

Incense burners in the Oasis of Tayma, Northwest Arabia: an olfactory perspective



Abstract: Dried resins such as frankincense or myrrh were important commodities in ancient societies due to their pleasant scent when burned. Burning aromatic fragrant smoke, used for a variety of functions in antiquity, is attested in both textual and iconographic sources. Since ephemeral phenomena such as smells and scents can be studied only through their indirect effects, investigating devices used to produce them provides important data. Incense burners are thus the essence of this investigation. Excavations at the oasis of Tayma revealed several vessels and cuboid containers, interpreted as incense burners, with preserved residues. This paper aims at presenting the assemblage of burners found at Tayma and to offer a sensory perspective on the use of aromatics in antiquity to provide new insights into the scented world of an ancient oasis.

Keywords: Tayma, Northwest Arabia, oasis, incense burners, ancient aromatics, residue analysis

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INTRODUCTION

As traditionally practiced, archaeology tends to be a visually oriented discipline on the whole. Whether publication, excavation or exhibition, nearly every step of the archaeological research process depends on the sense of sight. Yet, human perception of the world involves all five senses, that is, sound, smell, touch and taste beside sight. Although socio-anthropological approaches of the past two decades have paid a great deal of attention to the sensual world (Classen, Howes, and Synnott 1994; Classen 1997; Howes 2005; Jütte 2005; Reinartz 2014), the consideration of sensory perspectives about the past is relatively new in the field of archaeology (Betts 2017: 1). In 2005, the anthropologist David Howes proclaimed a “sensory revolution” (Howes 2005: 1), which only recently has started to have a strong impact on archaeological studies. In recent years, a shift towards sensory archaeologies (Skeates 2010; Day 2013b; Hamilakis 2013; McMahon 2013; Bradley 2015; Betts 2017) has drawn attention to an underestimated set of sensory data providing new and more far-reaching insight into the past.

Smells and olfaction seem to have been important in the lives of ancient people judging by historical texts which describe all sorts of areas of application for odors and scents (Celsus *Med.* 5,7). As demonstrated by a high number of fragrant commodities transported in the past, aromatics played a pivotal role in antiquity. Among them, dried resins such as frankincense or myrrh were valued and appreciated goods due to the sweet smoke they produce when burned. According to Pliny the Elder, aromatics were burned on a lavish scale during the Roman Empire (Plin. *NH* 12,41).

Since ephemeral phenomena such as odours or scents usually do not leave any traces, dealing with them is for archaeologists certainly a challenging task. Smells created in the past disappeared long before modern scholars undertook research at a given site. Fragrant smokes obtained by burning incense are characterized by their transience and diffusiveness, not leaving any apparent imprint on the remains. Therefore, how can one investigate ancient smells and “smellscapes” (Bradley 2015: 16)?

BETWEEN PHENOMENOLOGY AND NATURAL SCIENCE: MULTIDISCIPLINARY APPROACH TO INVESTIGATING ODORS

Obviously, there is no universal method of reconstructing ancient smells or sensorial experiences. Scholars have developed various methods of how to approach the sense of smell depending on contexts, sources and archaeological evidence (Day 2013a; 2017; Bradley 2015; Derrick 2017;

Flohr 2017). Since past smells emitted by aromatic substances are long gone, they can be studied only through indirect effects, that is, the devices used to produce it. Devices such as incense burners are, therefore, essential for this kind of investigation.

In this paper, the analysis is based on the material evidence from the ancient oasis of Tayma, Northwest Arabia, an archaeologically rich and well documented site, which has yielded an extensive data set for discussing phenomena such as ancient smells, scents and aromatics. The excavations at Tayma have been carried out by a joint Saudi-German expedition composed of the Saudi Commission for Tourism and National Heritage (SCTH) and the Orient-Department of the German Archaeological Institute (DAI). Mainly funded by the German Research Foundation (DFG), one of the project's research aims is the investigation of economic processes in an ancient oasis that was after all one of the stops on the "Incense Road" network (Hausleiter and Eichmann 2018).

Investigations revealed several vessels and containers interpreted as incense burners, showing both traces of burning and residue of resinous substances preserved on the inside. Even though invisible, like their smell, absorbed residues of resins such as frankincense or myrrh are among the organic materials that are well preserved in the archaeological record due to their long stability (Van Bergen et al. 1997: 8409; Regert et al. 2008: 668). Molecules of substances can survive within the walls of pottery containers or in the pores of coarse stone material (Evershed 2008a: 26; 2008b: 903–904; Roffet-Salque et al. 2017: 627).

At Tayma, organic residue in incense burners survived in three different forms: the fill inside vessels found *in situ*, the visible residue appearing on the inte-

rior surfaces of artifacts (i.e., crusts) and the absorbed residue. Organic remains in incense burners are thus well suited for organic residue archaeological analysis, a standard tool in chemistry. Once extracted, the analysis of these residues by means of chromatographic and mass spectrometric techniques enables us to identify the nature of the used aromatics by determining characteristic profiles of secondary metabolites of natural products such as resins (Evershed et al. 1997; Serpico and White 2000; Stern et al. 2003; Modugno, Ribechini, and Colombini 2006; Regert et al. 2008; Huber et al. forthcoming).

In this case study, a combination of analytical methods from different disciplines, including archaeology and natural product chemistry, has been applied in order to investigate the scented world of an ancient oasis. The investigation includes analyses of: (1) the artifacts, (2) the archaeological context to determine the dating and function of given objects, and (3) organic residue from archaeological contexts as well as modern botanical reference samples. This multidisciplinary approach was aimed at determining the kinds of aromatics used in Tayma from the Middle Bronze Age until late antiquity (about 2000 BCE through the 6th century CE) as well as their use contexts, offering a sound base for drawing conclusions about changes in the use of aromatics within the socio-cultural context of the oasis. Considered as generators of sensory data, the artifacts evaluated here lend themselves to a better understanding of the sensorial interactions between humans and things.

WHAT CONSTITUTES AN INCENSE BURNER?

When studying fumigation devices for burning incense,¹ several questions and problematic issues arise that should first be addressed. Faced with the variety of materials that incense burners can be made of (pottery, sandstone, limestone, soapstone, basalt, clay, bronze), their forms (cuboid boxes, blocks, goblets, bowls, pans and shovels, burners with cylindrical shafts, tripod cups, animal-shaped burners, etc.), sizes and decorations, one is entitled to ask what actually defines an incense burner (see also Zimmerle 2014: 34–35). In most cases it is the vessel form/shape. However, even though some forms like the four-legged cuboid burners are very characteristic, there are also numerous atypical forms, such as, for example, the Egyptian incense burners in the shape of an arm. Consequently, form is not enough to base a definition on (Zimmerle 2014: 34).

Traces of burning activities such as burn marks or soot, especially on the inside of a vessel, can be important clues in this regard. However, not all incense burners

show burn marks. The use of sand or ash under the embers is even now common practice (Stockhammer 2011: 207), and it could explain the clean surfaces of some vessels interpreted as incense burners. Additionally, resinous crusts or other deposits adhering to the interior can help to identify a container as an incense burner.

Another way is to look at object affordance, which is a concept developed by psychologist James Gibson to describe the potentialities or capabilities of an object for a specific set of actions (Gibson 1979; Knappett 2004).² This means that a vessel does not necessarily need to be specifically designed as an incense burner in order to be used as one. A vessel designed for a different purpose might as well be used or reused as an incense burner. Thus, in general terms, any container can be (re)used as an incense burner if it suits the purpose. An incense burner is, therefore, a device, which has the potential to contain embers and incense for the act of burning, regardless of its appearance.

CASE STUDY:

INCENSE BURNERS FROM THE OASIS OF TAYMA

The ancient oasis of Tayma [Fig. 1] stretches over more than 9 km² (Eich-

mann et al. 2006; 2010; 2011; 2012; Hausleiter 2011; 2019; Hausleiter and

- 1 In this paper the term “incense” is used in a general meaning, to indicate burning of various substances. The term “incense” does not refer to resins of any specific plant, but incorporates all organic material containing aromatic substances.
- 2 An artifact’s affordance is not exclusively an independent property of the artifact itself, but rather it is a “relational property” shared between an agent and a thing (Knappett 2004: 46). The affordance of an object may also change depending on the situation or context in which it is used (Knappett 2004: 46). In a particular situation, a vessel can serve as a beaker and afford drinking. In another context, the same vessel can be used for burning incense.

Eichmann 2018). North of the walled archaeological area lies a former salt lake (*sabkha*), to the south there are extended graveyards at al-Nasim, Rujum Sa'sa', Sana'iye and Tal'a (Petiti, Intilia, and Hausleiter 2014; Hausleiter and Zur 2016). Permanent occupation at Tayma continued over several millennia, from about 4000 BCE until modern times (see Hausleiter and Eichmann 2018: 18–19, Table 1). The construction of a substantial wall enclosing the oasis during the 3rd millennium BC (Hausleiter 2018) suggests the existence of an oasis of considerable size and importance; pottery production may have started as early as the late 4th/early 3rd millennium BCE (Tourtet, Daszkiewicz, and Hausleiter 2021: 45, 49).

MATERIAL

The study of incense burners at Tayma includes both containers made of stone and pottery vessels from different periods and areas. The earliest attestations of vessels interpreted as incense burners at Tayma can be dated to the first half of the 2nd millennium BCE, a period elsewhere known as the Middle Bronze Age. Of interest for the study of incense burners are also the early Iron Age (12th–9th centuries BCE), mid-to-late Iron Age (9th to 5th centuries BCE), and second half of 1st millennium BCE through late antiquity. The incense burners are presented chronologically in their respective contexts, starting with the earliest forms. Functional contexts that made use of these objects are discussed as well.



Fig. 1. Tayma: general plan with a walled archaeological area and graveyards south of it (DAI Orient-Department | S. Lora)

Middle Bronze Age burners

Up to now, the oldest incense burners attested at Tayma were found in Area E-East (TA 12289.20), in the center of the ancient settlement, and in Square W₄₁

(TA 7963.27) alongside the western section of the wall surrounding the oasis [see *Figs 1, 2*].

The burners are made of a coarse fabric with mineral inclusions (Macrofab-



Fig. 2. Plan of the ancient settlement area of Qrayyah and excavation areas (DAI Orient-Department | S.Lora)

ric 3; see Hausleiter 2014: Table 2) and are covered by a dark reddish slip, additionally burnished. They have been identified as belonging to the Red Burnished Ware, henceforth RBW, a ware characteristic of the first half of the 2nd millennium BCE (Hausleiter 2014: 403; Tourtet, Daszkiewicz, and Hausleiter 2021: 52–55). Only two items belonging to the RBW were identified as incense burners [Fig. 3]: (1) a small goblet with plain foot (TA 7963.27) from Square W41 and (2) a base fragment with remains of a broken handle (TA 12289.20) from Area E-East. Neither vessel has the rim

preserved. Carbonised traces are visible on the inside and outside of goblet TA 7963.27. The lowermost inner part of the vessel does not display any traces of burning, whereas the inner surface of the wall shows dark-greyish traces. Should this vessel have indeed been used as an incense burner, one might assume the lower part of the vessel to have been filled with sand, on which the embers would have been placed; this would have protected the surface from being burned by the charcoal. The second burner, TA 12289.20, displays carbonized traces solely at the center of the inner side of its base.

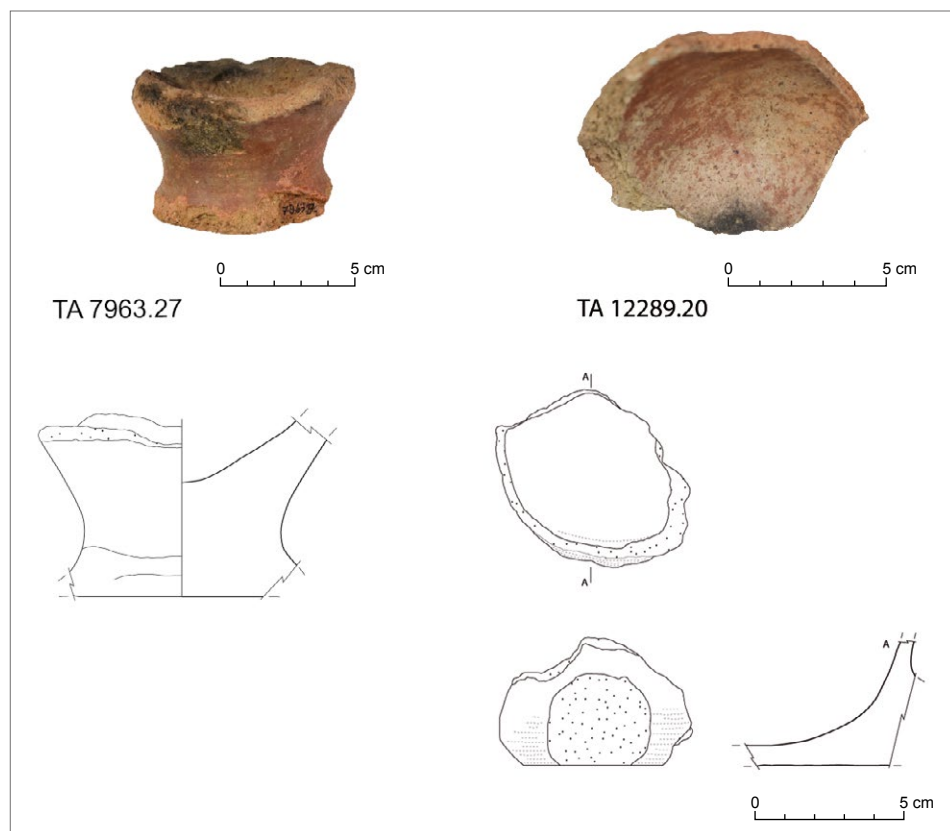


Fig. 3. Incense burners dated to the Middle Bronze Age (DAI Orient-Department | drawing A. Borlin (pencil); L. Kohl, H. Kosak (digital); photo B. Huber)

Radiocarbon dating of samples from a primary context in Square W₄₁ provided a date in the mid-2nd millennium BCE (Hausleiter 2014: 405; Tourtet, Daszkiewicz, and Hausleiter 2021: 54). Recent ¹⁴C-dating of graves at the cemetery of al-Nasim [see Fig. 1], south of the walled settlement of Tayma, indicate that RBW was produced as early as the early 2nd millennium BCE (Hausleiter and Zur 2016: 153; Tourtet, Daszkiewicz, and Hausleiter 2021: 54–55).

The two incense burners were discovered in different areas at Tayma. The first object (TA 7963.27) was found in Square W₄₁, within a tower of the outer wall

with two building stages (G. Sperveslage in Hausleiter et al. 2018b: 67–72) dating to the end of the first/beginning of the second half of the 2nd millennium BCE (Hausleiter 2014: 402, Note 8). The functional context of incense burner TA 12289.20 in Area E-East remains unclear, since it was found in a secondary deposit.

Incense burners from the early Iron Age

The early Iron Age, that is, the period between the 12th and 9th centuries BCE (confirmed by a series of ¹⁴C dates; A. Intilia in Hausleiter et al. 2019: 51), is particularly well attested in Tayma in



Fig. 4. Area O (DAI Orient-Department | drawing S. Lora)

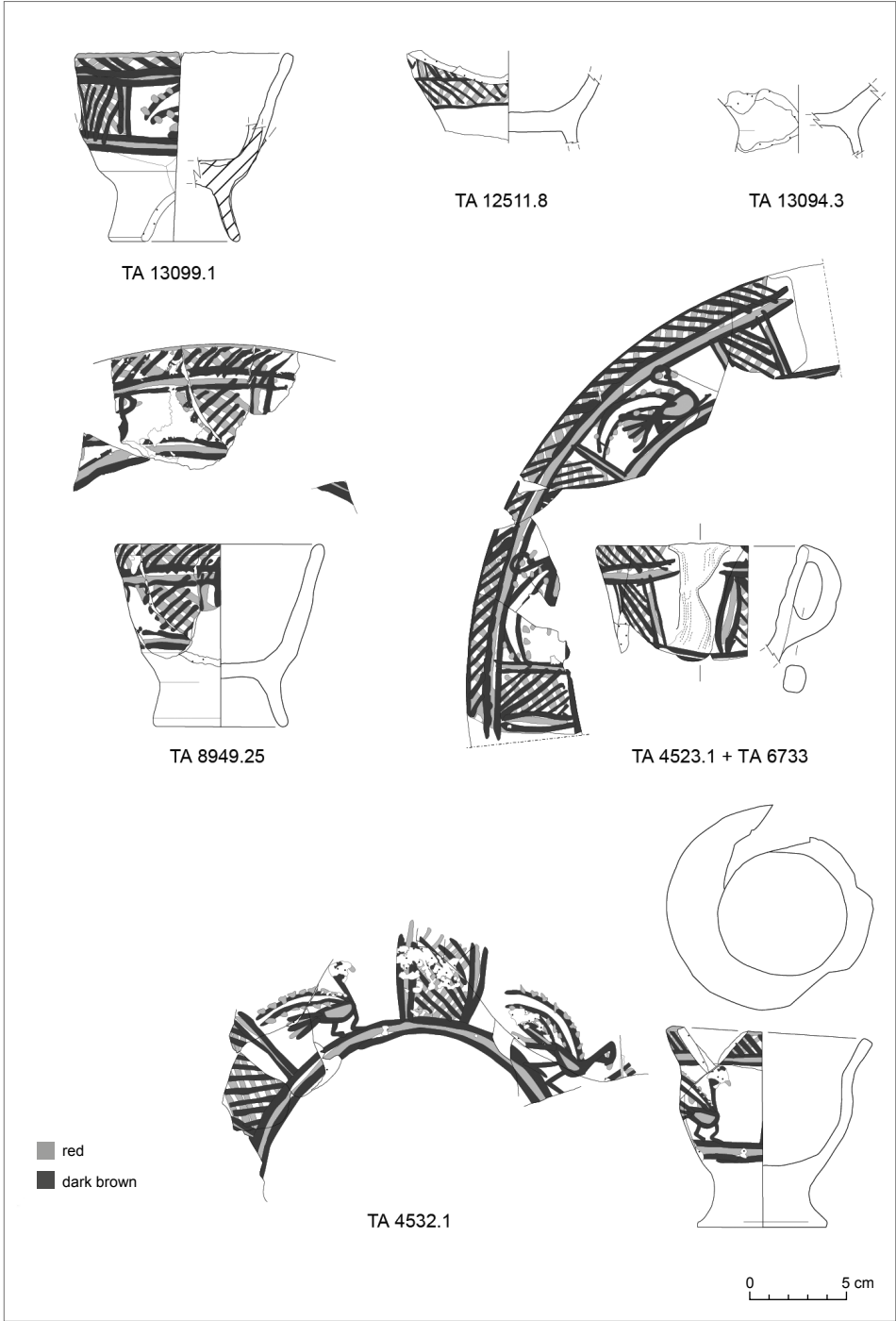


Fig. 5. Incense burners from the Early Iron Age (DAI Orient-Department | drawings A. Borlin [pencil, digital], E. Götting, H. Kosak, A. Zur [digital])

Area O [Fig. 4], a large architectural complex enclosed by a massive stone wall comprising the main public building (O-b1) and several rooms next to it (see A. Intilia in Eichmann et al. 2011: 97–102; in Eichmann et al. 2012: 100–106). North of the building is a large courtyard with a structure interpreted as a cistern; north-east of O-b1 there is a smaller building (O-b2) consisting of a group of three rectangular units, one of which contains three pyrotechnical installations [Fig. 4].

Most of the rooms of the early Iron Age complex were ultimately destroyed by fire, an event resulting in the collapse of the walls of most structures which led to the good preservation of layers predating the destruction (A. Intilia in Eichmann et al. 2012: 100–106; Renzi et al. 2016: 237). This marked the end of early Iron Age occupation in these contexts.

The rooms yielded quantities of luxury goods, including many Egyptian imports and metal objects (A. Intilia in Eichmann et al. 2011: 101; in Eichmann et al. 2012: 104; Sperveslage 2013: 243; see also Sperveslage 2019), together with

plain and painted vessels characteristic of the so-called Tayma Early Iron Age Ware, henceforth TEIAW (Hausleiter 2014: 414; Tourtet, Daszkiewicz, and Hausleiter 2021: 58–61). The prestigious goods and the architectural layout of the complex, coupled with the absence of pottery vessels and tools related to food preparation and domestic use, suggest a public and official function for this complex (A. Intilia in Hausleiter et al. forthcoming).

A group of vessels of TEIAW, characterized by their specific shape ('goblets'), was assumed to have been used as incense burners [Fig. 5]. These goblets, wholly wheel-thrown, usually consisted of two parts: an upper one—the actual burner—with an everted, simple, rounded or slightly bevelled rim and a single looped handle, and a lower one consisting of a high ring base applied to the bottom of the upper part. The goblets are made of a fine, mineral tempered fabric (Macrofabric 1; see Hausleiter 2014: Table 2) and were usually decorated with bichrome (red and dark-brown) paint on the exterior [see Fig. 5]. The most characteristic



Fig. 6. Incense burner (broken in two) with evidence of burning activities on the inside, TA 13099.1 (DAI Orient-Department | photo J. Kramer)

painted motifs are geometrical patterns such as crisscross decoration and figurative motifs (see Tourtet, Daszkiewicz, and Hausleiter 2021: 60). Frequent—but not regular—carbonization traces inside the vessels suggested their use as incense burners (F. Tourtet, personal communication).

Four goblets (TA 13099.1, TA 13094.3, TA 12511.8, TA 14714.6) were chosen for residue analysis due to clearly recognizable traces of burning on the inside and a clean

outer surface [Fig. 6]. The chemical signature of these residues clearly confirmed their use as incense burners (Huber et al. forthcoming). Other goblets of this kind either show carbonized traces on both the inside and the outside—having been burnt most probably in the fire that destroyed the buildings at the end of the early Iron Age—or no burn marks at all. As said earlier, the latter does not necessarily imply that the vessels had not been used as incense burners, an issue requiring further analysis.

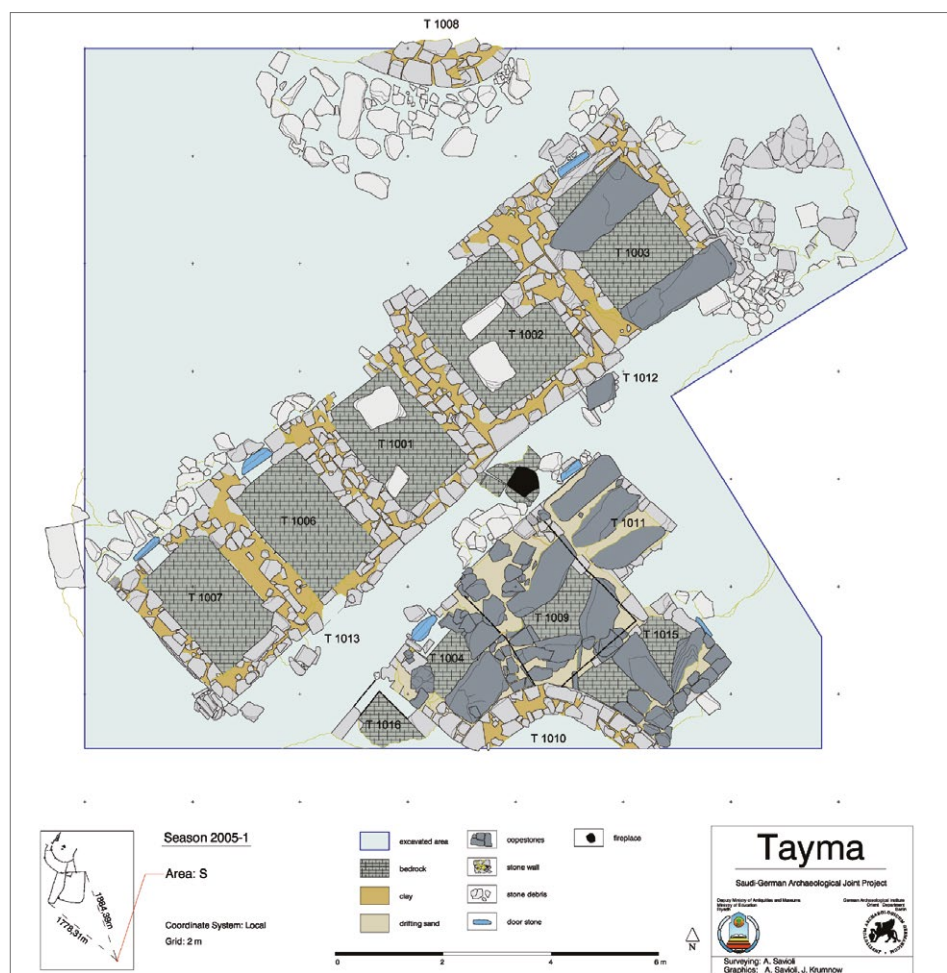


Fig. 7. Burial ground at the site of Tal'a, Area S (DAI Orient-Department | drawing J. Krumnow)

Another idea worth considering is the possibility of reuse of this type of vessels for burning incense. The foot of the goblet makes the vessel well suited for burning aromatics. The hollow space created by applying a high ring base to the cup functions as a thermal isolation chamber to protect surfaces upon which the incense burner would have been placed.

Mid-to-Late Iron Age incense burners

At Tayma, incense burners have also been found outside the walled settlement at the site of Tal'a (Area S) [see *Fig. 1*], in a burial ground located about 2 km southeast of the oasis; some graves there have been dated to a period between the 9th and 5th centuries BCE (Hausleiter and Eichmann 2018; Lora, Petiti, and Hausleiter 2010: 237; Hausleiter and Zur 2016: *Fig. 4*; Petiti, Intilia, and Hausleiter 2014: 373). At Tal'a, 15 tombs of different sizes and shapes have been excavated (A. Beuger in Eichmann et al. 2010: 134). The most characteristic examples consist of rectangular stone chambers with capstone roofs and an entrance on the northwestern side; they were used for multiple burials [*Fig. 7*]. Also discovered were small stone cists with single infant burials attached to the described tombs, simple pits with single burials and circular graves (Petiti, Intilia, and Hausleiter 2014: 373).

A characteristic painted pottery, Sana'iye Painted Ware (see Hausleiter 2014: 414–418; Tourtet, Daszkiewicz and Hausleiter 2021: 61–64), was found in the graves. Some of the vessels showed traces of burning and contained a dark brown material, including also resinous fragments.

Prior to the investigations at the cemetery in Area S, excavations carried out by the Saudi Directorate of Antiquities at the site of Sana'iye,³ located north of Tal'a, had revealed similar vessels with burn marks and ash. Those were the first “censers” to be identified (Abu Duruk 1989: 15–16; 1990: 16; 1996: 21). These vessels are wheel-thrown,



Fig. 8. Incense burners from tomb T. 1006, from the mid-to-late Iron Age (DAI Orient-Department | photos M. Cusin)

3 The pottery group was named after the industrial site of Sana'iye where this kind of painted pottery was found for the first time (Hausleiter and Daszkiewicz 2014: 414).

conical cups (7–9 cm high), with flat, circular bases (stands), and are characterized by whitish clay and dark brown and red painted decoration (Macrofabric 2; see Hausleiter 2014: Table 2) [Fig. 8].

In the case of the artifacts of Sana'iye Painted Ware identified as incense burners, the decoration consists of geometric motifs, such as vertical red bands, filled with a roughly orthogonal and regular red hatching, alternating with a brown, geometric motif positioned either vertically or horizontally. The shape of the latter motif ranges from a simple cross to two triangles opposed by their apices (Tourtet, Daszkiewicz, and Hausleiter 2021: 62, Fig. 11a and 11b,c respectively). The motif on vessels examined in this study [see Fig. 8] seems to have been extremely schematized, resembling more an 'H' than two triangles. Surfaces are heavily eroded, and the decoration is only partly preserved.

Three incense burners (TA 517, TA 527 and TA 1949) found in grave T. 1006 [see Fig. 7], contained a dark brown fill with

small burned inclusions. This made them ideal for a chemical analysis, the results of which confirmed their use as incense burners.

Incense burners from the second half of the 1st millennium BCE and later

Lastly, incense burners were discovered in Areas E and F, located in the central part of the ancient settlement [see Fig. 2]. Area E is characterized by a large official building (E-b1), one of the major temples of Tayma, covering an area of approximately 500 m² (Lora 2017: 21, 24, 29). It was constructed supposedly during the 4th or 3rd century BCE and was, with substantial modifications in the Nabataean and Roman periods, continuously occupied until abandonment in late antiquity (Lora 2017: 21, 30–37, Fig. 6). East of it (where Area E-East is now located), a tunnel was placed, connecting the building with a large well (Lora 2017: 33; A. Hausleiter and A. Zur in Hausleiter et al. forthcoming). An enclosure wall surrounded large parts of the complex.



Fig. 9. Selection of cuboid incense burners found in Areas E and F (DAI Orient-Department | photo J. Kramer)

South of the E-b1-district lies a residential quarter (Areas E-South and F) which was occupied from the second half of the 1st millennium BCE until the early Byzantine period (Watkins 2019; Weigel 2019; 2020). The occupation of the whole area was relatively dense, with buildings of different sizes and multiple storeys, and narrow streets (excavated part covers 1600 m²). Domestic structures have several small storage compartments and larger rooms (Tourtet and Weigel 2015: 388–389; Weigel 2019; 2020).

In general, the contexts in Areas E and F in the second half of the 1st millennium have yielded too few primary contexts to be well dated. The general dating comes from analyzed ¹⁴C samples. Regarding the incense burners in these areas, they originate chiefly from fill or secondary deposits and are therefore not precisely assigned to functional contexts other than belonging to the domestic area.

The incense burners found in the residential quarter are for the most part small, roughly squared containers with four feet—so-called cuboid incense burners⁴—made of sandstone [Fig. 9]. They are carved from a single block and show no signs of decoration. In most cases the feet, if preserved, are placed directly at the corners and they taper towards the bottom. They are rounded on their inner side (towards the center) and show sharp edges on the outside. The upper part of these objects has a shallow depression framed by thin walls which are mostly not preserved.

Many incense burners show carbonized traces on the surface of the indentation, the part where the incense was burned. The sizes vary from about 7 cm to 13 cm in side length and approximately 5–8 cm in height, but a full profile of the piece has been preserved in only a few cases. This form it is the most common shape of stone incense burner at Tayma.

In the residential quarter, several elaborate incense burners of sandstone were uncovered as well. Four of these (TA 3414, TA 3415, TA 3416 and TA 3424), one of them in very poor condition, originated from Room 1 in Square E16. The objects are almost 40 cm high, comprising a cylindrical shaft mounted on a base and tapering slightly towards the top, where there is a 'crown' of four horns on the sides [Fig. 10]. The horns frame a slightly indented space where, judging by the burn marks, the burning of incense took place. The burners are decorated with incisions in the middle of the cylindrical shaft: carved band with a set of vertical grooves alternating with blank fields, as well as incisions framing the horns. All four burners are asymmetric and slightly inclined.

The shaft of one of these incense burner (TA 3424) bears a very fragmentary Nabataean inscription, indicating that it, as well as the other three objects from the same context, were produced in the Nabataean period. Furthermore, three rectangular incense burners found in the residential quarter (TA 884, TA 8675 and TA 14279+14280) also bear Nabataean inscriptions [Fig. 11].⁵ Only

4 For further reading on cuboid incense burners see Zimmerle 2014.

5 According to Michael Macdonald (for the translation of the inscription see Macdonald 2021: 171), the signs of TA 14279+14280 look like a mix of Nabataean letters and signs from an unknown or invented script.

one of these incense burners was identified within a secure context from a temple (TA 6166). It is a base fragment of a stone vessel with three rounded feet. Two of them are broken, one is preserved to its full length (2.1 cm). The center of the bottom is pointed towards the ground. Compared to cuboid contain-

ers, the rim of this device is rather thick. The inner surface is flat and shows burn marks; similar traces can be observed on the outside as well. On the exterior, vertical and concentric lines formed by picked dots appear on the surface. The decoration is rather irregular, and no evident pattern is recognisable.



Fig. 10. Incense burners with cylindrical shafts and horns (DAI Orient-Department | photo M. Cusin)



Fig. 11. Incense burners with Nabataean Inscriptions (DAI Orient-Department | photos M. Cusin and J. Kramer)

DISCUSSION

Context and chronology

65 artifacts from Tayma, assumed to be incense burners, used in different functional contexts inside and outside the walled oasis, are currently under investigation. They are distributed in three different functional contexts:

- public, representative contexts (Area O and temple E-b1)
- funerary contexts (Area S)
- domestic contexts (Areas E-South and F)

From a chronological point of view, the earliest evidence for burning incense at Tayma derives from the Middle Bronze Age. No incense burners of earlier date have been found, which does not mean that burning aromatics was not practiced in earlier periods.⁶

Equally, no evidence of burning aromatics has been delivered for the interval between the Middle Bronze Age and the Early Iron Age, namely, the timespan

between the end of RBW production in the mid-2nd millennium BCE (Tourtet, Daszkiewicz, and Hausleiter 2021) and the 12th century BCE. Afterwards, fumigation devices at Tayma are well attested from the early Iron Age throughout the 1st millennium BCE until late antiquity.

Materials, shapes and distribution

The temporal distribution of incense burners demonstrates that until the Nabataean period, only pottery incense burners were used at Tayma.

Several different types of incense burners are present in the ancient oasis: small goblets, conical cups, beakers, four-legged cuboid incense burners, rectangular burners, burners with cylindrical shafts and horned ‘crowns’, and circular stone vessels with feet.

Particularly striking is the correlation between given types of burners and specific kinds of contexts. Conical cups

Table 1. Functional contexts, materials and shapes of the incense burners from Tayma

Functional context	Area	Dating	Material	Shape
Public Official	Area O	12th–9th century BCE	Pottery	Goblets Globular vessel
	Temple E-b1	Second half 1st millennium BCE–late antiquity	Stone	
Funerary	Area S	9th–5th century BCE	Pottery	Conical cups
Domestic	Area E-South/F	Second half 1st millennium BCE–late antiquity	Stone	Cuboid burners Burners with ‘crowns’ Rectangular inscribed burners

6 Incense burners of Early Bronze Age date have been excavated at Ra’s al-Jins and in Wadi Samad on the eastern Arabian coast (Cleuziou and Tosi 1997: 59; Zimmerle 2014: 5, 164–165). The earliest burner from Ra’s al-Jins was found in an Early Bronze Age building from period III (2300–2200 BCE) (Cleuziou and Tosi 1997: 64). These earlier phases in Tayma (mid-to-late 3rd millennium BCE) are known from the pottery, e.g., Reddish Coarse Ware and Gritty Ware (Tourtet, Daszkiewicz, and Hausleiter 2021) and architectural structures, but no pertinent functional contexts have been identified thus far.

appear only in funerary contexts, while painted goblets are found only in the public complex in Area O, and nearly all of the cuboid incense burners were used in the residential quarter. It must be kept in mind, however, that in terms of architectural remains, some periods at Tayma are attested only in one area. Thus, it cannot be said that the same kind of burners would not have been used in the same period in another context. Comparisons of this kind are possible only in the central part of the settlement (Areas E and F), where both public and residential buildings have been excavated, covering the same periods. However, since only one incense burner has been discovered in the temple, comparison are not justified. Even so, as far as cuboid incense burners are concerned, all of the fragments, with the exception of two found near the temple, came from domestic contexts.

Cuboid burners

Debate on the function and use of the cuboid incense burners has been ongoing. Scholars have argued that cuboid burners are frequently found in private houses and therefore a primarily secular interpretation is more likely (Albright 1974: 25, 28; Fowler 1985: 25; Millard 2011: 116–117). The argument to the contrary claims that cuboid incense burners have also been found in religious or cultic contexts, thus making it viable to attribute to them a secular or religious function depending on the context (Gitin 1989: 64; Zimmerle 2014: 7, 397). The third view is of a standard household accessory with both secular and religious functions in daily life (Cleuziou and Tosi 1997: 61; Knowles 2006: 60). The cuboid burners from Tayma seem to be

used primarily in households, but it cannot be determined yet whether in a cultic or secular manner, or both.

RESIDUE ANALYSIS

In the past decades the use of scientific methods such as molecular analysis of ancient residues in archaeology has increased considerably. Previous studies concerning the function of objects have shown that interpretations and assumptions are sometimes proven wrong. A study by Philipp Stockhammer (2011: 204) demonstrated that the so-called Kylikes or footed bowls from the southern Levant had been wrongly interpreted as vessels for drinking wine. Residue analysis demonstrated that they were actually used for burning incense.

Since a reliable identification of ancient resins is impossible at the macroscopic scale, molecular analysis is required (Pollard and Heron 2008: 241). Recently, a large number of different resins, mostly found in mortuary contexts in ancient Egypt, Greece and the Roman Empire, have been identified (Koller et al. 1998; Buckley, Stott, and Evershed 1999; Modugno, Ribechini, and Colombini 2006; Charrié-Duhaut et al. 2007; Pappageorgopoulou et al. 2009; Brettell et al. 2014; 2017). Several papers have also dealt with the analysis of resinous plant exudates from ancient settlements in Egypt, Oman, Yemen and the Levant, confirming that aromatics were important elements of ancient societies (Cleuziou and Tosi 1997; Regert et al. 2008; Stockhammer 2011; Namdar et al. 2013).

Published chemical analyses of ancient resins used in burning incense on sites in Saudi Arabia have, however, been

lacking at least to the author's knowledge. Ancient resins from a tomb in Mada'in Salih have been studied (Mathe et al. 2009), but the samples were obtained from textile fragments which contained a mix of fatty acids and triterpenoid compounds, rather than from resins used for burning and producing fragrant smoke. To gain more insights into the scented world of ancient Arabia, more analyses are necessary. The oases along the trading routes provide a good starting point for such a sensorial study and Tayma offers a first case study opportunity.

SAMPLING STRATEGIES

Chemical analysis of the organic constituents can be performed on any preserved visible remains, but also on powder drilled from an object. For the present study, the

sampling took place in the conservation laboratory of the Museum of Tayma.⁷ Three different sampling methods were used:

- (1) Mechanical removal of visible residues (crusts) with a scalpel.
- (2) Destructive sampling of absorbed residues (drilling, approximately 2 g of powder).
- (3) Solvent extraction of absorbed residues with solvents.

For the destructive sampling a Dremel 200 drill with flexible shaft fitted with either a tungsten abrasive bit (for pottery) or a diamond grinding bit (for stone objects) was used to remove powder [Fig. 12]. Between two samplings, the drill was systematically cleaned using solvents. In most cases an area of about 1 × 2 cm was removed to a depth of 2 mm, collected on aluminium foil.

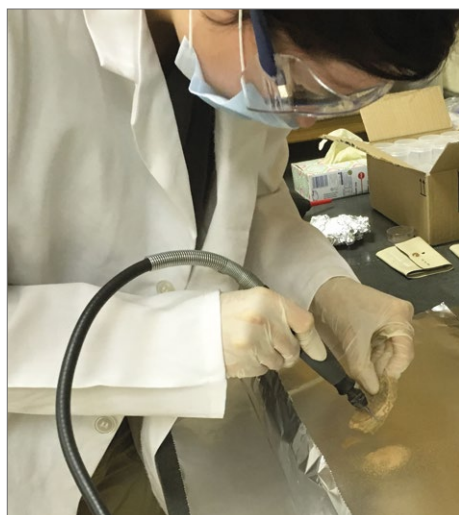


Fig. 12. Destructive sampling of an incense burner fragment using a drill (DAI Orient-Department | photo A. Zur)

BIOMARKERS, MODERN BOTANICAL REFERENCE SAMPLES AND PRELIMINARY RESULTS

For a structural elucidation of the organic remains, previous studies on resins, such as frankincense, myrrh, copal or the resin of *Pistacia* trees, were reviewed in order to detect biomarkers of the resins. Following the Archaeological Biomarker Concept established by Richard P. Evershed (1993; see 2008b: 897), the structure and composition of an organism—or as Evershed (2008b: 895) puts it, “the chemical fingerprint”—can be compared with the composition of any given organism or substance exploited in the past. Plant resins consist of characteristic di- and triterpenoid components which have been ex-

tensively studied (Evershed 2008b: 898). The method relies upon comparing these characteristic components with components of the archaeological samples. Typical markers for frankincense are α and β -boswellic acids as well as their derivatives (Evershed et al. 1997; Van Bergen et al. 1997; Culioli et al. 2003; Regert et al. 2008; Baeten et al. 2014). If the markers can be identified in any sample (together with other characteristic components), it is likely that the resin is frankincense. Additionally, modern reference samples, provided by the Botanical Museum Berlin, of *Boswellia* sp. (frankincense), *Commiphora* sp. (myrrh) and *Mastics* (resins of *Pistacia*) were chemically analysed to identify the main components of each resin and to compare them to the archaeological samples.

The results presented here are still preliminary, the residue analysis having been completed only for samples from the residential quarter and from some burners in Area O. A detailed analysis of all of the archaeological samples, and a complete description of the method will be published in Huber et al. forthcoming.

Several resins have already been identified by chemical analysis. Samples obtained from burners found in the residential quarter (e.g., 1st century BCE–4th century CE) showed the presence of characteristic boswellic acids and derivatives. In other words, the resins used in the residential quarter were obtained from frankincense trees. It is likely that more than one species of *Boswellia* is represented, but at the current stage of the investigation, it cannot be determined with certainty. In addition, the plant resin of *Pistacia* trees was also used at Tayma. Samples from the early Iron Age complex in Area O are very similar to a modern reference sample of *P. lentiscus* and contained a large number of *Pistacia* sp. markers; the concentration of the modern sample is obviously higher, and some molecules are not present in the archaeological sample, but the structure and main components match.

The preliminary data suggests a chronological distribution pattern for the use of aromatics at Tayma: *Pistacia* resin was used in the early Iron Age, while frankincense was used in the second half of the 1st millennium BCE in the temple and households (confirmation from other samples pending).

CONCLUSIONS

The human olfactory sense is incomprehensibly extensive and at the same time specific. Whenever we get a breeze of a smell in the nose—the balmy scent of baked bread, the rotting cadaver of a dead animal, the vivid smell of freshly cut grass or the rich aroma of ground coffee—we are able to identify it instantaneously. Smells can completely alter the olfactory perception of a place depending

on whether they are fragrant or foul. It is evident, however, that our connections and associations with certain smells are, on the one hand, deeply rooted in our cultural socialization and, on the other hand, heavily subjective (Bradley 2015: 3; Derrick 2017: 72). Trying to recapture how people perceived smells in the past—whether they assessed them as good or bad—is therefore a problematic issue.

Nonetheless, traces imprinted in the archaeological record enable a reconstruction of activities that produced various smells in the past.

At Tayma, a full “smellscape” of the oasis cannot be reproduced, but several small areas or “micro smell environments” (Derrick 2017: 82) can be highlighted. Some smells in the oasis were byproducts of processes or caused unintentionally—the stench of rubbish or the smoke from firing ceramics, whereas burning incense is a deliberate act, sometimes also used to cover disliked odors. Creating pleasant smoke in households of the residential area could have changed the olfactory condition of the place or it could have been used in rituals, applied against insects or for hygienic or sanitary purposes (Groom 1981: 6–8). It is, however, a fact that the inhabitants of Tayma purchased aromatics for their own use, which implies that the settlement was not just a transit point on the incense trade route, but also a customer. The local perspective of the use of incense is missing from most of the ancient textual sources (e.g. Herodotus, Pausanias, Plautus, Celsus, Pliny), who focussed only on the trade of aromatics for Greek and Roman use.

The study has also shown a predilection for the use of frankincense in private houses. Most burners from the domestic quarter date to the Nabataean and Late Roman periods, when, according to contemporary Roman writers, frankincense was extremely expensive (see Plin. *NH*, chapters 37, 41). Hence, it can be concluded that the inhabitants of the ancient oasis could afford to buy precious goods.

The results of this study also indicate that the people of Tayma used different kinds of aromatics for different purposes. In the temple dated to the early Iron Age only *Pistacia* resin was burned. A palynological study of samples from the *sabkha* at Tayma lists, among others, the pollen of *Pistacia* trees, which means that the oasis was in the catchment area of *Pistacia* pollen (cf. Dinies et al. 2015; 2016). Therefore, it can be assumed that the resin used in the public complex was obtained from local trees. In this period, incense was evidently not restricted to foreign imports; local resources were used as well. The use of *Pistacia* resin could also be tied to specific time periods. For instance, if frankincense was not to be had in Tayma during the early Iron Age, the native inhabitants would have naturally resorted to using local products.

The people of Tayma also burned incense in funerary contexts, where they placed incense burners next to the deceased in the tombs. In this particular setting, incense could have been an olfactory signal to mourn and remember the deceased. Mark Bradley (2015: 16) argues that different places in the past have their own “signature smells”. An event, like a funeral, was accompanied by the scent of incense, imbuing the entire graveyard with a pleasant smell and, as Jerry Toner (2015: 163) argues, smells could be a useful signal of rites of passage. Considering that the olfactory organ located in the nasal cavity is connected with the amygdala and hippocampus complex, parts of the limbic system in our brain, which is responsible for emotional processing (Zald and Pardo 1997: 4119), smells have the ability to strengthen our memory at an emotional

level (Reinarz 2014: 6), thus ensuring a lasting impression and a vivid memory. Using specific smells at funerals, for instance, triggers memories and emotions and creates a space for remembrance.

The results from Tayma indicate the use of different resins in varying proportions and fields of use over a long period

of time, suggesting that olfactory perception played a crucial part in the everyday life of the ancient oasis. However difficult smells may be to reconstruct, the smell of a place seems to have been essential to past people, to their practices, their behaviors and the way they perceived their world.

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Abbreviations

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