



HAL
open science

Dubious Early Medieval Jewels from Matzhausen (Bavaria): New Material and Technological Investigations

Jan Hasil, Estelle Ottenwelter, Ludmila Barčáková

► **To cite this version:**

Jan Hasil, Estelle Ottenwelter, Ludmila Barčáková. Dubious Early Medieval Jewels from Matzhausen (Bavaria): New Material and Technological Investigations. *Studies in Conservation*, 2020, *Studies in Conservation*, 65 (6), pp.333-345. 10.1080/00393630.2019.1677082 . hal-04256645

HAL Id: hal-04256645

<https://univ-tlse2.hal.science/hal-04256645v1>

Submitted on 24 Oct 2023

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Copyright



Dubious Early Medieval Jewels from Matzhausen (Bavaria): New Material and Technological Investigations

Jan Hasil, Estelle Ottenwelter & Ludmila Barčáková

To cite this article: Jan Hasil, Estelle Ottenwelter & Ludmila Barčáková (2019): Dubious Early Medieval Jewels from Matzhausen (Bavaria): New Material and Technological Investigations, Studies in Conservation

To link to this article: <https://doi.org/10.1080/00393630.2019.1677082>



Published online: 01 Dec 2019.



Submit your article to this journal [↗](#)



View related articles [↗](#)



View Crossmark data [↗](#)

Dubious Early Medieval Jewels from Matzhausen (Bavaria): New Material and Technological Investigations

Jan Hasil¹, Estelle Ottenwelter^{1,2} and Ludmila Barčáková¹

¹Institute of Archaeology of the CAS, Prague, Czech Republic; ²CNRS-UMR 5608-TRACES, Maison de la Recherche, Université de Toulouse le Mirail, Toulouse, France

ABSTRACT

A controversial set of elite jewels assumed to be of early medieval period, recovered in 1937–1938 from a burial site in Matzhausen (northeastern Bavaria) was investigated to determine their technological coherency as well as their authenticity. The discovery of these jewels was exploited by German nationalists to argue that the material culture observed in Bohemia and Moravia in the ninth century had Germanic roots. The circumstances of their discovery, however, remain unclear. Research in archives demonstrated the involvement of the SS Ahnenerbe organisation in the recovery of the jewels. Are these jewels authentic or are they forgeries manufactured or modified by a modern craftsman to serve German expansionist nationalism? Three jewels recovered in the grave – a *gombik* (hollow spherical pendant), an earring with chainlet, and a zoomorphic figurine – were investigated using scanning electron microscopy (SEM) coupled with energy-dispersive X-ray spectroscopy (EDX), X-radiography, and stereomicroscopy. The investigation revealed a very heterogeneous set of objects with respect to technology and state of preservation. It also uncovered repairs and past invasive interventions involving modern metal and solder. Comparison with similar types of jewels from Bohemia and Moravia points to important differences in construction and technology, which confirms the uniqueness of this set of objects and casts suspicion on their authenticity.

ARTICLE HISTORY

Received December 2018
Accepted September 2019

KEYWORDS

Slavs; silver jewels; early middle ages; SEM-EDX analysis; X-radiography; manufacturing process; alteration; conservation; authentication

Introduction

This paper deals with the historical context and the study of the material, manufacturing process, construction, state of preservation, and past conservation treatment of three early medieval silver artefacts: a hollow spherical pendant (known as a *gombik*), an earring with chainlets, and a zoomorphic figurine from the late ninth or early tenth century, recovered from excavations of Grave No. 2/3 in the burial ground of Matzhausen (northeastern Bavaria). The circumstances of the discovery of these objects are obscure. Research in archives demonstrated the SS-Ahnenerbe organization's involvement in their recovery. Are these jewels authentic, or are they forgeries manufactured or modified by modern craftsman to serve German expansionist nationalism? Research in archives, material investigation using scanning electron microscopy (SEM) coupled with energy-dispersive X-ray spectroscopy (EDX), X-radiography, as well as comparison with similar types of jewels from Bohemia and Moravia have brought some new elements to light.

The archaeology of the Slavs in Southern Germany in the 1920s and 1930s and the Grave No. 2/3 of Matzhausen

The settlement of Matzhausen was located in the district (Landkreis) of Schwandorf, on a terrace to the

south-east of the River Vils, ca 2 km northwest of the village of Dietldorf, today a town quarter of Burglengenfeld. The demise of the village was associated with the re-building of the Nazi Wehrmacht at the end of the 1930s. Several villages and settlements were removed, and the military training area of Hohenfels, used since 1945 onwards by the US army, was established. The first early medieval graves were found at the position Auf dem Hübel (Pöllath 2002, Taf. 106.2), and had been destroyed without documentation as early as 1929 (Reinecke 1929). Another unprofessional disruption in 1937 led to the commencement of a systematic research campaign which, in turn, led to the opening of seven trial trenches, in which a total of 44 inhumations – amongst which was Grave No. 2/3 – arranged in rows oriented north–south were recovered (Figure 1; for catalogue of the graves, see Pöllath 2002, 54–61; for depiction of objects, see Stroh 1954, Taf. 8 and 9).

The discovery of this grave played an important role in the archaeology of Slavs in Upper Palatinate (most recently Losert 2007/2008), but the historical circumstances under which the excavations started were largely unfavourable. The excavations were stopped soon after the discovery of the jewels in Grave No. 2/3 because of the onset of World War II and were never further completed. Thus, the cemetery was not

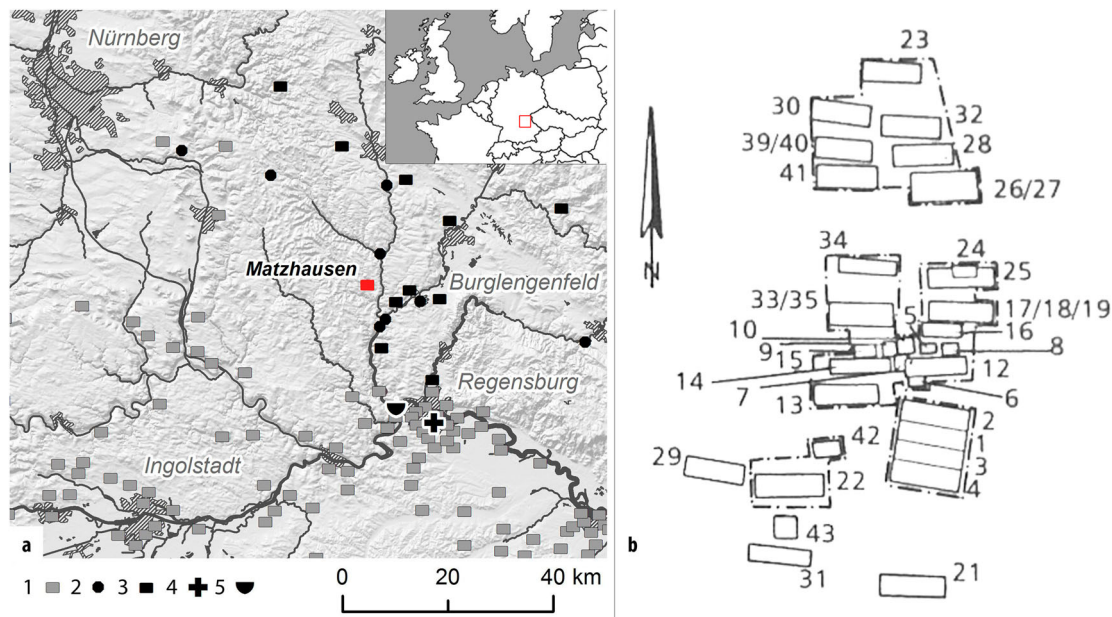


Figure 1. (a) – location of the site (background data of the Bundeslandvermessungsamt). Burial grounds/cemeteries: 1 – Merovingian burial grounds; 2 – late Merovingian/early Carolingian; 3 – Carolingian and Ottonian; 4 – Church cemetery; 5 – Early Medieval cremation burials (after Losert 2007/2008); (b) – plan of the burial ground of Matzhausen (after Pöllath 2002, Taf. 107).

excavated completely. There was also festering nationalism in Germany in the inter-war period. Prior to World War I, the most important Bavarian archaeologist, Paul Reinecke (1872–1958; on his personality, see Krämer 1985) had acknowledged the Slavic nature of the finds from northeastern Bavaria. However, in the second half of the 1920s his position shifted to that of an anti-Slav to whom even the modern dating of the northern Bavarian cemeteries to the Late Merovingian period was unacceptable. The shift of Reinecke's opinions towards nationalism has been given systematic attention by Pöllath (2002, 18–23).

At the start of the 1940s, Karl Dinklage (1907–1987; on his personality, see Neumann 1987), in keeping with the Nazi discourse, in numerous papers (e.g. 1938, 1940, 1943) rejected the notion of Slavic settlement in northeastern Bavaria. In this case, his position was obviously opportunistic, as he was angling in influential circles for a permanent post in the Südostinstitut of the University in Munich. This institute had been founded for the specific purpose of interdisciplinary research into the land broadly characterised as the territories of the Danube, called *Südostforschung* (see Gottas 1997/1998). This notion was misused during the Third Reich for propaganda and ideological support for its claims to these territories (see Beer and Seewann 2004). Dinklage thus completely rejected the idea of any form of Slavic cultural influence in the German-speaking areas (cf. Dinklage 1963, in which he had already retreated from this position). It was in this atmosphere, in 1937, that archaeological research began into the Slavic cemetery of Matzhausen.

The research was conducted by the municipal museum in Regensburg through its long-time

collaborator Baptist Dechant (Steinmetz und Eckes 1937; Eckes 1938; Langsdorff und Schleif 1938). It is difficult to envisage the bizarre research tandem of Dechant, local Regensburg patriot, natural historian and, amongst other things, freemason, and the experienced archaeologist, participant in a number of Middle Eastern expeditions and one of Hitler's 'alte Kameraden' who had participated in the Munich Beer Hall putsch in 1923, member of SS-Ahnenerbe, Standartenführer Alexander Langsdorff (on his personality, see Legendre 2009). As Pöllath demonstrated (2002, 55), it was not the first meeting of the two institutions and protagonists. In 1936, Langsdorff had already caught Dechant and his supervisor Richard Eckes (then Head of Prehistory in Regensburg museum) changing the provenance of finds, and applying non-scientific techniques (i.e. divining) in other fieldwork. Langsdorff's extensive 'oversight' of the Matzhausen research is a crucial consideration when discussing the finds from Grave No. 2/3, since it would seem that they were totally out of the control of Regensburg Museum employees.

In the majority of cases, information on the position of the finds in each grave was (for the most part) preserved, and these went directly into the Regensburg museum collections (Steinmetz and Eckes 1937, 289, Abb. 4; catalogue Pöllath 2002, 55, 57–61), catalogued under inventory numbers 118–153. According to the report, they were there in 1937, and R. Eckes, who was undoubtedly thoroughly acquainted with the research, referred to the project as 'research conducted according to the instructions of the Reichsführung of the SS between 12 and 24 April 1937.' Amongst the finds acquired were 'monochrome beads, temple

rings, iron knives, a bronze pendant, one sickle and pair of iron stirrups.' It is not insignificant that Eckes's initial report speaks of the uncovering of 44 graves. It is all the more striking that a year later, Eckes again noted (1938, 269, Abb. 4) the 'find from the destroyed rows of graves (...) handed over from the Reichsführung of the SS', among which there was a 'granular animal figurine, a granular earring, two discharged balls with a masque-like decoration, two engraved pendants, one amber and more glass beads.' These items, with a description corresponding to the so-called Double grave No. 2/3, were assigned the inventory numbers 273 and 274. Thus it is clear that these items were dealt with in the period 1937–1938, and separate from the other materials from Matzhausen. From the perspective of this paper, a crucial aspect is then the question of the state of the items from Grave No. 2/3 when found. The earliest depictions are photographs attached to Eckes's report from 1938 (Figure 2), which corresponds to the state of the artefacts as they are captured by the post-war drawing documentation in the Stroh's catalogue (Figure 3). The repair in the corner of the figurine's bottom sheet is already visible. Numerous modern interventions were identified during the technological and material analyses, and these must have been made – essentially under the direction of the SS Ahnenerbe – before the handover of the finds from Grave No. 2/3 to the museum in Regensburg. The actual circumstances of this exceptional find, made during the Third Reich with the assistance of the SS-Ahnenerbe organization, raised doubts as to the authenticity of the provenance, even of the individual artefacts. Could this collection be a forgery, manufactured, modified, or assembled to serve German expansionist nationalism? Scanning electron microscopy (SEM) coupled with energy-dispersive X-ray spectroscopy (EDX), X-radiography, observation

of tool marks, and comparison with similar types of jewels from Bohemia and Moravia have brought some new elements to answer to these questions.

Grave No. 2/3, description of the objects

Grave No. 2/3 is the wealthiest early medieval grave known from northeastern Bavaria. The Matzhausen burial ground is a relatively exceptional locality, because two other graves indicate the presence of people of higher social status (Grave 6 containing a fragment of a stirrup and Grave 22 with fragments of a pair of stirrups with fastening (Stroh 1954, Taf. 9. J.3, 9.N.2; Pöllath 2002, 56, 58). The presence of richly furnished graves is not in any way exceptional for the Western Slavic milieu in the period under review, but in northeastern Bavaria is extraordinary. Among tens of other examined localities we know from this region only a small number of graves of the elite, usually of males, but none of them can be compared with Matzhausen's Grave No. 2/3. A similar image is provided also by the written sources, which do not mention any local Slavonic elites in the region in the Carolingian Period.

As already noted by Pöllath, the inventory of Matzhausen grave No. 2/3 would have aroused doubts even without the highly suspicious circumstances of the find. The deceased were to be accompanied on their last journey by a total of 13 silver artefacts, the actual combination of which is unusual and unique to this day in time and space but still possible (Pöllath 2002, 55; cf. Hasil 2011, 350). Specifically, they are six silver S-shaped temple rings of type SR 1 (Hanning 2003; cf. Hasil 2010), i.e. large format ended with a S-shaped loop and functional hook, two pieces of silver S-shaped temple rings SR 2a, one with a broken loop, which served as the hanging elements for the pair of silver moonlike earrings with chains, two silver



Figure 2. The earliest known documentation of the items from Grave No. 2/3 from 1938. The items already show traces of modern interventions (after Eckes 1938, Abb. 4).

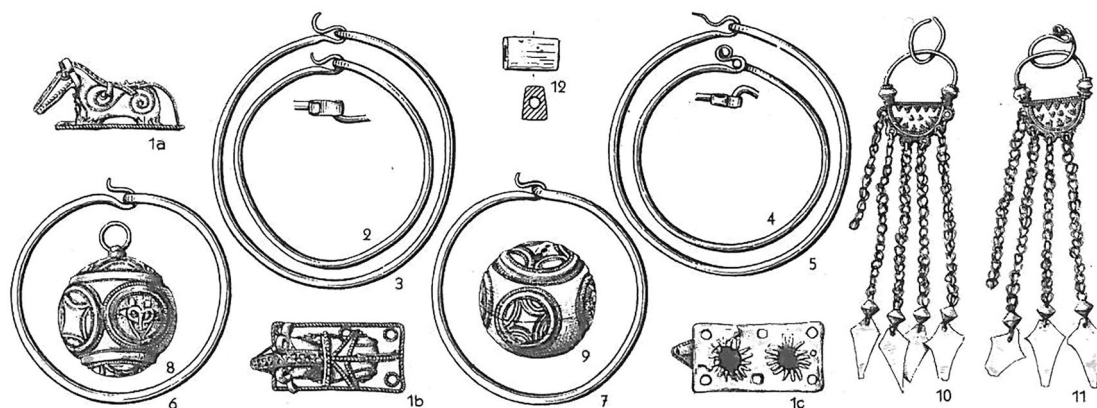


Figure 3. The earliest drawn documentation already testifies to the current state of the items (after Stroh 1954, Taf. 8B).

gombiks (hollow, spherical pendants), one complete, the other partially preserved, and a silver zoomorphic figurine in the shape of a four-legged animal with prominent ears and horns (see Figure 5(a)) perhaps a ram (cf. the only direct morphological parallel known, a figurine of a ram from Komárov, okr. Opava, in southern Silesia (Michnová et al. 2010; Figure 10a), and earrings from Grave 106b at Stará Kouřim (Šolle 1966; Figure 10c)). The functional interpretation of this artefact is unclear; it is possible to express the hypothesis that it is part of a box for magical items and substances, a so-called *kaptorga* (for the functional, social, and symbolic role of this artefact, see Štefan 2004; Profantová and Šilhová 2010). From the turn of the tenth century, several entirely silver *kaptorgas* are known, on which similarly expressed figures of four-legged animals are represented, namely as surface decoration of the box comprising a trio (Stará Kouřim – U Libuše, Grave 106b; Šolle 1966, 153, Fig. 40:6 a and b), a quartet (Marlow, Ldkr. Vorpommern – Rügen, Herrmann 1985, Taf. 71:a) and a quintet (Libice nad Cidlinou – Vnitřní hradiště, Grave 268; Turek 1976, Taf. 2) of stylized animals. The zoomorphic figurine from Matzhausen could have been placed on the body of a case made from perishable organic material. This would also accord with the presence of a necklace among the grave goods, which were usually part of the contents of *kaptorgas*. Supposedly included in the assemblage from grave No. 2/3 was a polyhedral amber bead, largest dimension of 14.5 mm, and the 1938 report by Eckers mentions other glass beads.

In general, two cultural-chronological components meet in the Matzhausen collection, of which the first part is the six local Carolingian – Ottonian type SR-1 temple rings, whereas earrings with chainlets, *gombiks* – perhaps also a *kaptorga* – indicate the Great Moravian tradition. The zoomorphic motifs indicate (purely subjectively) the influence of the so-called Prague workshops, named after the finds in Prague – Lumbe’s Garden (Smetánka and Frolík 2014), which are represented in the Upper Palatinate in Regensburg – Niedermünster (recently Profantová 2013).

Material investigation

Three objects supposedly recovered from the grave No. 2/3 were selected for non-destructive material investigation, focussed on surface observation and analysis: *gombik* n°8, the earring with chainlets with a small added temple ring n°11, and the zoomorphic figurine n°1.

In order to validate or invalidate the hypothesis that these objects could be derivative of Moravian and Bohemian jewels, or otherwise, forgeries, or modified artefacts, it was necessary to identify the construction of the jewels, their different components, and to characterize the material as well as manufacturing techniques used in their fabrication. It was also necessary to identify possible defects, repairs, tool marks, and to evaluate the state of preservation of the objects, all to allow comparison with Moravian and Bohemian finds.

Methodology

The artefacts were first examined using an Olympus SZX7 stereomicroscope (10-56X). The different components forming the jewels were measured with an Olympus SZX7 stereomicroscope equipped with an Olympus QuickPHOTO camera 3.0. X-ray radiography was undertaken with a digital X-Test 225/200. Elemental analysis and observation at high magnification were carried out using a scanning electron microscope (SEM) coupled with energy dispersive X-ray analysis (EDX) after unvarnishing of the objects. SEM-EDX was chosen as a non-destructive method of observation and analysis because it combines high-resolution micrographs with microanalyses (Meeks 1987, 1988; Scott 1988). It has been largely used in studies of ancient metals to identify material compositions and ancient manufacturing processes (Ogden 1982; Duczko 1985; Giunlia-Mair 2005), as well as identifying corrosion products (Děd and Šilhová 2005; Robbiola and Portier 2006).

Observation and analysis were performed with a PHILIPS XL30 scanning electron microscope (SEM)

equipped with an EDAX system (EDX) on different components of the jewellery, on chosen areas selected previously by examination under stereomicroscope. The observed and analysed surfaces were documented in SE and BSE mode. The electron microanalyses were performed on the surface of the different components, solder areas, and repairs at the Department of Structure and Phase Analyses from the Faculty of Mechanical Engineering VUT in Brno by Ing. D. Janová.

Results and discussion

Gombik n°8

Description

The *gombik* has a maximum height of 42 mm and weighs 9.8 g. It consists of two joined identical hemispheres (diameter 41 mm), the upper being pierced. The suspension system comprises three elements: a loop, 9.2 mm in diameter, a clamp (split pin, 2.2 mm width, flattened on the internal side), and a ring, 5.3 mm in diameter, formed from plain wire of circular section (Figure 4(a)).

The two hemispheres were made from blank discs of metal embossed in a block and soldered together. The loop and the ring were made from drawn, round-sectioned wires of two different diameters (1.6 and 1.1 mm). The decoration is primarily chased but also engraved. Six medallions cover nearly the entire surface – one each at the poles of the *gombik*, and four spaced evenly around the circumferential line of join between the two hemispheres. The medallions at the poles and two facing each other at either end of the major diameter are decorated with equal-sided parallelograms with concave sides (Figure 4(a)). The two other medallions on the body of the *gombik* are ornamented with masks (Figure 4(a, d)).

Condition of the artefact and quality of work

The *gombik* is in an astonishingly well-preserved state. It has a sound metallic core (Figure 4(a)). It is not affected by intergranular corrosion as Bohemian silver *gombik* and jewellery made from thin sheets of silver usually are (Děd and Šilhová 2005; Ottenwelter, Děd, and Barčáková 2014, 168–170; Kolářová, Děd, and Ottenwelter 2014, 289–310). The surface, however shows etching, in particular at the lower pole, where the extent of the original surface has been lost, indicating that the object was exposed to acids (Figure 4(a)).

Observation under a binocular microscope and X-radiography (Figure 4(b,e,f)) revealed several repairs. The *gombik* was pierced next to the suspension system (Figure 4(b,f)) probably to insert four small metallic strips inside the *gombik* (Figure 4(b)). The hole was covered with a small sheet of metal which was soldered into place (Figure 4(f)). Several repairs are visible along the joining areas of the two hemispheres (Figure 4(e)).

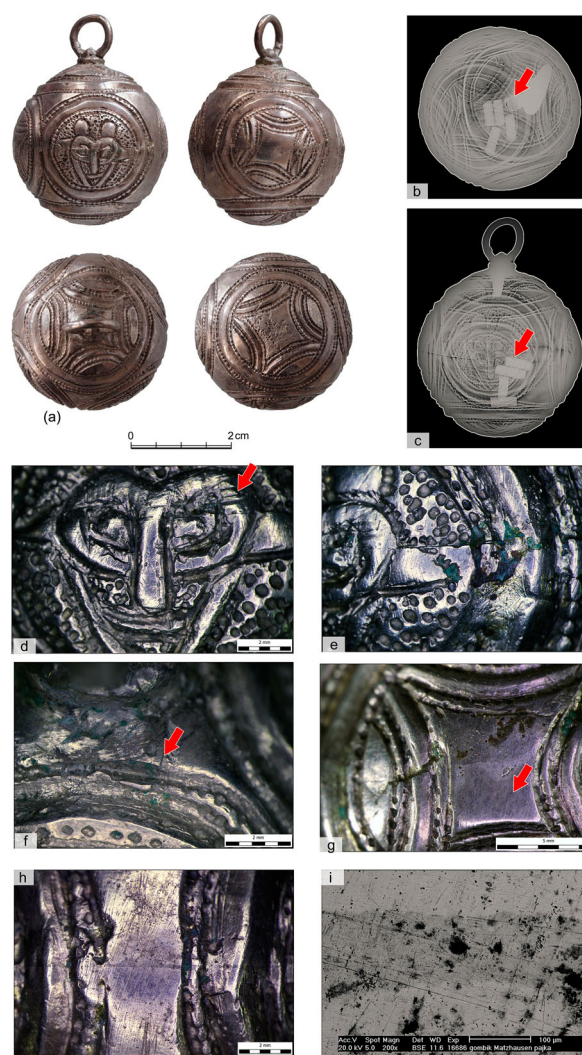


Figure 4. *Gombik* n°8: (a) – general view; (b) – X-radiography showing the perforation of the upper hemisphere (L. Barčáková); (c) – X-radiography revealing the presence of four metallic strips inside the *gombik* (L. Barčáková); (d) – detail of the mask motif and traces of incision; e–modern repair; (f) – plate covering the perforation on the top hemisphere; (g) – filled surface; (h) – filled joint area; i–solder area between the two hemispheres, micrograph, BSE image (photo E. Ottenwelter and D. Janová).

The area of the joint between the two hemispheres bears traces of coarse filing (Figure 4(g,h)). Analyses (Table 1) revealed the presence of zinc in the repaired areas suggesting that all these repairs are modern.

Overall, the *gombik* is of poor quality. The chased decoration is very clumsy. The medallions and masks motifs are irregular (Figure 4(a)). In addition, it is deformed as if the craftsman failed to fill the joined hemispheres with chaser's pitch as required to avoid deformation during the chasing process (Untracht 1985, 121–122).

Scanning electron microscopy and microanalysis

SEM-EDX microanalysis (Table 1) showed that both hemispheres of the *gombik* were made from silver, with a small amount of copper (below 5 wt%). Analyses

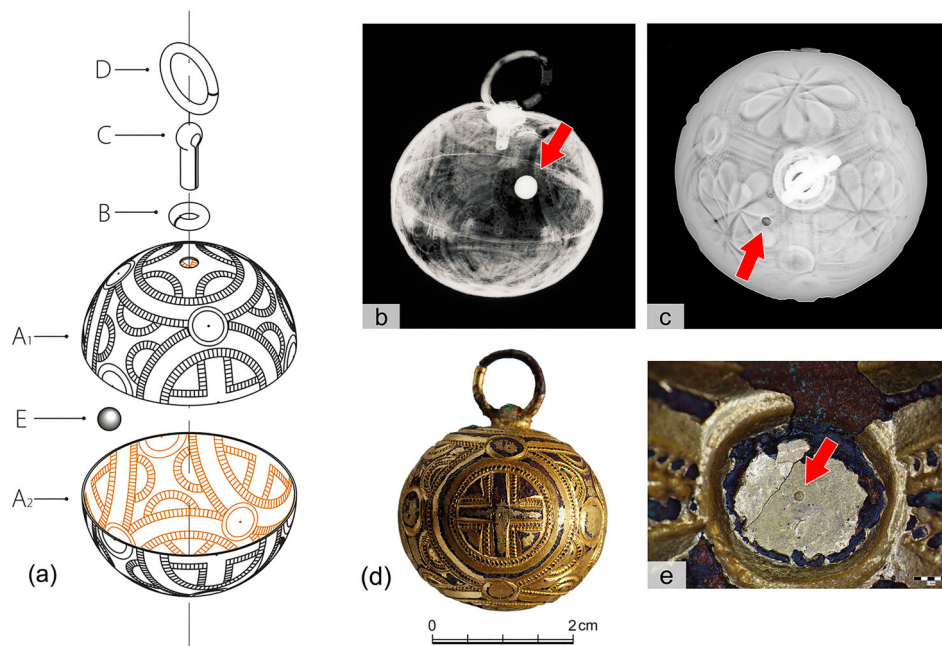


Figure 5. Construction of Bohemian *gombiks*: (a) – exploded view of the *gombik* H104-4 from Lumbe’s Garden cemetery, Prague Castle (A-loop, B-clamp, C-ring, A-hemisphere, E-pellet) (drawing. G. Plítková in Ottenwelter, Děd, and Barčáková 2014, 171); (b) – X-radiography of *gombik* H 104-4 found in the Lumbe’s Garden cemetery showing the presence of a pellet inside it; (c) – X-radiography of *gombik* 63/š from Mikulčice (Moravia) showing a hole pierced in the upper hemisphere; d-photo of Bohemian *gombik* H104-4 from the Lumbés Garden cemetery, Prague Castle (photo J. Sobek in Ottenwelter, Děd, and Barčáková 2014, 173, Fig. 4/6a); (e) – compass mark on *gombik* H 104-4 from the Lumbés Garden cemetery, Prague Castle (photo. E. Ottenwelter).

performed on the elements forming the suspension system show that other materials were used to manufacture the loop, the clamp, and the ring. Analyses on the loop detected pure silver. Copper was not detected, but presence of chlorides on the surface may have hidden it since analysis was performed on a slightly tarnished surface. In that case, the results of surface analysis may not be representative of the true metal composition since tarnish layers can distort the results. This tarnished surface was detected only on the suspension system. Other areas were clean.

Ternary alloys of silver–copper–gold with less than 3% of gold and less than 4% of copper were found on the clamp and the ring. A very small amount of tin was highlighted in the clamp. A higher percentage of copper (6%) was noted in the analyses of the solder area between the two hemispheres, suggesting the use of copper compounds in the solder (Table 1). The sheet used to cover the hole detected on the X-radiography

was manufactured from silver containing almost 5% of copper. A modern solder containing zinc was used to join this sheet to the hemisphere, as well as on repairs present on the area of the joint between the two hemispheres (Table 1).

Discussion

The sizes of the different elements making up the *gombik* and its global construction are very similar to Bohemian *gombiks* (Figure 5(a)), the construction of which comprises two hemispheres and a three-element suspension system (loop, clamp, and ring). However, a significant difference was revealed by X-radiography. Instead of the expected pellet or pellets (two, possibly three) found inside Bohemian and Moravian *gombiks* (Figure 5(b)) four strips of metal slightly narrower than the diameter of the hole pierced on the top hemisphere (Figure 4(c)) were revealed.

A small hole is sometimes observed also on *gombiks* from Moravian context (Figure 5(c)). They can be explained from a technical point of view as vents to prevent possible bursting of the joined hemispheres during the process of soldering by releasing pressure (Untracht 1985, 116). However, in these *gombiks*, the perforation is never concealed and is smaller.

Another difference can be seen in the technique of decoration. Bohemian and Moravian *gombiks* with chased decoration observed so far are made by chasing and repoussé work but not by engraving. Here though, the chased lines are sharpened by

Table 1. Analysis performed on *gombik* n° 8.

Gombik n°8	Chemical composition [wt. %]						
	Au	Ag	Cu	Sn	Zn	Cl	S
Hemisphere	–	97.6	2.4	–	–	–	–
Hemisphere	–	97.8	2.2	–	–	–	–
Loop	–	98.5	–	–	–	1.5	–
Clamp	2.4	92.6	3.7	0.6	–	0.7	–
Ring	2.8	93.9	1.8	–	–	0.9	0.6
Solder area (loop)	3.1	84.9	10.5	–	–	1.5	–
Solder area (Hemisphere)	–	93.9	6.1	–	–	–	–
Modern Repair (Hemisphere)	–	90.3	4.3	–	5.4	–	–
Modern Repair (Sheet Repair)	–	85.2	9.6	–	3	1.2	1
Sheet Repair	–	95.2	4.8	–	–	–	–

engraving (Figure 4(d)). The craftsman who made this piece was poorly skilled, and it is evident that he was not familiar with the technique of chasing. The motifs were not sketched to organize the decoration, and there is no use of drawing compass or visible sketch lines as we can observe on fine pieces from Moravian and Bohemian contexts (Figure 5(e)). The chased decoration is irregular and clumsy. Further, the *gombik* is deformed.

Although decoration within medallions is common in Bohemia (Figure 5(d)) and Moravia, the prevailing motifs are stylized birds or geometrical motifs. The mask motif is unknown there to date.

The composition of the bulk metal used to manufacture the Matzhausen *gombik* is similar to that from which similar *gombiks* from Bohemian and Moravia were made – almost pure silver with a small amount of copper. However, the presence of modern solder containing zinc above the plate hiding the perforated hole and along the joint between the two hemispheres demonstrates that this artefact was modified in modern times. The traces of heavy filing on the repaired area and soldered areas also highlights a rather invasive and coarse finish linked to a modern intervention. Modern invasive restoration using modern metal was also observed on *gombiks* from Mikulčice which were restored in the 1950s. Modern solder and metal were commonly used in restoration of metal artefacts before the arrival on the market of synthetic resins and adhesives.

The state of preservation of the *gombik* is also casting suspicion although Moravian silver *gombiks* are also very well preserved. There is no trace of intergranular corrosion as observed on *gombiks* of Bohemian provenance. The four strips of metal inside the *gombik* are not concreted by corrosion products to the interior surface as is always the case for Bohemian *gombiks*. On the contrary, it chimes very distinctively.

Earring with chainlets

Description

The earring is 90 mm long and weighs 3.4 g. It is constructed from a wire of round cross section, hammered into a square cross section on the lower part and bent into an open ring (Figure 6(a)). A plate of 0.1 mm thickness is folded around the central wire to form a semi-circle with originally six small perforated ‘petals’ on the lower part (Figures 6(a,d)). This plate is attached mechanically on the side by overlapping around the central wire (Figure 6(c)). A strip of a width of 0.6 and 3 mm thick reinforces the plate and holds a row of decorative granules (Figure 6(d)). It overlaps the plate on the reverse to reinforce it mechanically (Figure 6(e)). Two globes 5 mm in diameter are threaded on the

central wire on each side of the plate (Figure 6(a,f)). They are topped by a small ring, 2 mm in diameter, which is decorated with a row of granules 0.6 mm in diameter. The plate is decorated on the front with granulation work organised in triangles (Figure 6(d)) and is plain on the reverse (Figure 6(c)). The ‘petals’ are also decorated with granulation work (Figure 6(d)). There is a row of granulation along the central wire, and another around the perforation. The perforations are strengthened by a small ring 2 mm in diameter (Figure 6(d)). Six chains made from a single loop-in-loop system hung originally from the body of the earring (Figure 6(a)), but two have been lost. At the end of each hangs a conical bead (Figure 6(g)) and a rhomboid plate (Figure 6(a)).

A small S-shaped temple ring made from the same round-sectioned wire, rather than the central wire of the main earring, is threaded on the central wire

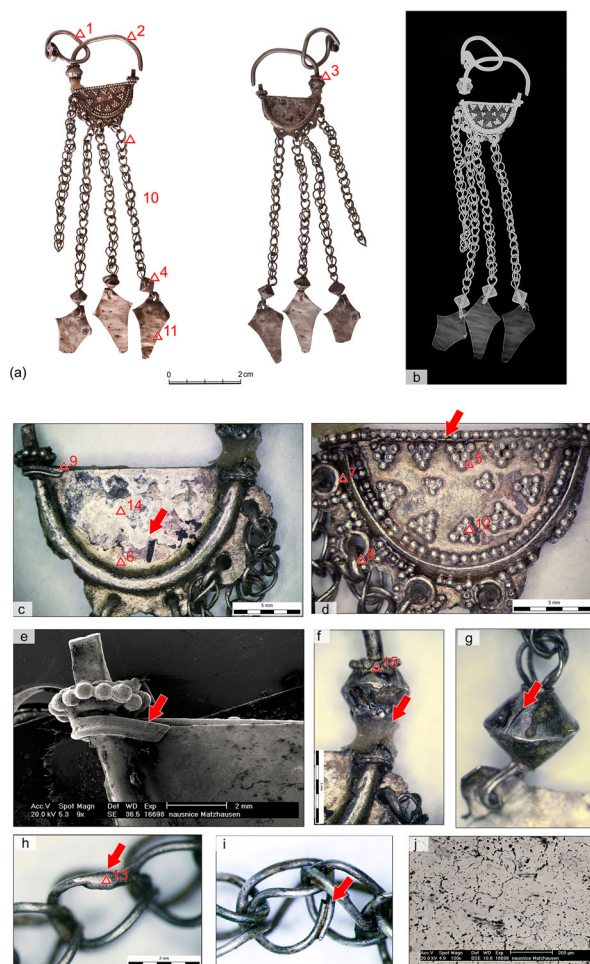


Figure 6. Earring with a chainlet n°11: (a) – general view; (b) – X-radiography of the earring (L. Barčáková); (c) – modern repair covering the inventory number; (d) – detail of the semi-circular part of the earring; (e) – detail of the reinforcing strip overlapping the external wire; (f) – modern gap-filling in epoxy resin; (g) – detail of the biconical bead; (h) – detail of the joined rings forming the chain loops; (i) – detail of the superimposed and joined ends of the wires forming the chain loops; (j) – intergranular corrosion observed on the semi-circular plate (BSE micrograph, D. Janová). (Photo. E. Ottenwelter).

(Figure 6(a)). The ring around the top hemispheres and around the perforations is made of exactly the same material, but joining rings to the chains are made from a different, thicker wire.

Condition of the artefact and quality of work

The object is incomplete, with two chains missing and another incomplete. An epoxy filling was placed between the upper globe and the semi-circular plate (Figure 6(f)). Modern repairs are visible on the reverse side of the semi-circular plate and top globe (Figure 6(c,g)). Intergranular corrosion was observed by SEM on the semi-circular plate (Figure 6(j)), and the advanced state of mineralisation of the semi-circular plate is also visible on the X-radiograph of the earring (Figure 6(b)). The chain and the pendants are, on the contrary in a very good state of preservation and do not show any sign of intergranular corrosion.

Scanning electron microscopy and microanalyses

Electron micro-probe analysis has shown that silver containing an average 3% of copper was used to manufacture the different components of the earring (Table 2). The top hemisphere contains half as much copper than the conical beads threaded on the chains. The joining rings with chains, the chains, the conical beads, and rhomboid pendants have the same composition: silver with around 2.5% of copper. The main plate forming the semi-circular body of the earring contains approximately 3% of copper.

Several modern repairs were performed on the earring: on its back over an old inventory number made in Chinese ink (Figure 6(c)) and on the top hemisphere. Both involve the use of soft solder with lead (Table 2).

The small S-shaped temple ring has 1% more copper than the other components forming the earring.

Table 2. Analyses performed on the earring with chainlet n° 11.

Earring with chainlet n°11	Chemical composition [wt. %]			
	Ag	Cu	Pb	S
Wire, small temple ring	96.9	3.1	–	–
Wire, central	95.7	4.3	–	–
Hemisphere, Globe	98.5	1.5	–	–
Biconical bead	97	3	–	–
Granule	97	3	–	–
Sheet, semi circular	96.6	3.4	–	–
Ring	97.2	2.8	–	–
Ring	97.4–	2.6	–	–
Strip	97.7	2.3	–	–
Wire, Chain	97.5–	2.5	–	–
Sheet, pendant	97.7–	2.3	–	–
Solder area between granules	89.1	3.8	–	7.1
Solder area, chain loop	97.9	2.1	–	–
Modern repair	74.8	14.5	2.6	8.1
Modern solder	89.9	–	8	2.1

Discussion

The state of preservation of the earring and its material composition are in accordance with similar contemporary finds. Several modern repairs containing lead have been detected on the back of the semi-circular sheet and around the top globe. We cannot exclude the possibility that some parts (chains and biconical beads) were added in a modern restoration, since they do not exhibit signs of intergranular corrosion.

It is interesting to note that the manufacture of the hemisphere and conical beads differs technologically from similar components in Bohemia and Moravia. In Matzhausen, they are made by folding a cut disc of metal (Figure 7(a)), while on specimens from Bohemia and Moravia observed so far, a disc of metal is embossed to form the hemispheres (Figure 7(b,c)).

The soldering of the chain seems also to be different. The wires of the loop overlap each other by 1.3 mm, unlike the soldered wires used to make similar chains found in Bohemia in Lumbe's Garden cemetery, Prague Castle (Ottenwelter, Děd, and Barčáková 2014, 238).

Zoomorphic applique

Description

The applique, which is 4 cm in length and weighs 6.1 g, comprises several parts: the animal (a ram?), and the bottom plate on which it is standing. The animal is formed by two opposed embossed shells (Figure 8(a)), which are soldered together. One shell overlaps the other under the jaw of the animal, joining the two parts mechanically (Figure 8(a)). The two shells are also mechanically joined by a strip of metal going through them and forming the ears and the horns of

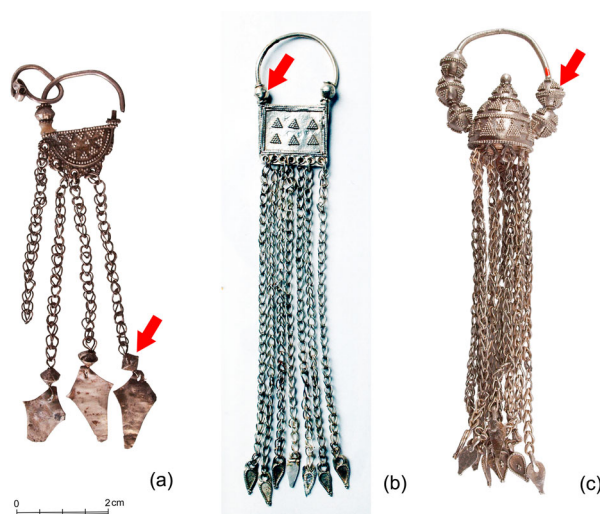


Figure 7. Different specimens of earring with chainlets: (a) – Matzhausen (Bavaria); (b) – Pohansko-Ducal Manor (Moravia) (Kouřil 2014, Fig. 261, p.417); (c) – Mikulčice-Valy (Moravia) (photo E.Ottenwelter).

the animal (Figure 8(a,e)). The legs of the animal are cut in small strips and folded onto the bottom plate. The bottom plate is also cut into several strips and is also folded onto the legs of the animal to join them mechanically (Figure 8(a,d)). The body is ornamented by several components: a strip 1.6 mm wide forms the ear and horns, while the eyes are formed by granules. A beaded wire surrounded by two single twisted wires forms the tail (Figure 8(f)). A decorative plate onto which are soldered beaded wires is placed on the back of the animal (Figure 8(a,f)). The sides and front of the animal are decorated by spirals of loose twisted wires topped by a granule (Figure 9(e)). A corrugated strip surrounded by beaded wires is placed on the head of the animal (Figure 8(e)).

The bottom plate is perforated by six square holes surrounded by a ring of block-twisted wire (Figure 8). The bottom plate is decorated on its edge by a twisted wire (Figure 8(a), Figure 9(a)), while a simple wire is attached to the tail (Figure 9(a)).

Several types of wire had to be manufactured to decorate the animal: beaded wire, loose twisted wire, twisted wire, and single block-twisted wire. Two sizes of granules, a corrugated strip and plate form the bottom and the decorative plate on the back of the animal. Fourteen different components, which were then soldered together, had to be manufactured to create this artefact. Mechanical joints were also used:

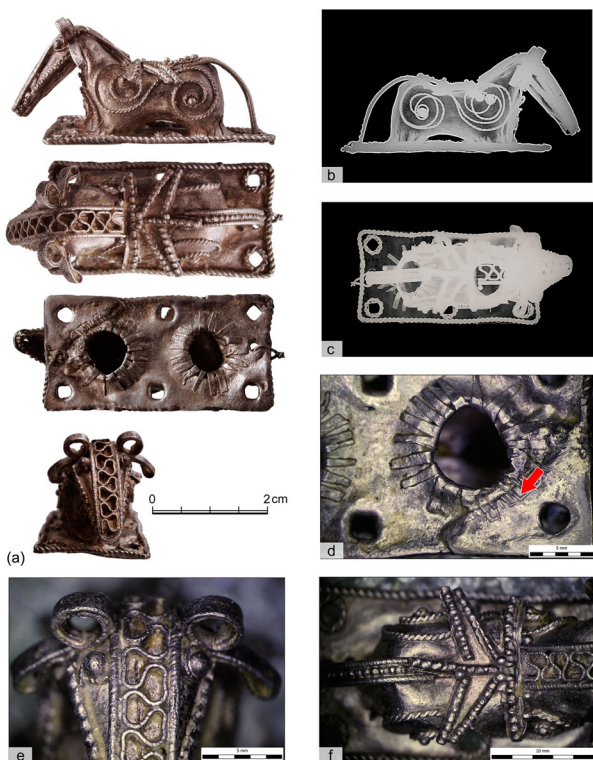


Figure 8. Zoomorphic applique: (a) – general view; (b,c) – profile and top X-radiography (L. Barčáková); (d) – modern repair; (e) – detail of the corrugated strip; (f) – top view showing detail of the decorative plate with beaded wire on the back of the animal (photo E. Ottenwelter).

legs and bottom plate, and bottom plate overlapping the twisted wire.

Condition of the artefact and quality of work

The object, which is complete, shows the intergranular corrosion expected for silver buried in a wet, aerobic, terrestrial environment (Figure 9(g,h)). A corner of the bottom plate was repaired. The hole in this corner is round and not square as the other holes. The missing cut and folded strips were drawn by incision on the repair (Figure 8(a,d)).

The object was made by a very skilled silversmith, granulation and filigree decoration work are very precise.

Scanning electron microscopy and microanalyses

Electron micro-probe analysis has shown that silver with a small amount of copper (average 2–3%) was used to manufacture the different components of the applique (Table 3). One corner of the bottom sheet (Figure 8(a,d)) was repaired in recent times with a hard silver solder containing zinc and tin.

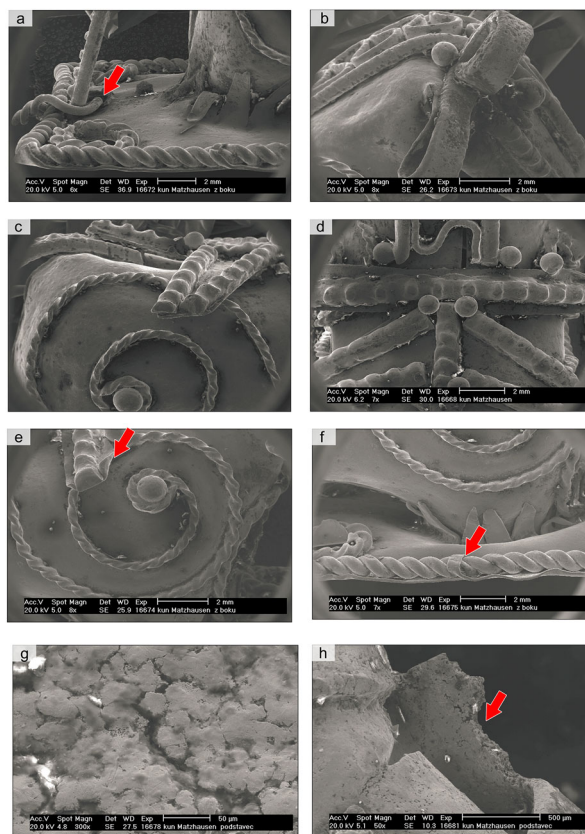


Figure 9. Zoomorphic applique: (a) – modern wire and patch of cut silver wire; (b) – detail of the strip forming the ears and horns of the animal; (c) – detail of block-twisted wire; (d) – detail of the beaded wire, top view; (e) – detail of the stamped beaded wire; (f) – mechanical joints of the legs and bottom plate and strips of the bottom plate over the twisted wire; (g) – intergranular corrosion observed on the surface of the bottom plate; intergranular corrosion observed on a broken folded strips of the leg (SE micrographs, J. Janová).

Table 3. Analyses performed on the zoomorphic applique.

Zoomorphic applique n°1	Chemical composition [Wt. %]						
	Ag	Cu	Pb	Sn	Zn	Cl	S
Shell I	97.8	2.2	-	-	-	-	-
Shell II	98.3	1.7	-	-	-	-	-
Sheet, bottom	98	2	-	-	-	-	-
Strip, ear	97.3	2.7	-	-	-	-	-
Corrugated strip	98.9	-	-	-	-	-	1.1
Wire block-twisted	97.7–	2.3	-	1.1	-	-	-
Wire beaded	97.8	2.2	-	-	-	-	-
Wire block-twisted tail	97.8	2.2	-	-	-	-	-
Wire twisted spirals	96.7	3.2	-	-	-	-	-
Filigree ring around eyes	97	3	-	-	-	-	-
Granule, back	98.4	1.6	-	-	-	-	-
Granule, eye	98.4	-	-	-	-	-0.8	-0.8
Solder area	96.2	2.8	-	-	-	-	-
Modern repair	93.6	2.4	-	1.3–	2.7	-	-

Discussion

The object is a masterpiece. The craftsman who made it was highly skilled in soldering, granulation, and filigree work. Zoomorphic figures made of two opposing, embossed shells joined by a strip of metal which also forms the ears are known in Bohemia namely in Stará Kouřim (Figure 10(b,c)), Prague Castle, and Libice nad Cidlinou, but this object clearly belongs to another school. The mechanical joins of the feet to the bottom plate, as well as the strips of the bottom plate over the twisted wire, are original mechanical joins of a type not observed so far on Bohemian jewellery. Furthermore, the beaded wire on the back, which was stamped on a sheet of silver and then cut and soldered to the plate, is also unique (Figure 9(e)). A zoomorphic figurine with a chased decoration, standing on a similar pierced plate was found in the Komárov hoard in Moravia (Figure 10(a)).

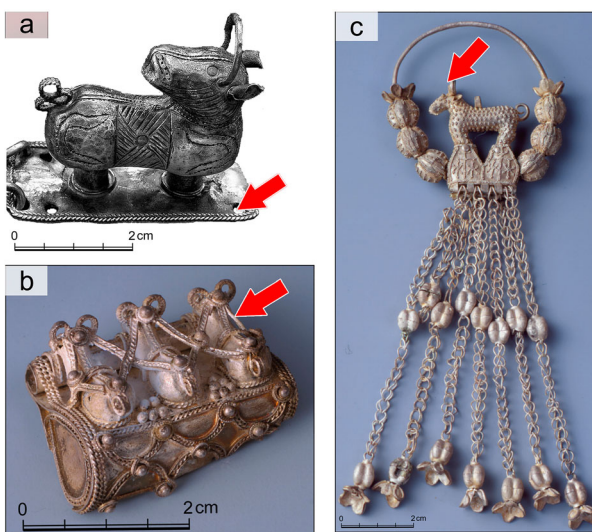


Figure 10. Zoomorphic figurines made of two opposite shells from Bohemia and Moravia: (a) – zoomorphic figurine from the Komárov hoard (photo Národní Muzeum v Praze); (b) – *Kaprtorga*, Stará Kouřim (Wieczorek and Hinz eds. 2000, 214); (c) – earring with chainlets, Stará Kouřim (Wieczorek and Hinz 2000, 215).

The state of preservation of the object and particularly of the bottom plate indicates burial in a wet aerobic environment. Decorative components such as the large granule forming the eyes, the twisted wire along the bottom plate, and the loose block-twisted spirals are, on the contrary, very well preserved.

The Matzhausen complex in scientific discourse

Immediately after the end of the Matzhausen research, Eckes (1938) offered the regional archaeological interpretation that the group was unequivocally Bavarian and placed it in the tenth-eleventh centuries CE. K. Dinklage categorized them in the context of *Carolingian, Early Germanic culture* (Dinklage 1943), but the representatives of the SS Ahnenerbe A. Langsdorff and H. Schleif (1938) expressed themselves in the strangest way, attributing them to the culture of the Avars! The positions of the first two researchers is, in principle, obvious and does not deviate from the discursive frameworks in which they worked during that period; all the more remarkable is the expression of Langsdorff and Schlieff, whose motivation is now impossible to uncover. If the SS Ahnenerbe had a cultural-political or propaganda plan for the items that it had allegedly collected from the Grave No. 2/3, it was unnecessary in 1938, in which there was the Anschluss of Austria (15 March) and the disintegration of Czechoslovakia (30 September), completed by the occupation of Prague, and the declaration of an independent Slovakia in mid-March of 1939. The geopolitical map of that part of Central Europe to which the objects of the Matzhausen collection typically and stylistically belong had changed considerably. The early medieval archaeology of these regions had not yet been distinctly profiled in 1938 as it is now, thanks to post-war research into the major centres and their burial grounds in Bohemia and Moravia. Thus, at the time, the Matzhausen collection could have had almost shattering potential for Nazi propaganda, which luckily remained unutilised.

The decline and fall of the Third Reich began a time of diminishing interest in the Matzhausen collection. Eckes died under unclear circumstance at the end of the war (Pöllath 2002, 54), Schleif shot his family and then himself in Berlin surrounded by the Red Army (Klee 2005, 475), Langsdorff died in captivity in 1946, and K. Dinklage shifted his interests to the land history of Carinthia. The study by Stroh (1954), which solved the problem of early medieval necropoli in the Upper Palatinate for the first time based on a systematically prepared catalogue of localities and finds, proved to be ground breaking. Stroh, with his open acceptance the Slavic nature of Upper Palatinate early medieval settlement, contrasts starkly with the overt revisionist tendencies resonating in the academic circles of the German exile movement well into the

1960s (Weger 2010). However, the question of early medieval Slavic settlement in northeast Bavaria remained on the periphery of the interest of regional academic communities in Central Europe (see Hasil 2010) also. Thus, the Matzhausen collection received only minimal attention on the margins of the treatment of the broader topics in the second half of the 1950s to the 1980s (Raschke 1959; Hejna 1971; Schwarz 1976, 1978, 1984; Korošec 1979), and remained practically unknown to the general public.

The pieces from Matzhausen found themselves involved in an entirely new social-political discourse from the end of the 1980s. Already the joint Bavarian-Salzburg land exhibition in 1988 devoted to the issue of the old Bavarians (Tovornik 1988) marked the common effort of Central European intellectual and academic circles to cross borders. This manifested itself completely after the events of 1989. Without ever having been subjected to thorough source criticism, the Matzhausen collection became one of the archaeological icons of the cultural interdependence of early medieval Central Europe, and the subject of a number of popular publications (Menghin 1990; Angerer 1995) and exhibition projects (esp. Neumayer 2000). The beginning of the 1990s also meant the renewal of research interest in the Slavic settlement of northeast Bavaria (Losert 1993). The rare combination of finds from Grave No. 2/3, indeed from the whole Matzhausen necropolis, became an important subject of debate, especially for the super-regional discussion of typological schemes linked to the chronology of individual artefact types (e.g. Tomková 1998; Hanning 2003; Losert 2007/2008; Košnar 2009; Hasil 2010; Eichert 2010; Michnová et al. 2010, 117; Košta and Tomková 2011; Ungerman 2016, 2018). However, an analytical approach to the collection as a whole, which would at least point to the need for revision of its interpretations, remained entirely missing (Pöllath 2002).

Conclusion

The Matzhausen collection demonstrates graphically that archaeological finds gain a new context through re-incorporation into a living culture, which is changeable in time and context. For this reason, it is always necessary to follow best practice in dealing with archaeological material (see e.g. European Archaeological Council 2014) and the fundamentals of ethical conservation. At present, this collection of silver early medieval jewellery continues to be a fascinating set of artefacts, the complex, critical assessment of which must combine the methods and knowledge of an archaeologist, a specialist in conservation science, and also a historian of contemporary history. In this study, we have been able to point out the problematic aspects of the alleged discovery of this collection, its

possible period connections, and to reveal very specific information on the medieval production technology, as well as modern interventions in some of the artefacts belonging to the ensemble associated with Grave No. 2/3.

Although, it is so far impossible to prove that the jewels are forgeries from a material sciences approach, since no destructive analysis was permitted, new information was discovered through surface analyses and observation as well as X-radiography. Observation of the objects demonstrated very different levels of skill, with the manufacture of the *gombik* being fairly poor, that of the applique excellent. The original joins of the applique and the manufacture of the globe and the earring with chainlets appear to be the products of a particular school.

The objects showed variable states of preservation, and instances where different components of the same objects differed in condition. In addition, invasive and undocumented restoration using modern materials and tools (modern solder, coarse files, holes made with different tools, and inserted strips of metal), and the possible modern replacement of several components, was identified.

Unfortunately, potential techniques for authentication were limited by the constraint of a non-destructive approach. Until a thorough analysis is conducted, ideally by laser ablation-inductively coupled plasma-mass spectrometry (LA-ICP-MS), combined with metallography, which would allow identification of trace elements and the state of preservation along the entire cross section, Matzhausen jewellery should be considered to be somewhat dubious.

Acknowledgements

We would like to thank the Municipal Museums of Regensburg – Historical Museum (Dr. Andreas Boos, Maximilian Ontrup), for having providing us with the objects and Brian Scott for editing the English text.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

This study is a result of the research funded by the Czech Science Foundation as the project GA ČR 18-00477 S “Between Avar and Carolingian Empire. Nodal Points of long-distance Contacts of Bohemia in 8th and 9th Century”.

References

Angerer, Martin, ed. 1995. *Regensburg im Mittelalter: Katalog der Abteilung Mittelalter im Museum der Stadt Regensburg*. Regensburg: Museen der Stadt Regensburg.

- Beer, Mathias, and Gerhard Seewann. 2004. *Südostforschung im Schatten des Dritten Reiches: Institutionen – Inhalte – Personen*. München: Oldenbourg.
- Děd, J., and Šilňová. 2005. *Degradace stříbrných předmětů z archeologický nálezu*, In: Sborník z Konference Konzervátorů a restaurátorů, Plzeň, 6-8. Zář 2005, Technické Muzeum v Brně pro Komisi Konzervátorů-restaurátorů a preparátorů AMG, Brno, 44–48.
- Dinklage, Karl. 1938. "Zur ältesten Besiedlungsgeschichte des Egerlandes." *Heimat und Volkstum* 14: 329–336.
- Dinklage, Karl. 1940. "Studien zur Frühgeschichte des deutschen Südostens." *Südostforschungen* 5: 158–198.
- Dinklage, Karl. 1943. *Frühdeutsche Volkskultur in Kärnten und seinen Marken*. Laibach: Institut für Kärntner Landesforschung.
- Dinklage, Karl. 1963. "Das frühmittelalterliche Reihengräberfeld Diemlach, Steiermark." *Schild von Steier* 11: 35–42.
- Duczko, Wladyslaw. 1985. *Birka V, The filigree and Granulation Work of the Viking Period: An Analysis of the Material from Björkö*. Stockholm: Kungl.
- Eckes, Richard. 1938. "Bericht der vorgeschichtlichen Abteilung des Museums der Stadt Regensburg." *Verhandlungen des Historischen Vereins für Oberpfalz und Regensburg* 88: 266–264.
- Eichert, Stefan. 2010. *Die frühmittelalterlichen Grabfunde Kärntens: Die materielle Kultur Karantaniens anhand der Grabfunde vom Ende der Spätantike bis ins 11. Jahrhundert*. Klagenfurt am Wörthersee: Geschichtsverein für Kärnten.
- European Archaeological Council. 2014. *Standard and Guide to Best Practice for Archaeological Archiving in Europe: EAC Guidelines 1*. Namur: European Archaeological Council.
- Giumlia-Mair, Alessandra. 2005. "On Surface Analysis and Archaeometallurgy." *Nuclear Instruments and Methods in Physics Research B* 239: 35–43.
- Gottas, Friedrich. 1997/1998. "Vierzig Jahre Südostdeutsche Historische Kommission: Rückblick und Ausblick." *Südostdeutsches Archiv* 40/41: 1–11.
- Hanning, Rita. 2003. "S-Schleifenringe in frühmittelalterlichen Gräberfeldern Nordbayerns." In *Aspekte der Archäologie des Mittelalters und der Neuzeit: Festschrift für Walter Sage*, edited by Ingolf Ericsson, and Hans Losert, 174–185. Bonn: Habelt.
- Hasil, Jan. 2010. "Problém chronologické synchronizace raně středověkých kostrových pohřebišť v Čechách a v severovýchodním Bavorsku." *Archaeologia historica* 35 (1–2): 159–167.
- Hasil, Jan. 2011. "Review of *Die frühmittelalterlichen Grabfunde Kärntens: Die materielle Kultur Karantaniens anhand der Grabfunde vom Ende der Spätantike bis ins 11. Jahrhundert*, by Stefan Eichert." *Archeologické rozhledy* 63: 348–353.
- Hejna, Antonín. 1971. "Archeologický výzkum a počátky sídlištního vývoje Chebu a Chebska II." *Památky archeologické* 62 (2): 488–550.
- Herrmann, Joachim. 1985. *Die Slawen in Deutschland: Geschichte und Kultur der slawischen Stämme westlich von Oder und Neisse vom 6. bis 12. Jahrhundert*. Berlin: Akademie der Wissenschaften der DDR.
- Klee, Ernst. 2005. *Das Personenlexikon zum Dritten Reich. Wer war was vor und nach 1945*. Frankfurt am Main: Fischer-Taschenbuch-Verlag.
- Kolářová, K., J. Děd, and E. Ottenwelter. 2014. "Metallographic Examination of Silver Jewellery from the Lumbe Garden Cemetery." In *Pohřebišť v Lumbeho zahradě Pražského hradu*. Vol. 2, edited by Zdeněk Smetánka, and Jan Frolík, 280–310. . Praha: Archeologický ústav AV ČR.
- Korošec, Paola. 1979. *Zgodnjerednjeveška arheološka slika karantanskih slovanov*. Ljubljana: Slovenska Akademij znanosti in umetnosti.
- Košnar, Lubomír. 2009. "K původu několika raně středověkých nálezů z Čech." *Archeologické rozhledy* 61: 666–672.
- Košta, Jiří, and Kateřina Tomková. 2011. "Olivovité korálky v raně středověkých Čechách a jejich postavení ve střeoevropském kontextu." *Památky archeologické* 102: 307–354.
- Kouřil, Pavel, ed. 2014. *Great Moravia and the Beginnings of Christianity*. Brno: Institute of Archaeology of the Academy of Sciences of the Czech Republic.
- Krämer, Werner. 1985. "Paul Reinecke." *Archäologie in Deutschland* 1985 (4): 23.
- Langsdorff, Alexander, and Hans Schleif. 1938. "Die Ausgrabungen der SS." *Germanien* 1938 (7): 6–11.
- Legendre, Jean-Pierre. 2009. "La vie picaresque d'Alexander Langsdorff (1898–1946)." *Antiquités nationales* 40: 1–11.
- Losert, Hans. 1993. "Die slawische Besiedlung Nordostbayerns." In *Vorträge des 11. Niederbayerischen Archäologentages*, edited by Karl Schmotz, 207–270. Buch am Erlbach: Leidorf.
- Losert, Hans. 2007/2008. "Slawen in der Oberpfalz – eine Bestandsaufnahme." *Acta Archaeologica Carpathica* 42/43: 301–370.
- Meeks, Nigel. 1987. "Artefacts, Surfaces and the SEM." In *Recent Advances in the Conservation and Analysis of Artefacts*, edited by James Black, 409–410. London: University of London.
- Meeks, Nigel. 1988. "Backscattered Electron Imaging of Archaeological Material." In *Scanning Electron Microscopy in Archaeology*, edited by Sandra L. Olsen, 23–44. Oxford: B.A.R.
- Menghin, Wilfried. 1990. *Frühgeschichte Bayerns: Römer und Germanen – Baiern und Schwaben – Franken und Slawen*. Theiss: Stuttgart.
- Michnová, Věra, Luboš Polanský, Kateřina Tomková, and Markéta Tymonová. 2010. "Komárovský poklad. Revize dochované části torza depotu." *Numismatické listy* 65 (3): 98–126.
- Neumann, Wilhelm. 1987. "Univ.-Prof. Dr. Karl Dinklage †." *Carinthia I* 96: 515–517.
- Neumayer, Heino. 2000. "Das Grab von Matzhausen." In *Europas mitte um 1000*. Vol. 2, edited by Alfred Wiczorek, and Hans-Martin Hinz, 192–193. Theiss: Stuttgart.
- Ogden, Jack. 1982. *Jewellery of the Ancient World*. London: Trefoil Books.
- Ottenwelter, Estelle, Jiří Děd, and Ludmila Barčáková. 2014. "Technical Study of the Jewellery from Lumbe 's Garden Cemetery, Prague Castle." In *Pohřebišť v Lumbeho zahradě Pražského hradu*. Vol. 2, edited by Zdeněk Smetánka, and Jan Frolík, 163–288. Archeologický ústav AV ČR: Praha.
- Pöllath, Rapph. 2002. *Karolingerzeitliche Gräberfelder in Nordostbayern: Eine archäologisch-historische Interpretation mit der Vorlage der Ausgrabungen von K. Schwarz in Weismain und Thurnau-Allendorf*. München: Arethousa.
- Profantová, Naďa. 2013. "Archeologický doklad kulturních styků Bavorska a Čech v 10. století." *Archeologie ve středních Čechách* 17: 207–214.
- Profantová, Naďa, and Alena Šilňová. 2010. "Raně středověké kaptorgy v Čechách: Analýza nálezů z hrobu č. 22 na pohřebišti Klecany II." *Památky archeologické* 101: 283–310.
- Raschke, Georg. 1959. "Frühgeschichtliche Bodenerkunden im Regnitzraum." *Jahrbuch für fränkische Landesgeschichte* 19: 103–134.

- Reinecke, Paul. 1929. "Zur Geschichte der Slaven in Nordostbayern." *Der bayerische Vorgeschichtsfreund* 8: 42–43.
- Robbiola, Luc, and Richard Portier. 2006. "A Global Approach to the Authentification of Ancient Bronzes Based on the Characterization of the Alloy-Patina-Environment System." *Journal of Cultural Heritage* 7: 1–12.
- Schwarz, Klaus. 1976. "Der frühmittelalterliche Landesausbau in Nordost-Bayern archäologisch gesehen." In *Ausgrabungen in Deutschland gefördert von der Deutschen Forschungsgemeinschaft 1950–1975*, 338–404. Mainz: Römisch-Germanisches Zentralmuseum. 1975.
- Schwarz, Klaus. 1978. "Im Wandel der Jahrhunderte: Die frühmittelalterlichen Anfänge nach den archäologischen Quellen." In *Der Landkreis Amberg-Sulzbach im Spiegel der Zeiten*, edited by Sturm, Heribert, 47–76. Amberg: Amberger Zeitung.
- Schwarz, Klaus. 1984. *Frühmittelalterliche Landesausbau im östlichen Franken zwischen Steigerwald, Frankenwald und Oberpfälzer Wald*. Mainz: Römisch-Germanisches Zentralmuseum.
- Scott, David A. 1988. "SEM and Microprobe Analysis: Complementary Methods of Investigation." In *Scanning Electron Microscopy in Archaeology*, edited by Sandra L. Olsen, 47–54. Oxford: B.A.R.
- Smetánka, Zdeněk, and Jan Frolík, eds. 2014. *Pohřebiště v Lumbeho zahradě Pražského hradu 2 vol.* Praha: Archeologický ústav AV ČR.
- Steinmetz, Georg, and Richard Eckes. 1937. "Jahresbericht der vorgeschichtlichen Abteilung des Museums der Stadt Regensburg (Ulrichsmuseum)." *Verhandlungen des Historischen Vereins für Oberpfalz und Regensburg* 87: 285–289.
- Stroh, Armin. 1954. *Die Reihengräber der karolingisch-ottonischen Zeit in der Oberpfalz*. Kallmünz/Oberpfalz: Lassleben.
- Šolle, Miloš. 1966. *Stará Kouřim a projevy velkomoravské hmotné kultury v Čechách*. Archeologický ústav ČSAV: Praha.
- Štefan, Ivo. 2004. "Kaptorgy: pokus o kontextuální analýzu." *Studia mediaevalia pragensia* 5: 21–60.
- Tomková, Kateřina. 1998. "Bernstein im frühmittelalterlichen Böhmen." *Památky archeologické* 99: 64–103.
- Tovornik, Vlasta. 1988. "Die Slawen." In *Die Bajuwaren: Von Severin bis Tassilo 488–788*, edited by Hermann Dannheimer, and Heinz Dopsch, 118–128. München: Prähistorische Staatssammlung.
- Turek, Rudolf. 1976. "Libice. Pohřebiště na vnitřním hradisku." *Sborník národního muzea – Řada A – Historie* 30: 249–316.
- Ungermaň, Šimon. 2016. "Karantánsko-köttlašský šperk na jihozápadním Slovensku a v dalších částech Karpatské kotliny." *Přehled výzkumů* 57 (2): 11–48.
- Ungermaň, Šimon. 2018. "Frühmittelalterliche Schlaufenohrringe mit Drahtanhängern oder Kettchen." In *Wege der Kommunikation zwischen Byzanz und dem Westen 1: Bilder und Dinge*, edited by Falko Daim, Dominik Heher, and Claudia Rapp, 9–43. Römisch-Germanisches Zentralmuseum: Mainz.
- Untracht, Oppi. 1985. *Jewelry Concepts and Technology*. London: Robert Hale.
- Weger, Tobias. 2010. "Bolko Freiherr von Richthofen a Helmut Preidel: případová studie o roli archeologů v tzv. vyhnaneckých organizacích po roce 1945." *Archeologické rozhledy* 62: 696–711.
- Wieczorek, Alfried, and Hans-Martin Hinz, eds. 2000. *Europas mitte um 1000 2 vol.* Theiss: Stuttgart.