

'AKKO III The 1991–1998 Excavations The Late Periods Part 2: The Knights' Hotel Site, The Messika Plot and Miscellaneous Studies



DANNY SYON AND AYELET TATCHER

IAA Reports, No. 73

'AKKO III The 1991–1998 Excavations The Late Periods

PART 2: THE KNIGHTS' HOTEL SITE, THE MESSIKA PLOT AND MISCELLANEOUS STUDIES

DANNY SYON AND AYELET TATCHER

With contributions by

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Back Cover: The sea at 'Akko (photographer, Daphna Stern); inset: ampulla and molds from the Crusader-period pilgrim-souvenir workshop (photographer, Danny Syon)

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Abbreviations

AASOR	Annual of the American Schools of Oriental Research
ABSA	The Annual of the British School at Athens
ADAJ	Annual of the Department of Antiquities of Jordan
AIHV	Association internationale pour l'histoire du verre
AJPA	American Journal of Physical Anthropology
'Akko I	E.J. Stern. 'Akko I: The 1991–1998 Excavations; The Crusader-Period Pottery (IAA Reports 51). Jerusalem.
'Akko II	M. Hartal, D. Syon, E. Stern and A. Tatcher. ' <i>Akko</i> II: <i>The 1991–1998 Excavations: The Early Periods</i> (IAA Reports 60). Jerusalem.
ANSMN	American Numismatic Society Museum Notes
ARCE	American Research Center in Egypt
BAIAS	Bulletin of the Anglo-Israel Archaeological Society
BAMA	British Academy Monographs in Archaeology
BAR Int. S.	British Archaeological Reports (International Series)
BASOR	Bulletin of the American Schools of Oriental Research
BMMA	Bulletin of the Metropolitan Museum of Art
BSAE	British School of Archaeology in Egypt
BSAJ	British School of Archaeology in Jerusalem
CIEPO	Comité International des Études Pré-Ottomanes et Ottomanes
DAFI	Cahiers de la délégation archéologique française en Iran
DOC 3	P. Grierson. Catalogue of the Byzantine Coins in the Dumbarton Oaks Collection and in the Whittemore Collection 3: Leo III to Nicephorus III. 717–1081. Washington, D.C. 1973
DOP	Dumbarton Oaks Papers
ESI	Excavations and Surveys in Israel
HA	Hadashot Arkheologiyot
HA-ESI	Hadashot Arkheologiyot-Excavations and Surveys in Israel (from 1999)
IEJ	Israel Exploration Journal
IGLSyr	Inscriptions Grecs et Latines de la Syrie
IJNA	International Journal of Nautical Archaeology
INJ	Israel Numismatic Journal

INR	Israel Numismatic Research
JAC	Jahrbuch für Antike und Christentum
JARCE	Journal of the American Research Center in Egypt
JAS	Journal of Archaeological Science
JEA	Journal of Egyptian Archaeology
JEMAHS	Journal of Eastern Mediterranean Archaeology and Heritage Studies
JERI	Journal of Excavation Reports in Israel
JESHO	Journal of the Economic and Social History of the Orient
JGS	Journal of Glass Studies
JNES	Journal of Near Eastern Studies
JRA	Journal of Roman Archaeology
JSOT	Journal for the Study of the Old Testament
LA	Liber Annuus
MA	Mediterranean Archaeology
MDAIA	Mitteilungen des deutschen archäologischen Instituts, Athenische Abteilung
MDAIK	Mitteilungen des deutschen archäologischen Instituts, Abteilung Kairo
NC	The Numismatic Chronicle
NEAEHL	E. Stern and A. Lewinson-Gilboa eds. <i>The New Encyclopedia of Archaeological Excavations in the Holy Land</i> 1–4. Jerusalem 1993.
NNM	Numismatic Notes and Monographs
OIP	Oriental Institute Publications
PAS	The Portable Antiquities Scheme
PEQ	Palestine Exploration Quarterly
QDAP	Quarterly of the Department of Antiquities of Palestine
RDAC	Report of the Department of Antiquities, Cyprus
SAOC	Studies in Ancient Oriental Civilization
SBF	Studium Biblicum Franciscanum
SCI	Scripta Classica Israelica
SEG	Supplementum epigraphicum graecum. Leiden 1923-
ZDPV	Zeitschrift des deutschen Palästina-Vereins

CHAPTER 21

THE KNIGHTS' HOTEL SITE: PILGRIM SOUVENIRS: A WORKSHOP OF LEAD AMPULLAE AND THREE FIGURINE MOLDS

DANNY SYON

INTRODUCTION

In Area A, a number of artifacts can be attributed to the remains of a workshop for producing lead ampullae as souvenirs for Christian pilgrims in the Crusader period (Fig. 21.1). Most of them originated in the collapsed debris of the second floor of a building in Unit A (L131, 132) and others were scattered nearby (see Chapter 16: Plan 16.1): a lead ampulla, a number of stone mold fragments, a lead seal probably intended for recycling, and a lead ingot used in the casting process. It is noteworthy that a crushed and poorly preserved lead ampulla was also found in Area D (L650, B2502). Several of these finds were subjected to compositional analysis (see Chapter 22).

Three limestone molds used in the production of figurines that were retrieved in various areas of the excavation, may also be related to Crusader-period Christian pilgrimage in the Holy Land, although no parallels of contemporary date are known.

Pilgrimages to holy sites are known in many religions, from early times to the present day, and were a major motivation for traveling in antiquity. Ever since the advent of Christianity as a state-recognized religion, pilgrimages to sacred sites in the Holy Land have been popular. The imperial family of Constantine the Great (307–337 CE), especially his mother Helena, were instrumental in establishing many of the sites that have become



Fig. 21.1. Selected finds from the workshop.

the most sacred to Christianity, such as the Holy Sepulcher in Jerusalem and the Cave of the Nativity in Bethlehem. Beginning in the Byzantine period (fifth–sixth centuries CE), the cults of saints became widespread in the Holy Land and throughout the Southern Levant, Egypt and Asia Minor, as well as across Europe. This gave rise to the establishment of shrines of Christian saints with purported magical powers that became pilgrimage centers.

Just like today's travelers, the Christian pilgrim wanted to take home a souvenir, some tangible object for remembrance of the visit to the *loca sancta*. These pilgrim souvenirs had the added value that they held a *eulogia*, a blessing that protected the pilgrim on his travels and at home, warding off illness, the evil eye and many other misfortunes that could befall a pilgrim. Early Christian *eulogiae* were relics that the pilgrim took away from the shrine, preferably items with special sanctity, a practice that resulted in the almost boundless quantities of purported pieces of the True Cross and saints' bones now found in churches throughout Europe (Hen 1996).

Realizing the commercial potential of this desire for a souvenir and a blessing, the caretakers of the holy sites began manufacturing and offering for sale a variety of small items that the pilgrim could purchase. These items were of various shapes and materials, meant to cater to all tastes and budgets, including small medallions, badges or disks bearing written blessings, effigies of saints or scenes depicting the holy sites; reliquaries, rings and other kinds of jewelry; and small containers in which holy oil, water, earth, or some other kind of blessed substance for which the shrine was famous, could be carried away. Many of these small containers were shaped as water bottles, also known as 'pilgrim bottles', a utilitarian vessel type widely used by travelers across the Graeco-Roman world in the classical period, as well as in earlier times. The water-bottle-shaped containers are often referred to as flasks or ampullae, and were made of clay or metal (lead, tin or a lead/tin alloy). Other shapes include miniature amphoriskoi of clay and glass containers of various shapes. The sites where such items were acquired are sometimes identifiable by the iconography and/or inscription appearing on the container, although the decoration was often generic.

Early Christian pilgrim ampullae are a well-researched category of finds. They probably first appeared in the late sixth century, when relatively large numbers of such items are known, indicating that they were manufactured in large quantities. Not surprisingly, pilgrim ampullae are usually found far from their manufacturing site, having been carried by the pilgrims to their homes and kept safe. An important class of lead-alloy ampullae from this period, and probably the most famous collection of such objects, is kept at the monasteries of Monza and Bobbio in northern Italy. They depict scenes from the life of Christ and representations of the Holy Sepulcher as it appeared at the time (Grabar 1958; Engemann 1973; Kötzsche-Breitenbruch 1984). These ampullae also bear inscriptions relating to their contents: "a blessing of the Lord," "oil of the tree of life," or "from the holy places of the Lord." Another class of early Christian ampullae, known as Saint Menas ampullae, comprises items made of clay that were manufactured at his shrine near Alexandria in Egypt; they represent an ubiquitous find throughout the eastern Mediterranean and into Europe, discovered as far north as Scandinavia (see, e.g., Rahmani 1966; Ovadiah and Ovadiah 1967–1968; Barnea 1995; Linscheid 1995). Yet another

distinct class of clay ampullae is known from Asia Minor, a large collection of which is displayed at the Louvre in Paris (Metzger 1981; Campbell 1988). Some of the finds from Asia Minor were probably products of the well-known shrine of Saint John at Ephesus (Duncan-Flowers 1990). Another early class of small containers used as pilgrim souvenirs, which is worth mentioning, comprises clay amphoriskoi bearing stamps (Hayes 1971). Finally, a class of small glass bottles, which were apparently used by both Christian and Jewish pilgrims, is known as well (Barag 1970, 1971).

With very few exceptions, notably the plain items among the Saint Menas ampullae (Metzger 1981:37–38, Nos. 89–95) and most of the glass vessels, all the early Byzantine ampullae bear Christian decorations, such as holy scenes, effigies of saints or other objects. The early ampullae made of clay or lead alloy are thought to have been manufactured in molds, one half at a time (Grabar 1958:11), with the halves then soldered together and finished by hand. The only surviving evidence of ampulla manufacture in the Holy Land in the early Christian period consists of a complete mold and a mold fragment, now housed in the Museum of the Studium Biblicum Franciscanum in Jerusalem, and claimed to have been found in that city (Piccirillo 1994), and half a mold bearing a cross from Caesarea (Patrich and Pinkas 2008: No. 7).

Following the Arab conquest in the mid-seventh century, the manufacture of Christian souvenirs in the eastern Mediterranean, especially in the Holy Land, came to an abrupt end (Albert 1998:44), except for a few places where the tradition apparently remained alive in the now-reduced Byzantine Empire, albeit on a small scale to judge by the dwindling finds (Bakirtzis 1990). For example, the shrine of St. John at Ephesus probably continued to manufacture clay ampullae for some time (Duncan-Flowers 1990). No evidence is known of lead-alloy ampullae production between the seventh and twelfth centuries.

A major revival of the tradition of ampulla production, including lead-alloy ampullae, took place in the twelfth century. Still, in the East, the number of ampulla finds from this period is very small compared to the early Christian period. These finds have not been extensively researched, and are often misidentified and erroneously assigned to the sixthseventh centuries. Beginning from the twelfth century, ampullae were manufactured in at least two centers: at the shrines of Saint Demetrios and Saint Theodora in Thessalonica, where items bearing images of saints were produced (Curčić and St. Clair 1986:81–82, No. 65; Bakirtzis 1990), and at the church of the Holy Sepulcher in Crusader-ruled Jerusalem, where items bore a representation of that church and associated scenes from the life of Christ (for examples of such ampullae held in museums and private collections, see Kötzsche 1988; Kühnel 1994:159–160, 243, Fig. 125; Folda 1995:294–296; Boertjes 2014). Continuity of the early Christian tradition of ampulla decoration into the Crusader period is manifested in the choice of scenes and the use of Greek in the few inscriptions that occur on the ampullae from Jerusalem. However, a difference is also evident in the way that the tomb of Christ is represented, reflecting the fact that it had undergone changes during Crusader rule; moreover, the artistic quality in the Crusader period is greatly reduced compared with the early Christian period.

While the exact time span when these ampullae were manufactured in Jerusalem is debated (Boertjes 2014:176–177), it certainly did not continue after 1187, when the First Kingdom of Jerusalem fell to Salah al-Dīn. Ampullae brought from Jerusalem to England in the twelfth century may have provided a model for the local manufacture of ampullae, which took place at one production center. That center began manufacturing ampullae soon after 1170 at the shrine of Thomas Beckett in Canterbury, and an ampulla mold was found there that is similar in shape to the ones from 'Akko described below, although it bears a scene and a related inscription (Spencer 1998:48, No. 6a).

With the establishment of the Second Kingdom of Jerusalem in 1191, 'Akko became the kingdom's capital and the main hub of Christian pilgrim activity in the Holy Land for the next hundred years. It was here that pilgrims arriving from Europe landed, obtained their provisions, and set out to visit the various holy places in Jerusalem, Galilee and parts of Syria. From here they also embarked on their return journey home. Due to the uncertainties of travel and the restrictions applied to Christian activities by the authorities in Muslimruled territory—including apparently the manufacture of souvenirs—Christian pilgrims needed to equip themselves with travel necessities, including ampullae to use in the various shrines to be visited. This reality is reflected in the fact that thirteenth-century ampullae of the Holy Land ceased to bear the recognizable hallmarks of specific holy sites and the religious representations associated with them. They became generic, mass-produced items, and the decorations comprised geometric, floral and cross motifs. These ampullae, many of unknown provenance located in public and private collections, have been found in far-flung places such as Lebanon (Coupel 1941), Corinth (Davidson 1952:74-76, Pl. 53:573–575), Sicily (D'Angelo 1972), Braunschweig (Kötzsche 1988:30, Fig. 22) and London (Spencer 1998:205-206, No. 214b).

Crusader-period lead ampullae characteristically have a body that is flat on one side and convex on the other, a long neck that could be flattened in order to seal the precious substance within, and two small lugs at the junction of the neck and body to hang the ampulla from the neck.¹ An example found in Berkshire, England (Fig. 21.2) closely resembles one of the ampullae from 'Akko (No. 1) in its dimensions, and one of the 'Akko molds (No. 2) in its geometric decoration. The ampulla was discovered near a village where an effigy of a Crusader, a Richard Westcote who is said to have taken part in the seventh crusade (1270–1272), is kept in the local church. It is not far-fetched to suggest that the ampulla from Berkshire originated in 'Akko. In fact, the geometrically-decorated ampullae resemble pilgrim bottles made during this period in the Islamic world (e.g., a Mamlukperiod pilgrim bottle found at the Messika plot excavation; see Chapter 26; 'Akko I:51 Pl. 4.27:6; see also Day 1935 for further examples).

¹ A fragment of a limestone mold found in Corinth (Davidson 1952: Pl. 53, No. 576) was probably used for the manufacture of ampullae of a type closely resembling, but not identical to, that which was produced in the Crusader-period Holy Land. This fragment was dated to the 'Byzantine period', as were two ampullae found there (Davidson 1952: Pl. 53:573, 575); another was found in a Frankish-period context (Davidson 1952: Pl. 53:574).



Fig. 21.2. Ampulla from Berkshire, England (PAS https://finds.org.uk/database/artefacts/record/id/187003).

The large assemblage of stone ampulla molds from 'Akko presented below, suggests that this city was the most important, if not the sole manufacturing center of lead-alloy ampullae for Christian pilgrims in the thirteenth-century Levant. In contrast to the majority of finds related to the ampulla industry, from both the early Christian and medieval periods, which are mostly ampullae housed in museum collections, the present finds originated in a controlled archaeological excavation. These finds provide, for the first time, an opportunity to study the whole technical process of producing these ancient souvenirs.

The remains of the workshop found in the collapsed debris of what appears to have been the second floor of a structure in Area A, represent the various stages of manufacture: lead scraps for recycling, raw material for casting, stone molds, one complete but untrimmed ampulla, and metallic mercury whose function is unclear. In addition, some colored, inorganic powders were collected from the excavated debris, possibly belonging to the workshop, although their possible use remains unknown as an analysis of the powders failed to identify the substances.² The presence of a copper-alloy, Persian-period fibula (see Chapter 23: No. 127) in the debris, probably intended for scrap metal, suggests that the workshop may have manufactured items from this material as well.

² The powders were analyzed at the Weizmann Institute of Science by Stephen Weiner.

THE FINDS

The finds are illustrated in Figs. 21.3–21.5 according to catalogue numbers. Abbreviations used in this catalogue are as follows: H = height, W = width, Th = thickness, D = diameter, Rec. = reconstructed ampulla measurement.

The Ampulla Workshop

No. 1. Complete ampulla, lead alloy; L132, B1363; IAA 1999-53.

H 67 mm; D 42 mm; Th 9 mm; opening D 22 mm.

Convex side (crushed inward): Entire surface covered with small scales.

Flat side: In center, an eight-petal rosette surrounded by an annular decoration of wavy lines; around the edge is a thin band of hatched lines.

Neck: Separated from the body by a narrow band of hatched lines; decorated with hatched lines oriented in the opposite direction. Two small lugs at the junction of neck and body are unpierced. There is a thin band of excess metal (flash) along the joint of the two mold halves (see below, *The Manufacturing Process*).

No. 2. Mold fragment, slate; L166, B1341; IAA 1999-59.

H 108 mm; surviving W 40 mm; Th 43 mm; Rec. H 87 mm; Rec. D 52 mm; Rec. 20–25 mm; Rec. opening D c. 30 mm.

The mold was for the flat side of an ampulla. Decoration consists of a six-petal rosette in the center surrounded by an annular band with pellets. The tips of each two petals are connected by an arc, and the space between the arc and the annular band is hatched; between each two petals is a pellet. The neck is separated from the body by a band with pellets; at mid-neck are two horizontal lines, and between the band and the lines is an incised X. A lug joins the neck and body, and a narrow vent connects the lug to the edge of the mold. The flat side of the mold has one completely preserved, shallow alignment hole. The mold appears to have been deliberately cut in two, probably to prevent further use.

No. 3. Mold fragment, slate; L131, B1143; IAA 1999-468.

H 89 mm; W 57 mm; Th 17 mm; Rec. neck H 48 mm.

Surviving decoration comprises hatched incisions on the neck. A lug between the neck and body is connected to the edge of the mold by a narrow vent.

No. 4. Mold fragment, slate; L132, B1239; IAA 1999-54.

Surviving H 54 mm; surviving W 64 mm; Th 25 mm; Rec. H c. 75 mm; Rec. D c. 40 mm; Rec. Th 15–20 mm; Rec. opening D 21 mm.

The mold was for the flat side of an ampulla. Surviving main decoration comprises traces of a crosshatch pattern surrounded by two annular bands. The neck is separated from the body by two lines, and close to the top of the neck are three additional lines. Traces of the lugs are preserved, with a narrow vent connecting them to the edge of the mold. The flat side of the mold has one partly preserved, shallow alignment hole.

No. 5. Mold fragment, slate; L122, B1102; IAA 1999-56.

Surviving H 53 mm; W 80 mm; Th 41 mm; Rec. D c. 52 mm; Rec. Th c. 20–22 mm. The mold was for the convex side of an ampulla. The surface is decorated with small scales, similar to that on the ampulla (No. 1).

No. 6. Mold fragment, slate; L152, B1278; IAA 1999-470 (not illustrated).

A very small fragment preserves a small part of the neck with one lug and scale decoration, probably from the convex side of an ampulla, which appears to be identical to that of No. 5 and may belong to the same object. Two narrow vents connect each lug to the edge of the mold.

No. 7. Mold fragment, limestone. L131, B1147; IAA 1999-469.

Surviving H 86 mm; surviving W 70 mm; Th 45 mm; Rec. H c. 80 mm; Rec. D 48 mm; Rec. Th c. 22 mm; Rec. opening D 26 mm.

The mold was for the convex side of an ampulla. It is barrel-shaped, with the tool marks of its manufacture visible on the exterior. The main decoration is a scale pattern identical to that of No. 1. The band separating the neck and the body bears crosshatch decoration. The neck is separated into vertical bands by thin lines; the bands are decorated with alternating, carelessly executed crosshatching and triangles, half of which are crosshatched and the others plain. Two lugs are preserved. The flat side of the mold has one complete alignment hole and half of the other. Another hole, in which a fragmentary copper pin is lodged, is found on the side, at a right angle to the complete alignment hole. The mold is partly burnt, either from the casting process or the destruction of the building where it was found.

No. 8. Seal, lead alloy; L132, B1125; IAA 1999-55.

D 40 mm.

This excellently preserved seal probably arrived at the workshop as 'scrap' for recycling (see Chapter 30).

No. 9. Ingot for casting, lead; L142, B1246; IAA 1999-471.

D 76 mm; H 18 mm.

The shape of this piece indicates that it had been melted down and solidified in a vessel with a hemispherical bottom, possibly a glass vessel. Its composition was analytically determined (see Chapter 22).

The Manufacturing Process of Lead Ampullae

Most of the molds associated with the workshop are made of slate, a material highly resistant to heat. Slate is not readily available in the Levant and may have been imported from Europe, either as raw material or—less likely—as finished molds. It possibly arrived at 'Akko as ships' ballast and was reused at the workshop for mold production.

The alignment holes in the molds indicate that they were made of two halves that had to match perfectly. Alignment holes are also seen in the above-mentioned early Christian mold from Jerusalem (Piccirillo 1994), although it is commonly held that these early ampullae were cast in separate mold halves and then soldered together (Grabar 1958:11).

The example of a complete ampulla (No. 1) preserves a thin band of excess metal (flash) around the parting line of the mold halves; this band formed when the excess metal flowed into the space separating the two molds. Normally, this excess metal would be trimmed and the holes of the lugs pierced as part of the finishing process. The presence of excess metal indicates that the ampullae were cast in one piece and not in separate halves, as the soldering of the two halves would have melted the excess metal. This excess metal also indicates that the 'lost wax' technique was not used in the production process. Further evidence for the use of direct casting at the 'Akko workshop consists of the very narrow vents connecting the lugs to the edge of the mold observed on all the molds that have the neck preserved. The vents functioned to release gases formed during the casting process. The void inside the ampullae was probably created by the use of a clay core attached to the end of a stick to hold it inside the joined halves of the mold. Examples of molds for direct casting of lead alloys found in Europe were made of diverse materials such as limestone, slate, sandstone, wood, copper and iron (Drescher 1978).

Metallurgical analysis of several of the 'Akko molds identified the presence of lead and tin particles on the mold surfaces, further evidence of the application of a direct casting technique at the workshop (see Chapter 22).

The raw material for the ampullae was apparently collected from discarded scrap lead, although it cannot be ruled out that new raw material was employed as well. The close similarity mentioned above between the ampulla from 'Akko and ampullae found in Corinth and Braunschweig suggests that the molds were made in the same workshop, or, at least by artisans belonging to the same artisanal school. The fact that not a single complete mold was found in the excavation, but rather what appear to be discarded fragments, suggests that the artisans may have been able to escape 'Akko in 1291 CE with most of their tools of trade.



Fig. 21.3. Ampulla and molds from the workshop.







Fig. 21.3 (cont.). Ampulla and molds from the workshop.



Fig. 21.4. 'Scrap' and raw material from the workshop.

Figurine Molds (Fig. 21.5)

Three limestone molds, for which no parallels are known, were discovered at the site, two in the 1995 season (Nos. 10, 11), which is the subject of this report, and one in the 2007 season (No. 12; see Syon, forthcoming). The molds have a flat face, and two (Nos. 10, 11) have alignment holes, implying the production of figurines in the round. The molds are incomplete, lacking the upper part, and portray a person wearing a long, plaited robe tied at the waist with a long belt, its end hanging loose. Mold No. 10 preserves the arms of the person with his hands held together in a praying posture.

No. 10. Mold fragment, limestone; Area G; L922, B4287; IAA 1999-57. Surviving H 180 mm; W 100 mm; Th 50 mm.

There are two alignment holes on the flat face (No. 10a). The round back bears clear tool marks (No. 10b). Partly blackened. A plasticine cast was made from the mold (No. 10c).

No. 11. Mold fragment, limestone; Area D, surface; L602, B1903.

Surviving H 120 mm; W 70 mm; Th 35 mm.

One alignment hole survives on the flat face. The back is three-faceted. The mold is worn, suggesting that it was a discarded item. The workmanship is poor.

No. 12. Mold fragment, limestone; Area C; L322, B3132.

Surviving H 120 mm; W 83 mm; Th 35 mm.

Almost identical in its preserved details to No. 10, except for the manner in which the hanging belt end is depicted. On this fragment, it is clear that the person is barefoot. Round smooth back.

The figurines produced in these molds, dressed in long robes with hanging belts, may represent knights, nobles or perhaps members of the clergy, and could be either men or women. They would have been about 20 cm tall. The material used was probably clay, as metal would have made them heavy and costly, and wax was not favored in the hot climate of the southern Levant.³ Following an exhaustive search of the literature, I have not been able to locate any finds throughout Europe that precisely match these molds.⁴ Somewhat similar objects, made of wax and pipe-clay, were common in western Europe of the fifteenth century, when they were used as votives (see, e.g., Geybels 2016; Barton 2018); however, the molds from 'Akko are much earlier.

The barefooted figure in Mold No. 12 suggests a connection with pilgrimage. However, unlike the small lead ampullae presented above, the figurines made in the molds were probably too fragile and cumbersome to carry home as souvenirs. It is more likely that the figurines were votive offerings bought by pilgrims to be placed in the churches within 'Akko. Figurines of this sort were most probably in demand during the second half of the thirteenth century, when considerable efforts were made to develop institutional urban pilgrimage within the city. Evidence of this is seen in the thirteenth-century itinerary list of 39 Latin churches, monasteries and hospitals in 'Akko, where pilgrims could receive indulgences, known as *Pardouns de Acre.*⁵ This system enabled pilgrims who were stranded in 'Akko and unable to reach the holy sites, due to warfare or unsafe roads, to collect generous indulgences by visiting and performing rites in and around the 39 religious sites in the city (Jacoby 2014:59–64).⁶

³ A good illustration of this is the fact that document seals in Europe were made of wax, while those in the Frankish East were made of lead.

⁴ I wish to thank Justine Bayley (Museum of London [ret.]), Vicky Foskolou (University of Crete) and Sarah Blick (Kenyon College, Ohio) for their help in the literature search.

⁵ For the latest translation of this source, see Pringle 2012:235–236.

⁶ For another aspect of the archaeological remains from 'Akko related to pilgrimage, see Syon 2023.



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Fig. 21.5. Figurine molds.







Fig. 21.5 (cont.) Figurine molds.

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References

- Albert B.-S. 1998. On the Importance of Frankish Pilgrimage to the Holy Land (7th–8th Centuries). *Cathedra* 90:33–52 (Hebrew; English summary, p. 197).
- Bakirtzis C. 1990. Byzantine Ampullae from Thessaloniki. In R. Ousterhout ed. *The Blessings of Pilgrimage* (Illinois Byzantine Studies 1). Urbana–Chicago. Pp. 140–149.
- Barag D. 1970. Glass Pilgrim Vessels from Jerusalem I. JGS 12:35-63.
- Barag D. 1971. Glass Pilgrim Vessels from Jerusalem II-III. JGS 13:45-63.
- Barnea I. 1995. Menasampullen auf dem Gebiet Rumäniens. In E. Dassmann and J. Engemann eds. Akten des XII. Internationalen Kongresses für christliche Archäologie, Bonn, 22–28 September 1991 1 (JAC Ergänzungsband 20,1; Studi di antichità cristiana LII). Münster. Pp. 509–514.
- Barton A. 2018. Wax Votive Offerings. https://theantiquary.online/wax-votive-offerings/ (accessed July 17, 2023).
- Boertjes K. 2014. The Reconquered Jerusalem Represented Tradition and Renewal on Pilgrimage Ampullae from the Crusader Period. In J. Goudeau, M. Verhoeven and W. Weijers eds. *The Imagined and Real Jerusalem in Art and Architecture* (Radboud Studies in Humanities 2). Leiden–Boston. Pp. 169–189.
- Campbell S.D. 1988. Armchair Pilgrims: Ampullae from Aphrodisias in Caria. *Mediaeval Studies* 50:539–545.

Coupel P. 1941. Trois petites églises du Comté de Tripoli. BMB 5:35-55.

- Curčić S. and St. Clair A. eds. 1986. Byzantium at Princeton: Byzantine Art and Archaeology at Princeton University, Catalogue of an Exhibition at Firestone Library, Princeton University, August 1 through October 26, 1986. Princeton.
- D'Angelo F. 1972. Un'ampolla da pellegrino. Sicilia Archeologia 17:58-59.
- Davidson G.R. 1952. Corinth XII: The Minor Objects. Princeton.
- Day F.E. 1935. Some Islamic Pilgrim Bottles. Berytus 2:5-10.
- Drescher H. 1978. Unterschungen und Versuche zum Blei- und Zinnguß in Formen aus Stein, Lehm, Holz, Geweih und Metall: Ein Beitrag zur mittelalterlichen Gießtechnik von Kleingerät. *Frühmittelalterlische Studien* 12:84–115.
- Duncan-Flowers M. 1990. A Pilgrim's Ampulla from the Shrine of St. John the Evangelist at Ephesus. In R. Ousterhout ed. *The Blessings of Pilgrimage* (Illinois Byzantine Studies 1). Urbana–Chicago. Pp. 125–139.
- Engemann J. 1973. Palästinensische Pilgerampullen im F.J. Dölger-Institut in Bonn. Jahrbuch für Antike und Christentum 16:5–27.
- Folda J. 1995. The Art of the Crusaders in the Holy Land, 1098-1187. Cambridge.
- Geybels H. 2016. *Het heiligenbeeldje: Een biografie*. Antwerpen. https://www.researchgate.net/ publication/319136203_Het_heiligenbeeldje_Een_biografie (accessed July 11, 2020).
- Grabar A. 1958. Ampoules de Terre Sainte (Monza-Bobbio). Paris.
- Hayes J.W. 1971. A New Type of Early Christian Ampulla. ABSA 66:243-248.
- Hen Y. 1996. Holy Land Eulogia Labels from Frankish Gaul. *Cathedra* 82:25–44 (Hebrew; English summary, pp. 190–191).
- Jacoby D. 2014. Ports of Pilgrimage to the Holy Land, Eleventh–Fourteenth Century: Jaffa, Acre, Alexandria. In M. Bacci and M. Rohde eds. *The Holy Portolano: The Sacred Geography of Navigation in the Middle Ages (Fribourg Colloquium 2013)* (Scrinium Friburgense 36). Berlin– Munich–Boston. Pp. 51–71.
- Kötzsche-Breitenbruch L. 1984. Pilgerandenken aus dem Heiligen Land. In E. Dassmann and K. Thraede eds. *Vivarium: Festschrift Theodor Klauser zum 90. Geburtstag (JAC* Ergänzungsband 11). Münster. Pp. 229–246.
- Kötzsche L. 1988. Zwei Jerusalemer Pilgerampullen aus der Kreutzfahrerzeit. Zeitschrift für Kunstgeschichte 51:13-32.
- Kühnel B. 1994. Crusader Art of the Twelfth Century: A Geographical, an Historical, or an Art Historical Notion? Berlin.
- Linscheid P. 1995. Untersuchungen zur Verbreitung von Menasampullen nördlich der Alpen. In E. Dassmann and J. Engemann eds. Akten des XII. Internationalen Kongresses für christliche Archäologie, Bonn, 22–28 September 1991 2 (JAC Ergänzungsband 20,2; Studi di antichità cristiana LII). Münster. Pp. 982–986.
- Metzger C. 1981. *Les ampoules à eulogie du musée du Louvre* (Notes et documents des musées de France 3). Paris.
- Ovadiah A. and Ovadiah R. 1967–1968. Three Early Christian Ampullae. Sefunim 2:39–45.

- Patrich Y. and Pinkas J. 2008. Lamps and Flask Molds. In J. Patrich. Archaeological Excavations at Caesarea Maritima. Areas CC, KK and NN; Final Report I: The Objects. Jerusalem. Pp. 296–300.
- Piccirillo M. 1994. Uno stampo per Eulogia trovato a Gerusalemme. LA 44:585-590.
- Pringle D. 2012. *Pilgrimage to Jerusalem and the Holy Land, 1187–1291* (Crusade Texts in Translation 23). Farnham.
- PAS: Ampulla. https://finds.org.uk/database/artefacts/record/id/187003: BERK-E3B315 (accessed April 25, 2015).
- Rahmani L.Y. 1966. Two Early Christian Ampullae. IEJ 16:71-74.
- Spencer B. 1998. *Pilgrim Souvenirs and Secular Badges* (Medieval Finds from Excavations in London 7). London.
- Syon D. 2023. The Archaeology of the Pardouns de Acre. In R.G. Khamisy, R.Y. Lewis and V.R. Shotten-Hallel eds. Exploring Outremer II: Studies in Crusader Archaeology in Honour of Adrian J. Boas (Crusades-Subsidia). London–New York. Pp. 107–116.

CHAPTER 22

THE KNIGHTS' HOTEL SITE: RESIDUE AND COMPOSITIONAL ANALYSES OF FINDS FROM THE AMPULLA WORKSHOP Nimrod Shay, Eugenia Klein and Sariel Shalev

The analyses presented here aim to determine whether the ampulla molds from the workshop in Area A (see Chapters 16, 21) were used with the 'lost wax' technique for the casting of wax models, or with direct casting, in which the lead alloy was poured directly into the mold (for further discussion of these techniques, see Craddock, Freestone and Dawe 1997). The analyzed items include one limestone mold, two slate molds and an ingot (see Chapter 21: Nos. 7, 3, 6, 9 respectively), as well as a crushed ampulla from Area D (L650, B2502), which was not among the finds from the workshop.

Methods

This study analyzed the chemical composition of particles adhering to the surfaces of the molds, as well as the composition of the ingot and ampulla. The molds were initially observed under a reflected-light optical microscope, followed by Scanning Electron Microscope (SEM), which revealed dark spots on the surface of the limestone mold (No. 7; Fig. 22.1).

The surfaces of the limestone mold (No. 7) and one of the two slate molds (No. 3) were carefully peeled with double-sided carbon conducting tape. The tape with attached



Fig. 22.1. Dark spots on the surface of the limestone mold (No. 7).

particles was then mounted on microscope studs, coated with a conductive carbon film (SPI fiber carbon coater) and examined with a scanning electron microscope (SEM; Jeol JSM 6400) equipped with an energy dispersive x-ray analyzer (EDS; Link Isis with a thin window detector), allowing the identification of traces of heavy metals. The microscope was operated at 20 kV or more, which allowed the qualitative determination of major and minor elements.

The surfaces of the three molds were not cleaned or prepared in any way for these analyses, and in order to ensure that surface contamination was neutralized. Mold No. 6 (the smallest piece) was carbon coated and mounted on the SEM stage. This sample could only be analyzed after opening the wall of the SEM chamber and orienting it into a position in which it could be accommodated. The analysis of No. 6 clearly demonstrated that metal grains were trapped in-between the grains of the slate (Fig. 22.2).

The ingot and the ampulla were mounted, ground and polished to 0.25 mm fineness, according to standard metallographic techniques, and their composition was qualitatively and quantitatively determined by EDS.



Fig. 22.2. Particles of lead on the contact surface of Mold No. 6 (SEM photograph).

Results

Very small particles of tin and lead were detected on the contact surface of the limestone mold (No. 7) and their composition was characterized by the L-series and M-lines respectively (the identification of lead was confirmed by its L-series, when the microscope was operated at 30 kV). Traces of tin and faint traces of iron and titanium were detected on the surface of the slate mold (No. 3), based on the wavelengths of the K α and K β spectral lines, and small particles of lead were detected on the surface of slate mold No. 6 (Fig. 22.2). The ingot (No. 9) and the crushed ampulla were both shown to comprise unalloyed metallic lead (Fig. 22.3).



Fig. 22.3. EDS composition analysis of the ampulla from Area D.

Conclusions

The analyses did not detect the presence of wax on the surfaces of the analyzed molds, hence there is no evidence for use of the 'lost wax' technique in the casting of these items. Small amounts of non-ferrous metals were detected on all the analyzed molds, indicating that metal was cast directly into them. The presence of traces of tin on No. 3 and traces of lead on No. 6 presumably indicates that in each mold the cast metal was unalloyed. This conclusion is reinforced by the fact that the analyzed ingot (No. 9) and the crushed ampulla were both made of pure lead. Only the limestone mold (No. 7) revealed both tin and lead particles, suggesting that, in this particular case, a lead-tin alloy was used for the casting process.

We cannot say whether the workshop in question had a set routine for casting different metals in separate molds, although it seems likely that a choice was made in each instance to produce certain items from either lead, tin, or an alloy of the two based on the respective properties of both the casting material and the mold itself. Lead provides several advantages as a raw material for casting. For one thing, it is relatively resistant to corrosive action. When freshly cast, lead has a bright, silvery appearance, but upon exposure to air, the surface soon becomes gray or grayish-white due to the formation of films composed of either oxide, basic carbonate or basic sulfate; these films protect the surface from further corrosion. Also, most lead salts and crystals have a very low solubility, which renders lead one of the most indestructible metals, and it can still be recycled after a long period of use. Its melting point is 327°C, much lower than that of other common metals. Lead is also the softest of the common metals and, due to its high ductility and malleability, can be easily formed into complex shapes without the need for frequent annealing and softening required with most other metals (Blaskett and Boxall 1990:12–13).

Lead-tin alloys form an important metallurgical group, mainly due to their use as solders. The eutectic point of such alloys is 183°C, which occurs when the lead content reaches 38.1%, making this alloy particularly suitable for low-temperature uses. Strength and hardness increase with additional tin content, up to maximum values around the eutectic composition, but then decreasing with further additions of tin (Blaskett and Boxall 1990:84).

The fact that most of the molds from 'Akko are made of slate, a material not found naturally in the Levant, likely has to do with its relatively high heat tolerance that makes it more suitable for casting. However, this material has the disadvantage that the details of the mold cannot be engraved with the fineness that is afforded by a limestone mold. The discovery of a limestone mold with indications of its use in casting with a lead-tin alloy may represent a choice of materials made by the artisans at the workshop

During production, the void inside the ampullae was probably created by the use of a clay core attached to the end of a stick held inside the joined halves of the mold. Another possibility was suggested by Bayley in a description of the production process of such ampullae:

"These ampullae were cast in two piece molds made of fine-grained stone, with lead pegs to correctly locate the two halves. The hollows were made by a process of slush casting, which involved pouring molten tin into a cool matrix and quickly inverting the mold so as to pour out the molten core and leave behind a comparatively thinwalled, lightweight vessel" (Bayley 1996:67).

According to Spencer (1998:11–12), this technique could only be successfully performed with unalloyed tin.

Examination of the crushed ampulla from Area D revealed that it was cast in one piece rather than in joined halves, as there is no sign of soldering at the cross section (Fig. 22.4), and the item is comparatively thick-walled, heavy and made of unalloyed lead.



Fig. 22.4. Cross section of the ampulla from Area D.

References

- Bayley J. 1996. Innovation in Later Medieval Urban Metalworking. Historical Metallurgy 30:67-71.
- Blaskett D.R. and Boxall D. 1990. *Lead and Its Alloys*. New York–London–Toronto–Sydney–Tokyo–Singapore.
- Craddock P.T., Freestone I.C. and Dawe C.D. 1997. Casting Metals in Limestone Moulds. *Journal* of the Historical Metallurgy Society 31:1–7.
- Spencer B. 1998. *Pilgrim Souvenirs and Secular Badges* (Medieval Finds from Excavations in London 7). London.
- Syon D. 2010. 'Akko, the Knights Hotel. *HA-ESI* 122 (September 5). http://www.hadashot-esi.org. il/report_detail_eng.aspx?id=1481&mag_id=117 (accessed May 16, 2023).