

Roman Balsamarium Shaped as a Male Head in Feline-Skin Cap from the Territory of Southeast Bulgaria

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The main objective of this archaeological note is to present to the scientific community the most comprehensive data available on a spectacular new find from the territory of the Roman province of Thrace—a brass balsamarium shaped as a male head in a feline-skin cap. By providing a detailed description of the balsamarium, the results of its metallographic analysis, and an accurate account of its archaeological context and its date, we hope to clarify some still unsolved problems related to the function and production of such vessels.¹

THE KRAL MEZAR TUMULUS

In 2015, an archaeological expedition conducted by Daniela Agre from the National Archaeological Institute with Museum at the Bulgarian Academy of Sciences undertook the rescue excavation of a tumulus known as Kral Mezar. The tumulus is located near the village of Boyanovo, Elkhovo municipality, in the southeastern part of modern Bulgaria. The shape and dimensions of the tumulus have changed as a result of post-antique agricultural activities and numerous episodes of looting. At the beginning of the excavations, the tumulus had a diameter of about 30 m and a height of about 3 m. Three grave constructions were discovered dug into the mound: a sarcophagus, a tomb, and a grave constructed of bricks (fig. 1). A broken column shaft, a Doric capital, and a base found near the periphery of the tumulus are probably the remains of a commemorative monument.²

The sarcophagus of marmorized limestone was put into a pit dug in the tumulus. The lid of the sarcophagus, in the form of a pitched roof, had been

¹We would like to thank Ivan Krastev from the Institute of Physical Chemistry at the Bulgarian Academy of Sciences for the elemental analysis of the balsamarium and strigil and Silvia Nikolova from the Institute of Experimental Morphology, Pathology and Anthropology with the museum at the Bulgarian Academy of Science for the anthropological analysis of the skeleton found in the grave. We would also like to express our deep gratitude to David Saunders, an associate curator in the Department of Antiquities of the J. Paul Getty Museum, for providing us with access to the comprehensive literature collection of the museum. Additional figures can be found with this article's abstract on AJA Online (www.ajaonline.org). All figures are the authors'.

²The shape of the capital and execution of the column suggest a date in the third century C.E.

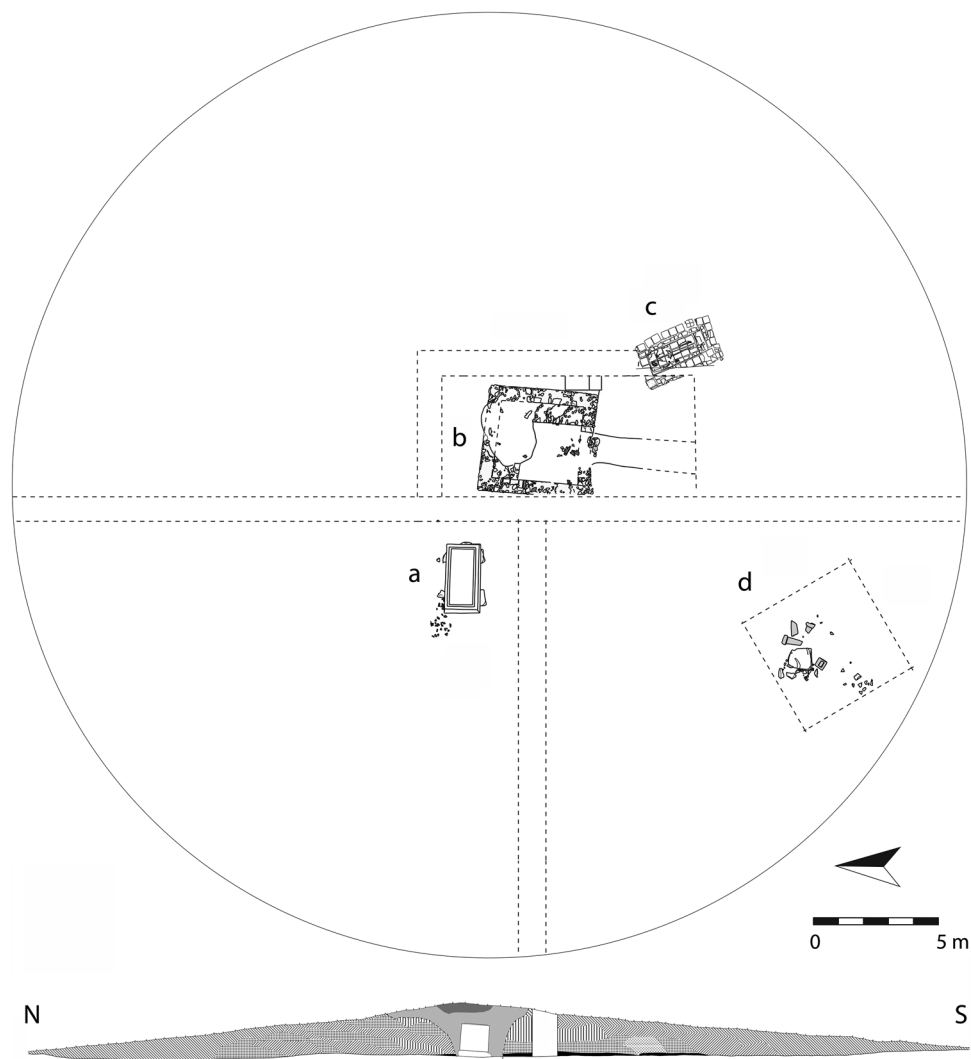


FIG. 1. Plan and elevation of the Kral Mezlar tumulus near Boyanovo, Bulgaria: *a*, sarcophagus; *b*, tomb; *c*, brick grave; *d*, commemorative monument.

broken and discarded.³ The sarcophagus dates from ca. 150–200 C.E., based on analysis of the archaeological material found in and near it. Because discoveries of sarcophagi in tumuli in the territory of Roman Thrace are extremely rare, it is generally believed that burials in sarcophagi were foreign to the Thracians.⁴

The much-disturbed tomb had been dug into the central part of the tumulus. The tomb has one chamber with an entrance at the south; the foundations

were built of irregularly shaped stones, and the superstructure was built of brick. It was probably covered by a stone barrel vault. The walls were plastered and painted. The motifs are mostly floral (palmettos, flowers, tendrils) and geometrical (lines, arcs); the colors include blue (dark and light), yellow, black, white, red, and green. The funerary assemblage consists of women's textile-making implements (fragmentary bone spindles and needles and a small glass distaff), some very small glass beads, numerous fragments of glass and ceramic vessels, and fragments of clay lamps produced in Attic workshops. A silver denarius of the emperor Caracalla minted in 202 C.E. in Rome was found at the level of the tomb's floor (obverse: ANTONINVS PIVS AVG, laureate and draped bust of Caracalla to

³Such a burial belongs to Type 8, Variant B, according to the classification of grave constructions and burial customs in Thrace during the Roman Age (Getov 1970, 6–7).

⁴Getov 1970, 6–7.

the right; reverse: PART MAX PONT TR P IIII, two captives seated at the base of a column with trophy).⁵ These materials date the tomb to the first quarter of the third century C.E.

The present note offers a detailed analysis of only the third burial construction, the brick grave, with particular emphasis on the metal balsamarium shaped as a man's head that was discovered in it. This vessel is a unique find in the Roman province of Thrace.

THE BRICK GRAVE: CONSTRUCTION AND CONTENTS

The brick grave (fig. 2) was discovered in the south-east quadrant of the tumulus. Its interior dimensions are 2.45 m long x 0.90 m wide x 0.70 m deep. The pit was dug into the tumulus and was oriented north-south with a deflection of about 30° to the west. The grave was built of bricks measuring 0.33 x 0.33 x 0.04 m. A thick layer of white plaster covered the walls and the gaps between the bricks forming the floor. Imprints on the tops of the brick walls show that wooden beams were laid across the tops of the walls and the ends of the beams were covered with plaster. The structure is a brick grave with a flat roof,⁶ one of the most popular types of grave constructions in Thrace during the Roman period and especially in the second and third centuries C.E.

The burial rite was inhumation. The body was placed in a wooden coffin, of which several iron nails are preserved. The body was laid on its back in an outstretched position with the arms slightly bent at the elbows and the head at the north (see fig. 2). The length of the preserved skeleton is 1.82 m. Anthropological analysis revealed that the buried person was a man at least 35 to 40 years of age.

The grave assemblage consists of metal and glass objects. A bronze coin of the emperor Caracalla with a Greek inscription, minted in Hadrianopolis, Thrace, and dated to 198–217 C.E., was found under the lower jaw (fig. 3; diam. 18 mm; obverse: AYT K M AYP CEY ANTΩNEINOC, laureate head to the right; reverse: AΔPIANOΠIOAEITΩN, eagle with folded wings standing to the right on garlanded altar, head turned back to

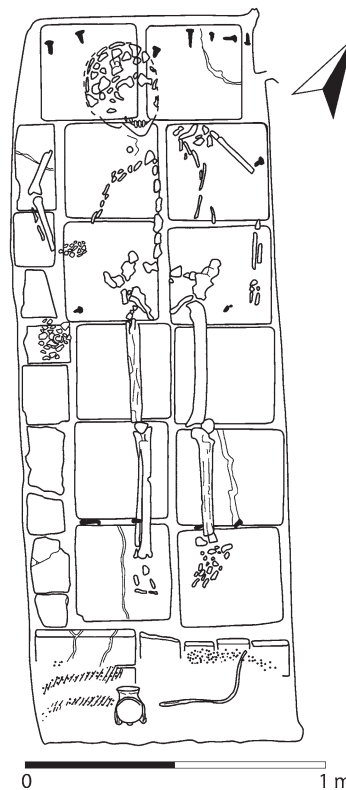


FIG. 2. The brick grave in the Kral Mezar tumulus.

⁵ Elkhovo, Ethnographic-Archaeological Museum, inv. no. EAM-E-H-3752. Compare <http://numismatics.org/ocri/id/>, search: ric.4.crl.65.

⁶ Type 9, Variant A, according to the classification of Getov (1970, 7).

the left with a wreath in its beak).⁷ Near the feet of the deceased, close to the south wall of the grave, a balsamarium⁸ and a strigil⁹ were found, as were the remains of two pairs of shoes studded with hobnails. The preserved length of the shoes is 27–28 cm.

Two clusters of fragments from glass vessels were found between the skeleton's right hip and the western wall of the grave. After a partial restoration, it was established that some of the fragments belong to a glass flask of Isings Form 103.¹⁰ Detailed analysis of the preserved fragments revealed that the body of the flask has wheel-abraded decoration combining topographical scenes and Latin inscriptions. There is no dedicatory inscription. Engraved scenes and inscriptions are placed in one row. There are no elements representing a harbor. The central image is an open-fronted temple with statues of two goddesses inside, probably Minerva and Diana. Because of the penetration of moisture and the acidity of the soil, the flask's bottom has disintegrated into powder.

Until now, only 17 similar flasks have been found. They belong to the so-called Puteoli-Baiae Group. Seven are partially preserved; the rest are represented by a few fragments.¹¹ The motifs depicted on the flasks are urban views of ancient Puteoli and Baiae, located on the Bay of Naples, with Latin inscriptions identifying each depicted building. Preliminary examination of the topographical scenes from the flask shows that they do not match any of the scenes known from other flasks of the Puteoli-Baiae Group. If the flask shows a specific town, it is apparently neither Puteoli nor Baiae.

The strigil found in the grave is fully preserved (fig. 4). The handle and blade are cast in one piece in brass and worked by hammering and chasing. The blade has a concave cross-section. The handle is solid and has a short lengthwise slot for the attachment of a strap. The length from the end of the handle to the end of the blade is 25.1 cm. This type of strigil is known from



FIG. 3. Bronze coin of Caracalla with a Greek inscription, minted in Hadrianopolis, Thrace, 198–217 C.E., from the brick grave in the Kral Mezar tumulus. Elkhovo, Ethnographic-Archaeological Museum, inv. no. EAM-E-H-3753.

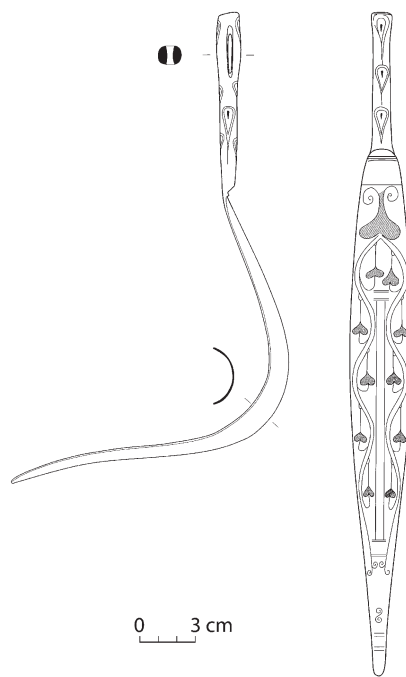


FIG. 4. Drawing of the strigil from the brick grave in the Kral Mezar tumulus. Elkhovo, Ethnographic-Archaeological Museum, inv. no. EAM-879, EAM, Elkhovo.

⁷ Elkhovo, Ethnographic-Archaeological Museum, inv. no. EAM-E-H-3753. The reverse of this coin is a type not documented in the standard numismatic references; an example is described in Varbanov (2005, 3498; Hadrianopolis).

⁸ Elkhovo, Ethnographic-Archaeological Museum, inv. no. EAM-876.

⁹ Elkhovo, Ethnographic-Archaeological Museum, inv. no. EAM-879.

¹⁰ Isings 1957, 121–22.

¹¹ Fujii 2009, 136; Popkin 2018.

burial complexes in Bulgaria that are dated to the second and third centuries C.E.¹²

The vessel found in the grave, a balsamarium, is made of brass (an alloy of copper and zinc) and takes the form of a man's head wearing a tight-fitting animal-skin cap (figs. 5, 6). There is an opening on the top of

¹² Vagalinsky 1993, 23.



FIG. 5. Balsamarium from the brick grave in the Kral Mezar tumulus, front view. Elkhovo, Ethnographic-Archaeological Museum, inv. no. EAM-876.

the head that was covered with a lid (now missing); the lid was attached to the head by a cylindrical hinge (also now missing). On both sides of the opening are lugs that were cast together with the head and intended for attaching a swing handle. The lugs bear traces of intensive wear, and their loops are now broken. An arched handle with a round cross-section is inserted into the lugs. One end of the handle is broken. Overall, the balsamarium is in good condition and has a very well polished surface covered with a brownish-green patina. It measures 12.0 cm high (without lugs) and 10.8 cm, maximum, wide (across the front). The measured volume of liquid that the Boyanovo balsamarium could contain is 670 ml.

The balsamarium is made from four parts: the body of the vessel in the form of a man's head, the bottom produced from a flat metal sheet, the lid (now missing), and the swing handle. The body was made by casting, then worked further with chasing, inlays, and polishing. The man's face is modeled with exceptional skill. It is wide, with regular features, protruding cheekbones, and slightly sagging cheeks. The face is clean-shaven except for a small, carefully formed goatee. The large eyes have concave pupils that were probably inlaid with stone or glass paste, now missing. The man has a large aquiline nose that is slightly bent to the left and has a wide base. A thin and shallow groove outlining the mouth probably served to attach a thin layer of



FIG. 6. Balsamarium from the brick grave in the Kral Mezar tumulus, left profile.

reddish metal over both lips. A very small fragment of the reddish metal is still preserved in the right corner of the mouth (fig. 7).¹³ The vessel has a low foot formed as the man's neck with the relief folds of a garment around the lower part.

The man wears a tight-fitting animal-skin cap that completely covers the top and back parts of the head.

¹³ The use of inlay is rather frequent in such vessels. E.g., the eyes and teeth of the balsamarium in the J. Paul Getty Museum (Los Angeles, inv. no. 2007.14) are inlaid with silver foil (Tovar 2008, 64); the ends of the cap of balsamarium in the Collection Dutuit (Petit Palais, Musée des Beaux-Arts de la Ville de Paris, inv. no. ADUT 86) are inlaid with a copper band (Petit 1980, 157).

The precisely rendered details reveal that the cap is represented as made from the head of a feline. The animal's muzzle with outlined nostrils and its half-closed eyes are shown at the front part of the cap (online fig. 1);¹⁴ part of the cap representing the lower jaw of the animal is shifted forward and covers the man's temporal bones. Sharp canine teeth, one in the upper and one in the lower jaw of the predator, are incised on both sides of the man's forehead. The lugs for attaching the handle are formed as the rounded erect ears of the animal. The animal's mane is represented by wavy relief lines descending from the lug ears to the top of

¹⁴ See AJA Online for online-only figures.

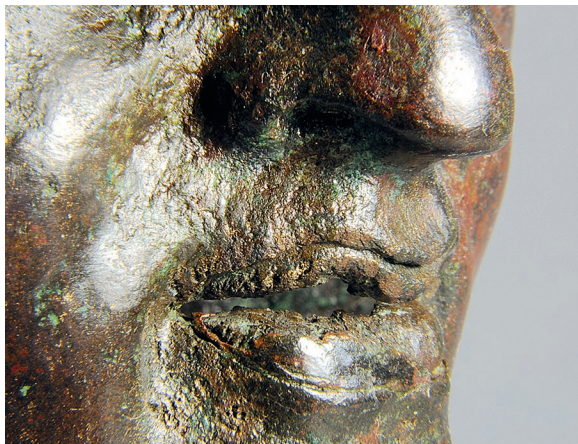


FIG. 7. Small fragment of reddish metal foil preserved in the right corner of the balsamarium figure's mouth.

the man's ears. The surface of the cap is decorated with V-shaped incisions representing the animal's fur and by incised circles with a point in their centers representing the animal's coat patterns. The craftsman thus identified the species of the animal as probably a panther or a leopard.

The handle of the balsamarium was fashioned from a round copper alloy wire by hammering; it is thicker at its center and has hooks at the ends. The surface is worn, but in a few places, an ornament in the form of stylized leaves can still be seen. The hooks that attach the handle to the vessel's lugs are quite worn. The handle's execution appears inferior to that of the body of the vase; it seems possible that this is not the original handle but a replacement.

The bottom of the balsamarium is made from a copper alloy plate, 1–2 mm thick. It was cut to the dimensions of the vessel's foot and then soldered to it. On the bottom, three concentric circles with a dot in the center were incised, probably with a lathe (see online fig. 2).

The brick grave in the Kral Mezar tumulus, based on the bronze coin of Caracalla found in the burial (see fig. 3), is no earlier than 198 C.E., and it probably dates in the first quarter of the third century C.E.

WHAT WAS THE FUNCTION OF THE BALSAMARIUM FROM BOYANOVO?

The scholarly community does not agree either about the name of such vessels or about their function. *Balsamarium* is a modern word, not used in antiquity by Latin-speaking people. The application of the term identifies vessels of this type as containers

for balm, perfumes, or aromatic oils related to bathing and to exercising in the palaestra (an open-air space in a bathing establishment). However, this presumed function is much debated,¹⁵ and many scholars think that a more general term, such as “anthropomorphic vessels,” is more appropriate since it designates a formal type rather than a hypothetical function.¹⁶

Direct evidence for the use of balsamaria, such as residue analysis of the contents, is very limited,¹⁷ and no traces of any substances were found in the Boyanovo vessel during its restoration. The main indirect argument for their use is the frequent association of such vessels with strigils or other pieces of toilette sets in burials. For example, in all burials from Moesia and Thrace containing balsamaria, at least one strigil was found as well.¹⁸ The discovery of the balsamarium from Boyanovo together with the strigil strengthens the case for identifying such vessels as unguent containers connected to exercise and bathing.

WHO IS REPRESENTED BY THE BALSAMARIUM FROM BOYANOVO?

Anthropomorphic vessels shaped as human busts or heads were very popular across the Roman empire,¹⁹ especially among the inhabitants of the Roman provinces of Moesia and Thrace.²⁰ Ethnographic types, variously identified as Nubians, Ethiopians, or black Africans, are most frequently represented. Another favorite theme was the representation of deities; the images of Hercules and of Dionysus and his procession (*thiasos*) were among the most popular. The images of young, nude, beardless men resembling depictions of Antinous, the lover of the emperor Hadrian, also occur frequently.²¹

Much rarer are anthropomorphic vessels that represent so-called grotesques,²² caricatures of fishermen, old women, shepherds, athletes, dwarves, and slaves. The five closest analogues to the piece from Boyanovo

¹⁵ See Mustață (2010, 53) for more on different opinions about possible functions of such vessels.

¹⁶ Marti 1996, 980.

¹⁷ Residue of the contents of three balsamaria has been analyzed; see Mustață 2010, 56.

¹⁸ Nenova-Merdjanova 1994, 2.

¹⁹ Majewski 1963; Marti-Clercx and Mille 2002, 385–88.

²⁰ Nenova-Merdjanova 1994, 1.

²¹ Mustață 2010, 52–3.

²² Nenova-Merdjanova 2000; Marti-Clercx and Mille 2002, 392.

have been found among such vessels: Lyon, Musée des Beaux-Arts, inv. no. E 408, dated to the second century C.E.;²³ Los Angeles, J. Paul Getty Museum, inv. no. 2007.14, dated to the first century C.E.;²⁴ Paris, Petit Palais, Musée des Beaux-Arts de la Ville de Paris, Collection Dutuit, inv. no. ADUT 86, dated to the second–third century C.E.;²⁵ no. 155 from the collection of Ch. Haviland, dated to the second century C.E.;²⁶ and Cologne, Römisch-Germanisches Museum, inv. no. L2175, dated to the second half of the second century C.E.²⁷ All five are shaped as the heads of men with large, bent or deformed, aquiline noses and clean-shaven faces with small goatees, and all wear tight-fitting leather caps. Each of the heads has a long lock of hair (*cirrus*) at the back of the head and two more locks, projecting from the top of the cap, that form lugs for the attachment of the handle. These features—the tight-fitting cap, the deformed nose, and the *cirrus*—are the most important elements for those who interpret these heads as images of boxers²⁸ or wrestlers.²⁹

The two main features distinguishing the Boyanovo balsamarium from its closest parallels are, first, the lack of the *cirrus* and the hair locks forming the lugs and, second, the presence of a cap in the form of a menacing feline's skin. Clearly the presence of the second feature explains the absence of the first. It is obvious that representation of the vessel's lugs as hair locks is an artistic way to rationalize the presence of such alien elements on a human head. In our case, the craftsman did not need such a rationalization since he had a much more convincing element for forming the lugs—the ears of the animal. The lack of the *cirrus* could be explained similarly—an additional lock of human hair would contradict the whole impression given by the animal skin used for making the cap. It should be mentioned that decorative details can be observed on a strictly utilitarian cap on the athlete-head vase from the Collection Dutuit. On that vase, the edge of the wrestler's

cap is emphasized with an inlaid copper band, and, above the wrestler's temporal bones, the cap is decorated by an inlaid copper cross on each side.³⁰ Based on the similarity of the balsamarium from Boyanovo to these other athlete-head vases, we believe that the Boyanovo vase also represents the head of an athlete (a wrestler or boxer).

The presence of such an impressive cap can be explained as an allusion to the skin of the Nemean lion, a well-known attribute of Hercules, whose cult was especially popular during the second century C.E.³¹ It is probable that the representation of the athlete's cap as the skin of a savage feline was meant to suggest the athlete's similarity to Hercules and, in this way, to signify the heroic power and courage possessed by the athlete.

DATING THE BALSAMARIUM

The balsamarium was deposited in a grave dated to the first quarter of the third century C.E. The handle lugs are worn, and the present handle is probably a replacement for an original handle that was damaged or lost. This evidence of long use suggests a possession that belonged to the interred person and not a grave gift newly purchased by the dead man's kin. It is possible that the balsamarium was in use for some time, perhaps as much as 20–25 years, before it was put into the grave. Thus, the balsamarium may have been made sometime in the last part of the second century C.E. or the early part of the third century.

WHERE WAS THE BALSAMARIUM MADE?

Although more than 350 ancient Roman anthropomorphic vessels are presently known, there is little information about the locations of the workshops where they were produced. Not one of these vessels has a craftsman's stamp. Since the practice of stamping bronze vessels disappeared after the middle years of the second century C.E.,³² the production of this type of vessel appears to have begun after this date.

An attempt to identify workshops producing anthropomorphic vessels based on the composition of the metal was undertaken by Valérie Marti-Clercx and Benoît Mille.³³ The results from metallographic analysis of 30 anthropomorphic vessels and figurines found

²³Boucher 1970, 60.

²⁴Tovar 2008.

²⁵Petit 1980, 157–58.

²⁶Hôtel Drouot 1922, 34, no. 155.

²⁷The balsamarium was found in a tomb in Luxemburger Strasse, Cologne. Because of its very crude execution, it is thought to have been made by a provincial craftsman, perhaps from Cologne (La Baume 1964, 223, no. 204).

²⁸Tovar 2008.

²⁹Petit 1980, 157–58.

³⁰Petit 1980, 157–58.

³¹Rabadjiev 1986, 117.

³²Petrovsky 1993, 181.

³³Marti-Clercx and Mille 2002.

in both the western and the eastern parts of the empire (though not in Thrace and Moesia) have shown that two types of copper alloys were used in their production. The first type contains four components (copper, tin, lead, and zinc) and is typical only of vessels found in the western part of the empire. The second is a tripartite alloy (copper, tin, and lead), typical of objects found in the eastern empire. Marti-Clercx and Mille conclude that zinc can be used as evidence for the western origin of a vessel.³⁴ However, the authors note that the absence of zinc does not require assigning an object to the eastern empire because, according to an analysis of 167 Roman bronze figurines from the territory of Gaul,³⁵ 87 of them were made from the tripartite alloy not containing zinc.

Marti-Clercx and Mille also mention that, from an iconographical point of view, the vessels produced in the eastern workshops depict deities and grotesques (such as a “Syrian” or a dwarf).³⁶ They describe two balsamaria from the Musée des Beaux-Arts, Lyon (inv. nos. E 408, which has close parallels to the Boyanovo vase, and E 330), as representing “Syrians”; neither balsarium has a known provenance, and both vessels are made from the tripartite alloy (leaded bronze).

We also have information about the elemental composition of another close analogue to the Boyanovo vessel, the boxer’s-head balsarium from the J. Paul Getty Museum, Los Angeles. According to X-ray fluorescence (XRF) analysis, this balsarium (probably found in Aleppo, Syria) is made from alloy that “is consistent with leaded bronze from the Graeco-Roman period.”³⁷

Elemental analysis of the balsarium from Boyanovo was made using the Fisherscope XDAL XRF spectrometer. XRF is a nondestructive technique that provides data about the elemental composition of a specific part (pointing area) of an object. Because it is a surface technique, the results may not reflect the composition of the bulk alloy. For this reason, several spots of the balsarium where the patina is missing were chosen for analysis. Where possible, the surface in the selected spots was prepared by mechanical cleaning. The areas selected represent the three surviving parts of the balsarium—body, bottom, and

handle—as follows: on the body, three spots (S1–S3) on the edge of the left ear of the head; on the bottom, two spots (S4, S5) between the center and the edge of the bottom; and on the handle, two spots (S6, S7) on the upper part of the handle.

Spot 8 is in the right corner of the figure’s mouth (see fig. 7), where preserved traces of reddish foil can be observed. As a reference point, we also selected a spot on the head where the patina was well preserved (S9). Finally, we analyzed a spot (S10) on the edge of the handle of the strigil (see fig. 4) that was found in the grave with the balsarium. The results of the analysis (table 1) show that the body and bottom of the balsarium are made of brass (chiefly copper and zinc) while the handle is bronze (mainly copper and tin). The strigil found in the grave is also brass.

Extensive use of brass by the Romans began in the first century C.E. This phenomenon might be related to the discovery of the so-called cementation process, through which a copper alloy with 23–28% zinc was created. In his study of 1,163 copper alloy objects of the Roman period from northern Britain, Dungworth demonstrated that the most frequently used alloys were bronze with an average tin content of 9%, brass with an average zinc content of 18%, and bronze with an average tin content of 2%.³⁸ Dungworth explains that the relatively low percentage of zinc in Roman brass is due to the evaporation of the volatile zinc when the fresh brass was melted prior to casting objects.³⁹

The XRF analysis indicates that the body and bottom of the Boyanovo balsarium, as well as the strigil, were made from brass with slightly more than 18% zinc. The differences observed in the analyses of the body, bottom, and strigil occur only in the percentage of lead, which either came with the zinc in the ore or was deliberately added to the brass in order to increase machinability, especially when objects were to be cast.⁴⁰

The brass composition used for producing the strigil is close to that of a strigil from the Roman military settlement at Thamusida, Morocco, dated to the first–third century C.E.⁴¹

³⁴ Marti-Clercx and Mille 2002, 391–92.

³⁵ Beck et al. 1985.

³⁶ Marti-Clercx and Mille 2002, 392.

³⁷ Walton and Svoboda 2007.

³⁸ Dungworth 1997.

³⁹ Dungworth 1997, 905.

⁴⁰ Dungworth 1995, 94.

⁴¹ The Thamusida strigil has 78.3% copper and 21.7% zinc (Gliozzo et al. 2011, 282, table 3, THAM 100).

TABLE 1. Results of XRF analysis of the balsamarium and strigil from the Kral Mezar tumulus at Boyanovo.

Spot	Pointing Area Diam. (mm)	Cu (%)	Sn (%)	Pb (%)	Zn (%)	Supplementary Elements (%)
Balsamarium						
S1, left ear	0.6	77.64	0.0	2.82	18.90	Fe = 0.64
S2, left ear	0.6	79.57	0.0	2.07	17.65	Fe = 0.71
S3, left ear	0.1	79.23	0.0	0.0	20.08	Fe = 0.69
Average for S1–S3		78.813	0.0	1.63	18.877	Fe = 0.68
S4, bottom	0.6	75.68	0.0	5.11	18.58	Fe = 0.58; Co = 0.03 Ni = 0.02
S5, bottom	0.6	79.77	0.0	1.64	18.00	Fe = 0.58; Co = 0.01
Average for S4–S5		77.725	0.0	3.375	18.29	Fe = 0.58; Co = 0.02 Ni = 0.01
S6, handle	0.6	90.32	8.92	0.42	0.0	Fe = 0.34
S7, handle	0.6	89.39	9.77	0.53	0.0	Fe = 0.31
Average for S6–S7		89.855	9.345	0.475	0.0	Fe = 0.325
S8, foil on lips	0.3	93.50	1.88	2.14	0.51	Fe = 0.25; Ca = 1.72
S9, patina	0.6	83.43	0.66	5.29	9.96	Fe = 0.61; Co = 0.05
Strigil						
S10, strigil	0.1	81.40	0.0	0.0	18.60	–

The composition of bronze used for producing the handle of the Boyanovo balsamarium is fully with the typical alloy containing 9–10% tin used for making Roman bronze vessels. The relatively high tin content provides the elasticity needed for mechanical processing (especially for hammering). That is why unleaded bronze (i.e., with less than 1% lead, as in the Boyanovo handle) was frequently used for producing sheets and wires.

The composition of the foil fragment from the right corner of the mouth (see fig. 7) corresponds to the composition of bronze alloys with low percentages of tin that were widespread in the Roman period. Pure copper was rarely used for producing vessels and adornments during this period.⁴² Rather, bronze with a low percentage of tin (less than 5%) was used because such an alloy was very malleable and had the color of

pure copper rather than the pink-brown color typical of bronze.

A comparison of the elemental composition of the Boyanovo balsamarium with that of the anthropomorphic vessels studied by Marti-Clercx and Mille⁴³ shows that the composition of the Boyanovo balsamarium significantly differs not only from the vessels produced in the eastern workshops (made from tripartite alloy with less than 1% zinc) but also from those assumed to be produced in the western workshops (made from a four-part alloy with 7.7% zinc and 7.6% tin on average). However, if we accept the conclusion of Marti-Clercx and Mille that zinc can be used as evidence for a western origin, then the presence of zinc in the elemental composition of the Boyanovo balsamarium should indicate a western origin of the vessel.

An additional argument in favor of the western origin of the Boyanovo balsamarium is the presence of

⁴²Dungworth 1997, 905.

⁴³Marti-Clercx and Mille 2002.

iron in the brass (which, in the balsamarium, is rather high at 0.68%). The zinc carbonate smithsonite ores of the western empire could be used directly in the cementation process for making brass, and the small amount of iron in the ore was likely to be incorporated into the metal. The zinc ores in the eastern empire were the sulfide and sphalerite ores, which had to be carefully refined by a sublimation process before being used in the cementation process. Only a very small amount of iron was left behind in the sublimation process, and the eastern brass thus had a very low iron content.⁴⁴

Another important question that should be answered in order to identify the location of the workshop that produced the Boyanovo balsamarium is whether the metal was diluted with scrap copper alloy or consisted only of fresh (cementation) brass. The answer could be found by analyzing the percentage of tin in the brass composition. Craddock, who looked at a wide selection of Roman copper alloys, has shown that there was an inverse correlation between the zinc and tin when the zinc content was between 5% and 18%, but, interesting to note, when the zinc content was higher, from 18% to the highest percentage in the upper 20s, there was no tin.⁴⁵ The Boyanovo balsamarium corresponds to Craddock's examples that had a high zinc content and no tin, and this strongly suggests that the Boyanovo vase is undiluted brass. Later analytical studies of Roman military fittings from the first and second centuries C.E.—which showed that they were almost all brasses with zinc typically in the 15–20% range and almost no tin—suggest that this composition was the usual straight, undiluted brass used by the military.⁴⁶ Because the brass of the Boyanovo balsamarium does not contain any tin, we can conclude that the balsamarium is made from undiluted fresh brass.

At present, only two workshops operating during the Roman period have been archaeologically proven to have made brass by the cementation process in sufficiently large volumes for the production of brass vessels.⁴⁷ Both workshops were in France, one near Autun and one near Lyon. The location of these workshops

and the fact that many balsamaria have been found in Gaul point to one of these workshops as the most probable place for the production of the Boyanovo balsamarium.

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⁴⁴Craddock and Eckstein 2003.

⁴⁵Craddock 1978.

⁴⁶Jackson and Craddock 1995.

⁴⁷Mustață 2013, 101.

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