 17 October 2025; Accepted: 6 November 2025

Figure 1. Censer no. 1 (PAP inv. 10697) (photograph by J. Eber).

the burnt organic material contained within two terracotta vessels recovered from domestic contexts during twentieth-century excavations (Figures 1 & 2). These residues identify the vessels as incense burners or censers—fireproof containers used for burning fragrant resins and other aromata, often as part of religious rituals. Numerous incense burners have been identified in Pompeii and other Roman cities, some found in domestic shrines and occasionally bearing scorch marks on their interiors (e.g. D'Ambrosio & Boriello 2001; Eber in press). Burnt organic residues, however, are rarely preserved. In some cases, successful analyses of samples, for example from Nabataean incense burners (Huber *et al.* 2018) and Judahite altars (Arie *et al.* 2020), enhance our understanding of ancient cult practices and enable reconstruction of ancient odours and smellscapes (Huber *et al.* 2022), thus forming an essential basis for research in the emerging field of 'sensory archaeology' (cf. Skeates & Day 2020).

The two Pompeian incense burners are therefore an invaluable resource for deepening our understanding of smoke offerings in the Roman domestic cult. Through the application of organic residue analysis and the examination of phytoliths and calcitic (calcite-based) micro-remains, this article aims to identify the substances burnt in each vessel. The results of these analyses contribute to reconstructions of Roman domestic sacrifices, which have so far been primarily based on ancient texts and images (e.g. Fröhlich 1991; Elsner 2012; van Andringa 2021: 79–98).

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Figure 2. Censer no. 2 (PAP inv. 40196) (photograph by J. Eber).

Classification, contexts and chronology of the censers

The two incense burners fit well into the typological spectrum of censers from Pompeii and beyond. Censer no. 1 is an incense cup, a goblet-like terracotta vessel composed of two parts: a conical foot and a shallow bowl (Figure 1) (D'Ambrosio & Boriello 2001: 45, cat. 54). This form, encompassing minor morphological variations, is commonly found in the Vesuvian cities, Italy, Dacia and the north-western Roman provinces (Mihăilescu-Bîrliba 1996; D'Ambrosio & Boriello 2001: 70–1, Gruppo G). Censer no. 1 was discovered in 1954 in the *Officina di Sabbatino* (II.8.4–5; this number format is specific to the Pompeian address system and identifies the location of a house or unit, which does not necessarily have a modern name), a building converted from a residence into an inn around the mid-first century AD. At the time of the volcanic eruption, the conversion was probably incomplete and the house uninhabited (Dentamaro 1997: 103–106). Smoke offerings and domestic sacrifices at construction sites were not uncommon in Pompeii and are attested at several other locations, such as IX.10.1 (Comegna & Corbino 2023). The find context, together with the stratigraphic dating of comparable examples, places this censer in the Early Imperial period (late first century BC to the eruption of Mount Vesuvius in AD 79).

Censer no. 2 is a hemispherical bowl decorated with three anthropomorphic female appliqués—two busts flanking a reclining woman (Figure 2) (Fergola 1987: 165).

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Figure 3. Censer no. 2 in situ *in the domestic shrine at Boscoreale (Pompeii, Archivio Fotografico inv. H6803).*

Similar examples with attached female figures are attested at Pompeii and Campania, though they appear to represent a local type (D'Ambrosio & Boriello 2001: 46–60, Gruppo E). The reclining figures likely depict deceased individuals venerated after their death (Eber in press). The censer was found in 1986 *in situ* within the fully furnished domestic shrine of a *villa rustica* in Boscoreale, a town near Pompeii (*proprietà Risi di Prisco*), together with a marble statuette of a reclining woman, a silver plaque and several vessels (Figure 3) (Stefani 2002: 112–15). This context identifies censer no. 2 as a cult instrument used for burning offerings during domestic rituals. Based on its form and the iconography of the appliqués, the vessel can be dated to the mid-first century BC to the mid-first century AD.

Smoke sacrifices in the Pompeian domestic cult

The archaeological contexts of both censers indicate an association with domestic cult practices—religious rituals conducted in residential and commercial buildings at household shrines (*lararia*) (Bassani 2008; van Andringa 2009: 217–69). About 570 such shrines are known from Pompeii (Boyce 1937; Orr 1972; Giacobello 2008). They often include painted or sculptural depictions of the deities worshipped there—the Lares (guardians of the house and land), the Genius of the *pater familias* (the protective spirit of the male head of the household) and the Penates (protectors of the pantry)

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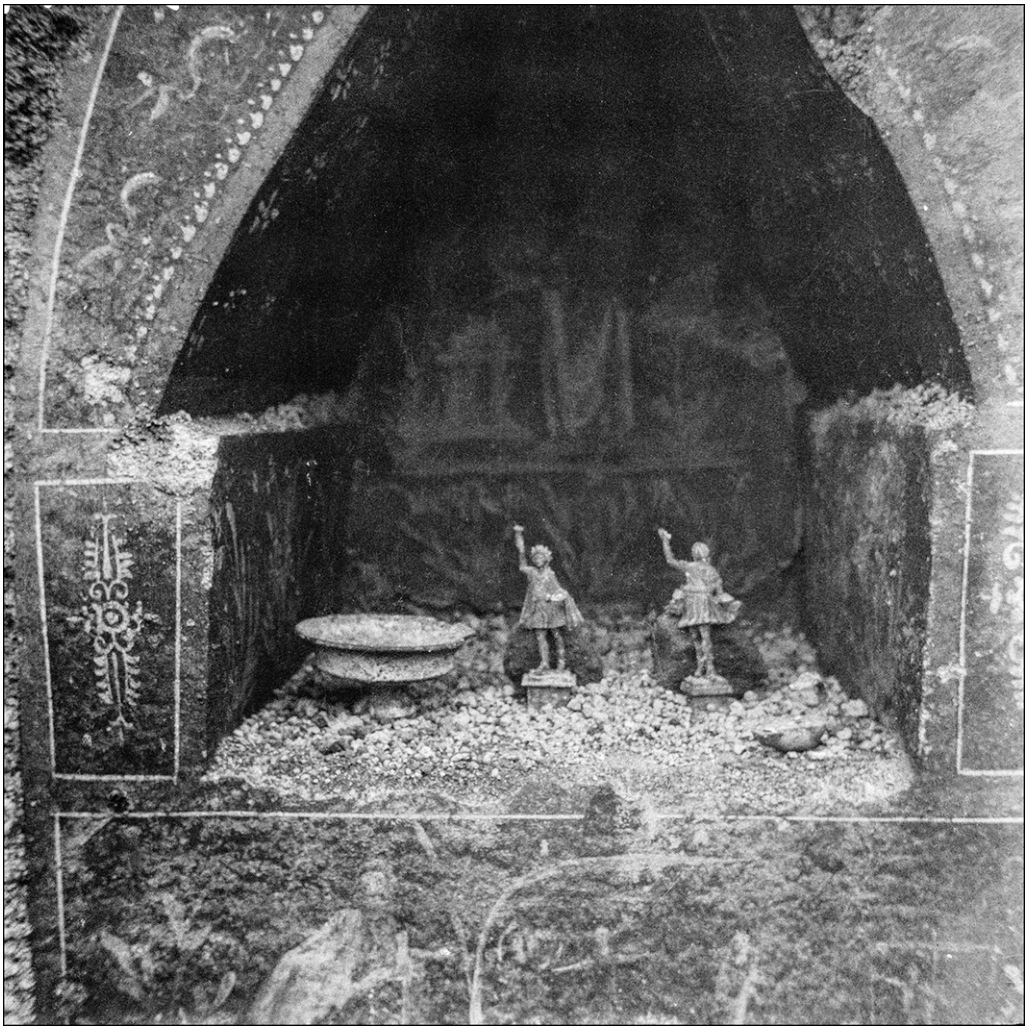

Figure 4. Household shrine in the Casa del Larario del Sarno *(I.14.7) with statuettes of Lares (PAP inv. 12125, 12126), a lamp (PAP inv. 12124) and a censer (PAP s.n.) (Pompeii, Archivio Fotografico inv. D964).*

(Fröhlich 1991; Kaufmann-Heinimann 1998: 209–26). The shrine in Boscoreale, where censer no. 2 was found, as well as the *lararium* of the *Casa del Larario del Sarno* in Pompeii (I.14.7), demonstrate that such domestic shrines held ritual instruments for sacrificial offerings, including censers (Figure 4) (Maiuri 1958: Tav. II; Eber 2022; Eber in press). Domestic sacrifices are also well documented in Latin literature: Roman authors often mention incense offered to the Lares and Penates (e.g. Juvenal 12.87–89: Morton Braund 2004; Propertius, *Elegies* 3.10.19–22, 32: Goold 1990); the scent of burning incense was considered sacred and pleasing to the gods (*Elegies* 4.4.1). Other sources record additional offerings such as wine, fruit, cakes, grain, flowers and wreaths (e.g. Plautus, *Aulularia* 24–25: De Melo 2011; Ovid, *Tristia* 3.13.13–17:

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Figure 5. Lararium *of the* Casa dei Vettii *(VI.15.1) with painted Lares (height 660mm) and Genius (height 630mm) (photograph by J. Eber).*

Wheeler 1924). Visual depictions also reflect incense offerings: in a painting in the *lararium* of the Casa dei Vettii (VI.15.1) a Genius flanked by two Lares holds a libation bowl and an open incense box (Figure 5).

Evidence of (frank)incense and sacrifices in Pompeii

Frankincense (the resin of the *Boswellia* tree, Latin: *t(h)us*) and other aromatic resins have so far not been archaeologically attested in Pompeii. Their presence is, however, documented epigraphically: a graffito from the *Thermopolium di Fabius Memor e Celer* (IX.7.24–25), probably written after AD 62, lists a small quantity of *thus* priced at one As, alongside staples such as oil, cheese and dates (CIL IV (Corpus Inscriptionum Latinarum vol. 4) 5380; Solin & Caruso 2016). The funerary inscription of the magistrate M. Obellius Firmus, from his tomb outside Porta Nola, also records that 10kg of frankincense were burnt at his burial (Cooley & Cooley 2014: 195, F114).

Burnt remains of (domestic) sacrifices have been found in several Pompeian contexts. Early excavation reports from the eighteenth and nineteenth centuries mention residues on several altars and in incense burners, including ash residues on a bronze tripod from the *sacrarium* (shrine) of the *Praedia di Giulia Felice* (II.4.2; MANN Inv. 27874; Winckelmann 1762: 48–49) and the remains of a bird skeleton and a laurel branch in bronze tripods near the garden shrine of the *Casa del Fauno* (VI.12.2; Fiorelli 1862: 253).

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In the twentieth century, further ash residues were discovered on altars such as the street altar at I.11 (Figure 6; Della Corte 1913: 189). However, none of these samples were scientifically analysed, and no material has survived.

More recently, ritual deposits of miniature censers, ashes and charcoal, containing burnt plants and animal bones, have been excavated in several houses and studied microscopically (Ciaraldi & Richardson 2000: 79; Robinson 2002, 2003, 2019; Ellis *et al.* 2023: 144–45). Identified materials include the remains of various plants, fruit stones, pine nuts, walnuts, figs and pomegranates. Similarly, residues from the *lararium* in IX.10.1 revealed figs, dates, olives, pine nuts, eggshells and fish vertebrae (Comegna & Corbino 2023) and the contents of an incense cup from the *lararium* of the *Casa di Fedra* (IX.12.B) consisted of burnt wood fragments—probably fuel—together with charred fig syconia and twigs with small leaves (Comegna 2024). While these observations are revealing, scientific analyses have the potential to identify further offerings.

Material and methods

The residues preserved in the two censers have not previously been studied. Analysis of the ashes from censer no. 2 is mentioned by G. Stefani (2000: 438, note 76), but results were never published, and no documentation exists regarding any post-excavation treatment. Based on the excavation photograph (Figure 3), some lapilli appear to have been removed from the interior of censer no. 2; similar documentation is not available for censer no. 1. As neither censer was recovered during recent excavations, control samples of the surrounding soil and lapilli could not be obtained.

Sampling was minimally invasive to preserve the original appearance of both objects. For each vessel, samples of burnt material were taken at two points: near the rim and in the centre (Figure 7). Samples of the pebble-like, charcoal-rich material from censer no. 1 and the fine ashy residues from censer no. 2 were collected not from the surface but from a slightly deeper layer to avoid contamination. Details of the samples are provided in Table 1.

Ash calcitic micro-remains

The concentration of calcitic ash micro-remains in each sample was quantified to determine whether additional fuel was used for incense burning and, if so, what type. Two micro-remains were quantified: ash pseudomorphs of calcium oxalate crystals (CaOx; biominerals formed in woody plants) and dung spherulites, which develop in the intestines of ruminants and indicate the use of dung as fuel (Gur-Arieh & Shahack-Gross 2020). Concentrations of dung spherulites and CaOx/ash pseudomorphs per 1g of sediment were calculated following the method of Gur-Arieh and colleagues (2013). Approximately 40mg of sediment were sieved through a 150µm mesh. The residue was suspended in 500µL sodium polytungstate (2.4g/L density) and sonicated for 10 minutes to prevent aggregation. The suspension was vortexed, and immediately 50µL was mounted on a glass slide, covered with a 24 × 24mm cover slide and analysed

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Figure 6. Pompeii, street altar on the façade of I.11, height of the altar is 870mm (Pompeii, Archivio Fotografico inv. C756).

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Table 1. Measurements and distribution of the samples.

Censer no.	Sample no.	Context	Mass of sample used for each analysis (g)		
			Calcitic ash	Phytolith	Organic residue
1	1.1	Edge	0.0634	0.6359	
1	1.2	Centre			0.1139
2	2.1	Edge	0.0637	0.414	
2	2.2	Centre			0.5307

Figure 7. Locations from which the samples were taken. Left: sample nos. 1.1, 1.2; right: sample nos. 2.1, 2.2 (censers not to scale) (photographs by C. Comegna (PAP) & J. Eber).

at ×400 magnification—first under plane-polarised light for ash pseudomorphs and then under cross-polarised light for dung spherulites. Micro-remains were counted in about 30 fields of view, and their concentration per gram of sediment was calculated following the formula presented by Gur-Arieh and colleagues (2013: 4335). The formula includes the following steps:

$$\frac{\Sigma \textit{ of microremains counted}}{\textit{Area counted } (\textit{no. of fields counted} \times \textit{area of 1 field of view})} \times \textit{Area of the slide} = \textit{no. of microremains on the slide } (50\mu l) = A \quad (1)$$

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$$10A = \frac{no.\ of\ microremains\ in\ all\ the\ solution\ (500\mu l)}{Initial\ sample\ weight\ (mg)} \times 1000$$
$$= no.\ of\ microremains\ in\ 1\ gr\ sediment \quad (2)$$

Sample no. 1.1 consisted mainly of charred material, preventing reliable identification of ash micro-remains; it was therefore reanalysed after heating at 500°C for four hours, leaving approximately 6mg of residue.

Phytoliths

Phytoliths are durable biogenic silica particles that form in plants and can survive decomposition or burning. They often preserve the shape of the cells in which they developed, allowing identification of plant species and plant parts (Power *et al.* 2014). To eliminate large charcoal fragments, sample no. 1.1 was dry-ashed by heating it to 550°C for three hours in a muffle oven and leaving it to cool for 30 minutes. One millilitre of 6M hydrochloric acid (HCl) was then added to sample no. 2.1 and the dry-ashed sample no. 1.1 to decalcify combustion-generated calcites. The samples were left until the reaction ceased (approximately two hours), then rinsed and centrifuged at 2000 × g for 10 minutes (Roth Mini-centrifuge) to remove the HCl, which was extracted from the samples by pipetting off the supernatant. This process was repeated three times.

A weighed portion of each processed sample was mounted on glass slides with 18 × 18mm or 22 × 22mm coverslips, depending on sample volume. Approximately 20µL of 25% glycerine solution was added before applying the coverslip. The mounting was performed in a laminar flow hood, and the slides were examined under brightfield and cross-polarised light using a Leica DM 5500 B microscope (N Plan 20×/0.40, HCX Plan 40×/0.65, HC PL Fluotar 63×/0.90, halogen light source). Phytoliths were enumerated through single and multi-cell counts using standard methods, counting each on its own tally (Weiss *et al.* 2022). Single-cell tallies include each single-cell phytolith as part of each multi-cell. Morphotypes were then counted using a field count method, which involved counting a recorded slide area, column by column, until a set count was reached. The number of phytoliths on the slide was calculated using the following algorithm (Power *et al.* 2014):

$$No.\ phytoliths\ per\ slide = \frac{no.\ phytoliths\ counted}{no.\ fields\ counted} \times total\ no.\ fields\ on\ the\ slide$$

This value was then used to derive a comparable unit of quantification for each phytolith type per gram of dry sediment as follows:

$$No.\ phytoliths\ per\ gram = \frac{no.\ phytoliths\ per\ slide}{tota\ amount\ of\ sediment\ mounted\ (mg)} \times \frac{total\ phytolith\ amount\ (mg)}{total\ initial\ sediment\ (mg)} \times 1000$$

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Organic residue analysis

Samples 1.2 and 2.2 (from the centres of the censers) were used for organic residue analysis, a bioarchaeological approach examining biomolecular components derived from the metabolites of plant and animal resources. Lipids are generally the most studied compounds, but other products, including plant secondary metabolites such as resins or fragrance oils, are also considered. Following established protocols (Mottram *et al.* 1999; Garnier & Valamoti 2016), lipid/resin extraction was performed using organic solvents (DCM:MeOH 2:1), followed by acid extraction and butylation to target fruit diacids, which are insoluble in organic solvents. The samples were then trimethylsilylated and analysed by gas chromatography and gas chromatography mass spectrometry (GC and GC-MS), following established parameters (Rageot *et al.* 2019a).

Results

Analysis of ash calcitic micro-remains indicates that neither sample contains dung spherulites and both have a high concentration of mostly rhombs-shaped ash pseudomorphs in the range of 3–3.6 million per gram of sediment. These results indicate the burning of woody plants, mainly eudicotyledons (or eudicots: flowering plants with two seed leaves (cotyledons) at the time of germination) based on the dominance of rhombs-shaped pseudomorphs (cf. Table S1; Durand *et al.* 2010; Prychid & Rudall 1999).

Phytoliths are present in both censers, showing concentrations of 4 866 660 (no. 1.1) and 384 578 (no. 2.1) per gram (cf. Table S2). Both samples are characterised by higher percentages (60–93%) of phytoliths derived from monocots and lower percentages of phytoliths derived from eudicots (6.3–40%; Figure 8). Grass short-cells are dominated by grasses of the subfamily Pooideae (sample no. 1.1: Pooideae = 414 493, Chloridoideae = 79 710, Panicoideae = 47 826; sample no. 2.1: Pooideae = 14 438, Chloridoideae = 1313, Panicoideae = 1313). Pooideae grasses typically grow in areas with seasonal climates, while Chloridoideae are associated with arid climates and Panicoideae are typical of tropical growing conditions. Morphotypes from eudicots are present in both samples (1.1 = 621 739; 2.1 = 13 126), with the presence of the facetate tracheids, hairbases, polyhedron and angular morphotypes indicating leafy eudicots (Hermans *et al.* 2025).

Phytoliths indicate the presence of a variety of plant types and parts, including grass stems and husks. Most of the phytoliths derive from C_3 grasses but there is also some evidence for C_4 grasses (Panicoideae and Chloridoideae) and thick-leaved shrubs in both censers.

Molecular analysis of the organic residues reveals no biomarkers in sample no. 1.2. This suggests that lipids/resins are not preserved in censer no. 1. However, molecular analysis of sample no. 2.2 via GC-MS identified triterpenic markers that can be associated with a Burseraceae resin, probably from *Canarium* (a genus of tropical and subtropical trees), as well as markers of fatty substances and aldaric acids suggesting the presence of a grape product. The association of α- and β-amyrins, lupeol and their derivatives also strongly suggests the presence of a Burseraceae resin, in particular a *Canarium* resin

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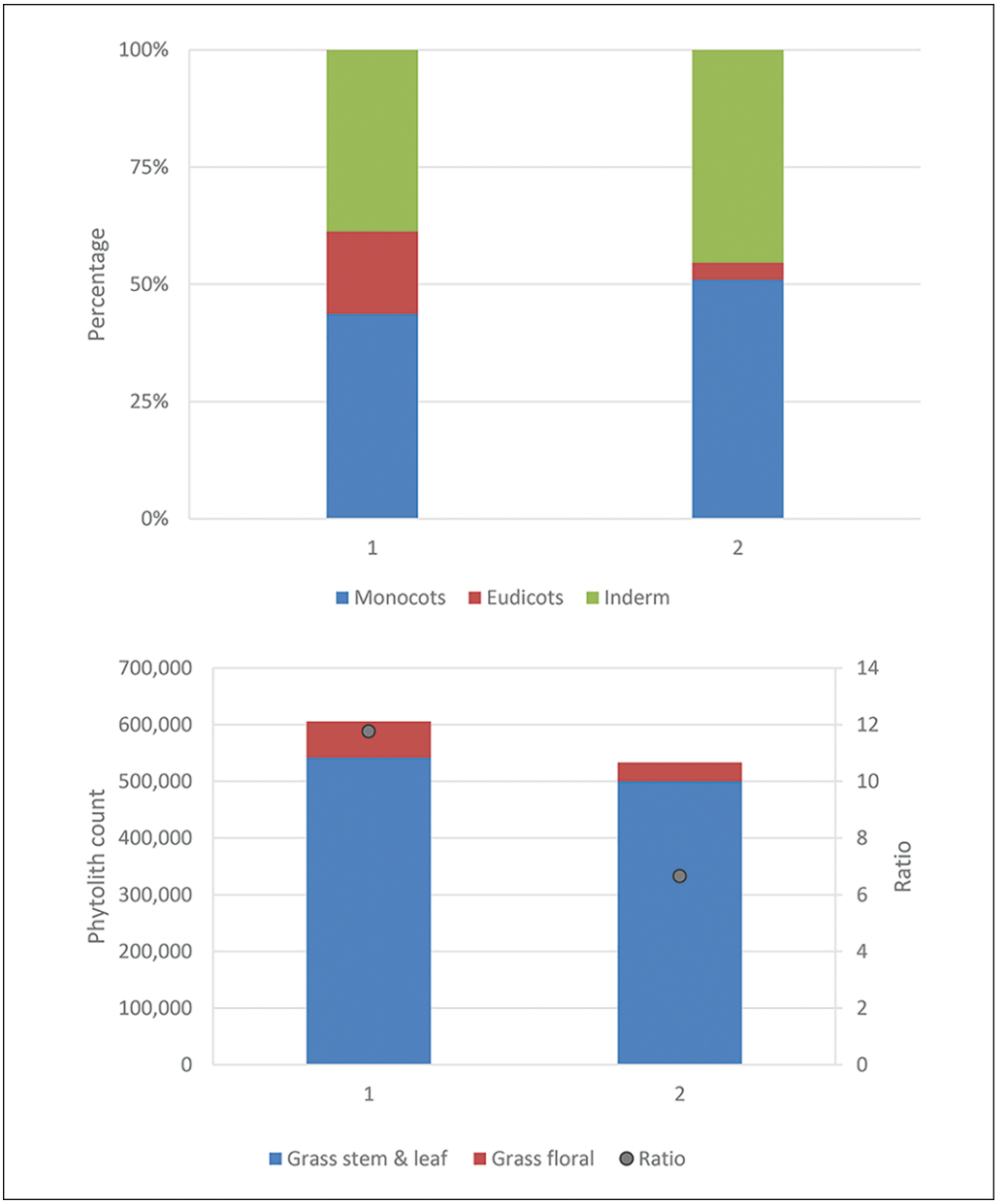

Figure 8. Attribution of phytoliths (top); total numbers of floral versus leaf/stem from the total monocots phytolith counts that can be assigned to plant parts on left axis, with floral-stem/leaf ratio on right axis (lower) (figure by R. Power).

also known as elemi (e.g. Rageot *et al.* 2023). In addition to α-amyrin acetate and lupeol acetate, the presence of epi-amyrins (α and β) and epi-lupenol confirms the presence of Burseraceae resin, as these compounds are identified in both frankincense and elemi (Mathé *et al.* 2004; Regert *et al.* 2008; Rageot *et al.* 2023). However, boswellic

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acids/acetates, which are characteristic markers of frankincense, were not detected in sample no. 2.2, nor were their degradation products (24-noroleana-3,12-diene and 24-norursa-3,12-diene) (Evershed *et al.* 1997).

Although the presence of some of the identified compounds may be related to natural decay processes, the detection of pentacyclic triterpene hydrocarbons, mainly derived from the dehydration of resin biomarkers (e.g. lupa-2,20(29)-diene; urs-2,12-diene), suggests exposure to heat treatment (Rageot *et al.* 2019b). The presence of acetate derivatives of olean-18-en-3-ol, α-amyrin and lupeol could also be considered as a secondary indicator of resin heat treatment (Rageot *et al.* 2023), although α-amyrin acetate has also been identified as a biomarker of *Canarium strictum* resin, the Indian elemi (Hinge *et al.* 1965).

The presence of a combination of succinic, fumaric, malic and tartaric acids in significant quantities within the residues contained in censer no. 2 (sample no. 2.2) (>5µg/g of residue) suggests the presence of a fruit-derived product, most likely of grape origin (e.g. Rageot *et al.* 2019a; Drieu *et al.* 2020). A malic-to-tartaric acid ratio of 0.7 could correspond to the chemical signature of a ripe grape product, such as wine or vinegar (Drieu *et al.* 2021). However, caution is required in identifying these biomarkers, particularly when they are not retrieved from the clay matrix of the vessel (Garnier 2021) and post-depositional contamination cannot be excluded. Indeed, no sediment control samples from the context were preserved, preventing the final confirmation that these biomarkers are associated with the original content of the incense burner. Likewise, the presence of fatty substance markers in this surface residue (i.e. not absorbed into the clay matrix of the vessel), such as monoacylglycerols or even diacylglycerols, does not rule out later contamination from biological soil activity (including from modern human contact), especially when they are associated with a low quantity of free fatty acids (Figure 9 & S1).

Discussion

The concentration of ash pseudomorphs in both analysed samples indicates that woody plants were burnt in both censers. This may reflect the use of charcoal or a similar fuel but could also derive from the offered plant or incense itself. Identified phytoliths suggest that the plant groups represented most likely include oaks (*Quercus*), laurel (*Lauraceae*) and mulberry or other stone-fruit plants (*Moraceae* or *Prunus* sp.). This identification is indicative rather than definitive due to capture biases and taphonomic filtering in phytolith assemblages (Power *et al.* 2021). Both censers thus contain traces of burnt plants, consistent with some of the votive deposits described in classical texts and previously published microscopic analyses. The similarity of these residues to those recently analysed from the *lararium* in house IX.10.1 (Comegna & Corbino 2023) and the incense cup from the *Casa di Fedra* (IX.12.B) (Comegna 2024) suggests that plant offerings were a common practice in the Pompeian domestic cult. While some plants, such as the C_4 grasses, may have been imported, the simultaneous presence of similar plants in non-cult-related contexts at Pompeii (Ciarallo 2004: 212–50; cf. Jashemski *et al.* 2002) suggests that most of the plants used as offerings were locally grown.

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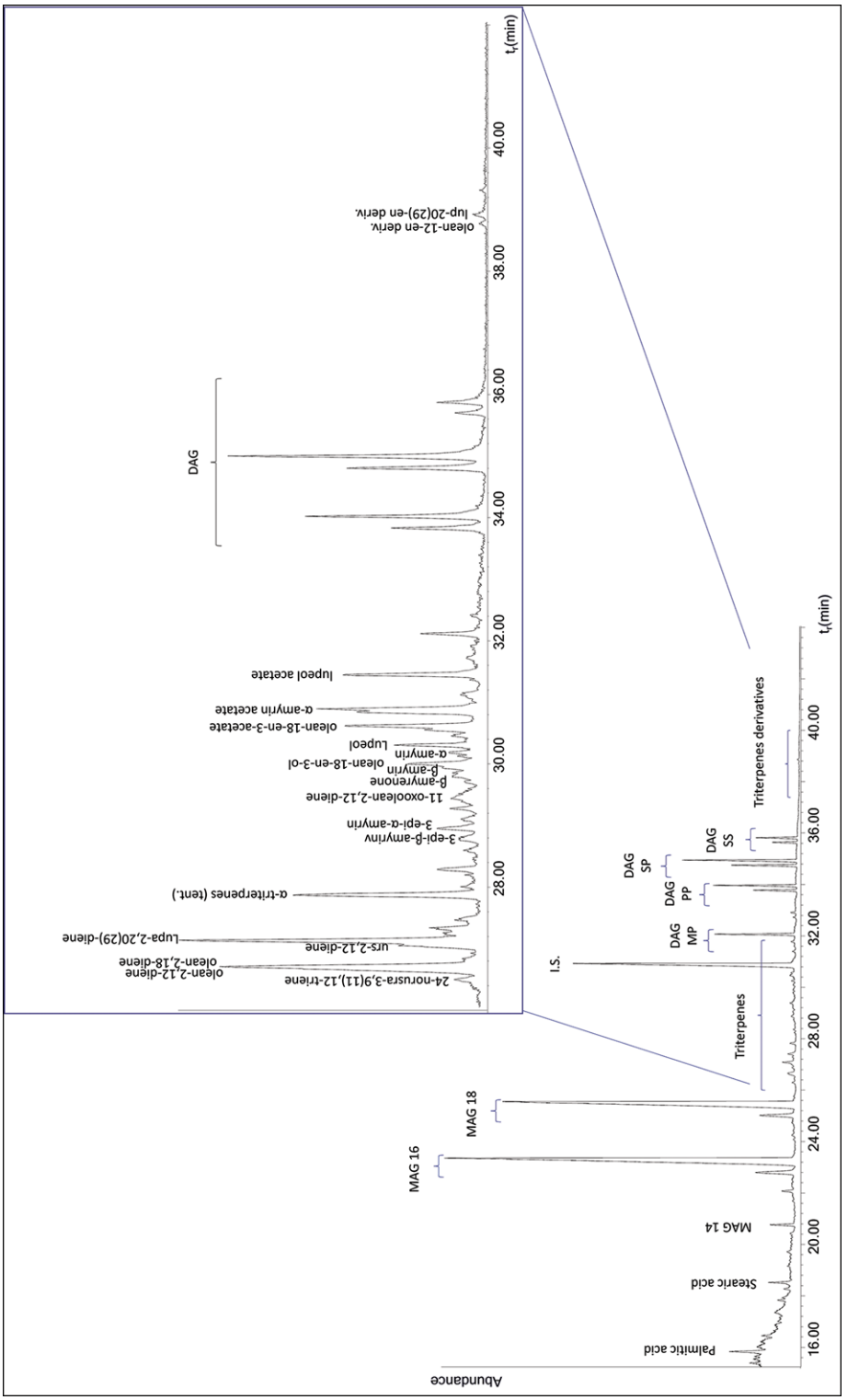

Figure 9. Partial gas chromatograms of organic residues extract from censer no. 2. The top right window corresponds to the Ion Extract Chromatogram (m/z 189) showing the triterpenes constituents of the Burseraceae resin. MAG: monoacylglycerols; DAG: diacylglycerols; M: Myristin; P: Palmitin; S: Stearin; I.S.: internal standard (figure by M. Rageot).

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Roman authors report that some of these plants were sacred to specific gods: oak was sacred to Jupiter (Pliny the Elder, *Historia Naturalis* 16.11: Rackham 1945), while laurel was burnt in honour of Apollo (*Elegies* 2.28a, 36). Written sources are, however, not always explicit about plant sacrifices in domestic contexts and the wreaths (*coronae*) mentioned in several texts cannot be further specified (e.g. *Aulularia* 385–87; *Tristia* 3.13.13–18).

The burnt Burseraceae resin residues in censer no. 2 represent the first archaeological evidence of an imported resin in Pompeii. While the possibility of a *Boswellia* resin, derived from trees endemic to the southern Arabian Peninsula or East Africa, cannot be entirely excluded, the traces most likely derive from *Canarium* (elemi), which may have originated in sub-Saharan Africa or Asian rainforests, particularly India (Rageot *et al.* 2023: fig. 5). In conjunction with finds such as the Indian statuette of Lakshmi from the *Casa della Statuetta Indiana* (I.8.5; MANN Inv. 149425; Ferrari 2016), this resin underscores Pompeii's integration into a trade network extending far beyond the borders of the Roman Empire. Odoriferous resins from Arabia and the African and Asian rainforests were traded alongside commodities from India and sub-Saharan Africa, moving northward across the Red Sea from at least the first century BC (*Historia Naturalis* 12.64; cf. Groom 1981; Young 2001; Mattingly *et al.* 2017; De Romanis 2020). These goods were eventually shipped via Alexandria to Italy through Portus and Puteoli, where incense traders are also attested epigraphically (Faider-Feytmans 1952: 151, cat. R.71).

Beyond these economic insights, the results presented here provide a rare archaeological perspective on ritual practices, previously attested only in written and visual sources. Alongside the burnt Burseraceae resins, organic residue analysis detected traces of fat and grape biomarkers in censer no. 2. While caution in interpretation must be maintained, this may suggest that wine was poured into the vessel. The combined offering of wine and (frank)incense (*ture ac vino*) was among the most commonly enacted preliminary sacrificial acts in Imperial Rome. Known as the *praefatio*, this ritual is frequently depicted in sacrificial scenes showing a *togatus* (a man wearing a toga) with an open incense box pouring a libation onto an altar. Relief work and painted *lararia* in Pompeii indicate that this ritual also took place in the city (Figure 4; e.g. CIL VI 2065 I 19; Cato, *De agri cultura* 134, 1–2, Hooper 1934; cf. Scheid 2003: 79–83; Elsner 2012). As noted above, the iconography of the appliqué busts on censer no. 2 links the vessel to domestic commemoration of the dead. The offering of incense and wine also played a central role in the Early Imperial funerary cult, as evidenced by literary descriptions by Statius and Martial and by the recovery of incense burners from Pompeian funerary contexts and the inclusion of libation tubes used for wine and perfume as offerings in graves (e.g. Statius, *Silvae* 2.1.158–62; 2.6.85–90, Shackleton Bailey 2015; Galeandro *et al.* 2021: 249; Van Andringa 2021: 115–28).

Conclusion

By using a combination of different analytical methods, we can gain a broader understanding of the different substances that were burnt inside Pompeian censers. Although the sparsely documented post-excavation histories of both artefacts analysed here

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necessitates caution in interpreting the results, the preserved ash pseudomorphs and phytoliths support the identification of (presumably) locally grown plants. This provides an additional perspective on domestic rituals, as written sources often emphasise the use of imported (frank)incense. The presence of resin remnants of this kind, identified through organic residue analysis, are reported archaeologically for the first time from Pompeii. These findings not only reinforce understandings of Pompeii's wide trade connections but, together with the traces of grape biomarkers, offer an archaeological complement to written and visual sources concerning Early Imperial sacrificial practices.

Acknowledgements

We thank the former and current directors of the Parco Archeologico di Pompei (PAP), Massimo Osanna and Gabriel Zuchtriegel, for authorising the analyses and the publication of this study. Many thanks go also to Anna Maria Sodo, Valeria Amoretti and Chiara Comegna (PAP) for further authorisation and practical help, as well as to Ruth Bielfeldt (Ludwig-Maximilians-Universität München). All photographs are courtesy of the Ministero della Cultura, Parco Archeologico di Pompei; reproduction by any means is prohibited.

Funding statement

This study was co-funded by the European Research Council (ERC) under the European Union's Horizon 2020 research innovation programme (ERC-2015-StG 678901-Food-Transforms) as part of Philipp Wolfgang Stockhammer's ERC Starting Grant project 'FoodTransforms: Transformations of food in the Eastern Mediterranean Late Bronze Age'. Johannes Eber's research was funded as part of 'Distant Worlds. Munich Graduate School for Ancient Studies' (GSC 1039). Robert C. Power is funded by Research Ireland 32/PATH-A/9284.

Online supplementary material (OSM)

To view supplementary material for this article, please visit https://doi.org/10.15184/aqy.2026.10320 and select the supplementary materials tab.

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