

The Early Roman “Hoard of Vrhnika”: A Collection of Finds from the River Ljubljana

Janka ISTENIČ

Izvleček

Analiza opisa predmetov v prvotni objavi (Stare 1953) in novi najdbi iz reke Ljubljane so pokazale, da je tako imenovani zgodnjorimski “vrhniški zaklad” zbirka predmetov iz reke Ljubljane, deloma ali morda v celoti iz odseka pri Bevkah. Gladij in nožnica s pozlačenimi srebrnimi okovi, okrašenimi z reliefnim okrasom (iz “vrhniškega zaklada”), ter v Ljubljani najdeni, doslej še neobjavljeni okov vojaškega pasu, tvorijo garnituro. Predstavljajo prestižne izdelke avgustejskega časa in italjskega prostora ter so bili verjetno last rimskega oficirja.

Abstract

A reconsideration of the records of the objects in the original publication (Stare 1953) and the study of the two finds from the River Ljubljana, published here for the first time, have shown that the so-called early Roman “Hoard of Vrhnika” is a collection of objects from the river; some, or perhaps all of them come from the Bevke sector. The *gladius* and its scabbard with gilded relief-decorated silver fittings (from the “Hoard of Vrhnika”), and also the military belt-plate from the River Ljubljana published here, constitute a set. They are products of the Augustan period and originate in Italian territory. In view of the prestigious character of this set, it seems likely that it had belonged to a Roman officer.

1. INTRODUCTION

The term the “Hoard of Vrhnika” was first used by Dr. France Stare in his publication of an iron *gladius* with ornate relief-decorated silver fittings on the scabbard (*Fig. 1*), a late La Tène sword with a scabbard with openwork decoration, an iron sword with fragments of a wooden scabbard, a sickle, a bident and a trident from “a wartime collection made by the senior taxidermist at Ljubljana, Janko Vertin” (Stare 1953, Figs. 1; 2; Pl. 4).¹

According to Stare (1953), Janko Vertin “acquired [these objects] about 25 years ago from a retired local police sergeant-major at Vrhnika” (o.c. 94). As for the information on the location and

circumstances of their discovery, Stare quoted Vertin’s note stating that all the objects belonging to the “hoard” “*had been found at the same spot, i.e. in the immediate vicinity of Vrhnika, on the riverbank of the Ljubljana in soil about one metre deep*” (o.c., 94). In his arguments “supporting the hoard theory” he stated “*the objects are not heavily patinated, the iron is relatively well preserved, and the surface of the objects is, in places, covered by a thin layer of lime; this is probably a residue of algae which had grown over the objects. It is typical that only one of the wider surfaces of each of the three swords and the sickle, for example, is covered by a layer of lime; that is, the one, which had faced upwards. It is also characteristic that before the gladius was cleaned, it*

¹ Kept by Mestni muzej (Town Museum) in Ljubljana, inventory numbers 510:LJU;32582 (La Tène sword with a scabbard in openwork decoration), 510:LJU;32583 (iron sword), 510:LJU;32617 (*gladius* with fittings of a scabbard), 510:LJU;32825 (trident), 510:LJU;32601 (bident) and 510:LJU;32826 (sickle).



Fig. 1: *Gladius* with the scabbard fitments from the “Hoard of Vrhnika”. Scale (a) = c. 1:4; (b) = c. 1:1. The archive of Mestni muzej, Ljubljana.

Sl. 1: Gladij z okovi nožnice iz “vrhniškega zaklada”. M. (a) = pribl. 1:4; (b) = pribl. 1:1. Arhiv Mestnega muzeja, Ljubljana.

could clearly be seen that another sword and the sickle had overlain it.” (l.c.)

All the items from this “hoard” of early Roman and late La Tène objects were republished, with improved drawings, by Jana Horvat (1990, 135-136, 238-239, 293-294, Pl. 27-29). The information on the find-spot was taken from the first publication (Stare 1953). However, the author did not tackle the issue of whether this had, indeed, constited a hoard (Horvat 1990, 58, 135-136, 174, 238-239, 293-294).

Individual objects from the “hoard” (i.e. the Augustan *gladius* with the silver scabbard fitments and the late La Tène sword with a matching scabbard in openwork decoration) have appeared in specialist studies and in reference works (Künzl 1996, 422-423, 458; M 36, Pl. 57: 3,4, previous literature quoted; Frey 1986, 49-52, previous literature quoted; for the La Tène sword see also Böhme-Schönberger 1998, 235-239 and Łuczkiwicz 2000, 369-376).

A careful re-reading of Stare’s descriptions of the finds in this “hoard” raises suspicions over the accuracy of the site information. It is hard to believe that the layer of limestone, which is “probably a

residue of algae” on “one of the wider surfaces”, had developed in the soil, even if it had been marshy. It is even less probable that any algae would have accumulated only on one side. Layers of algae are typical of riverine finds, e.g. the finds from the River Ljubljanica. Algae develop on the side of the object not lying in the mud, but facing upwards. In addition, during the registration and recording of archaeological finds from private collections (carried out by the Archaeological Department of the National Museum of Slovenia), some important new information was discovered relating to the site of the “hoard”, which raises the question of whether this really had been a hoard.

2. A TRANSVERSE FITMENT OF THE SCABBARD OF THE *GLADIUS*: THE SITE OF DISCOVERY AND DESCRIPTION

The transverse fitment of the scabbard of a *gladius* with rings attached (Zn 137-72; Figs. 2; 3) was found by an unauthorized diver on the 10th January 1998 in the Ljubljanica, in the grass-covered river-bed

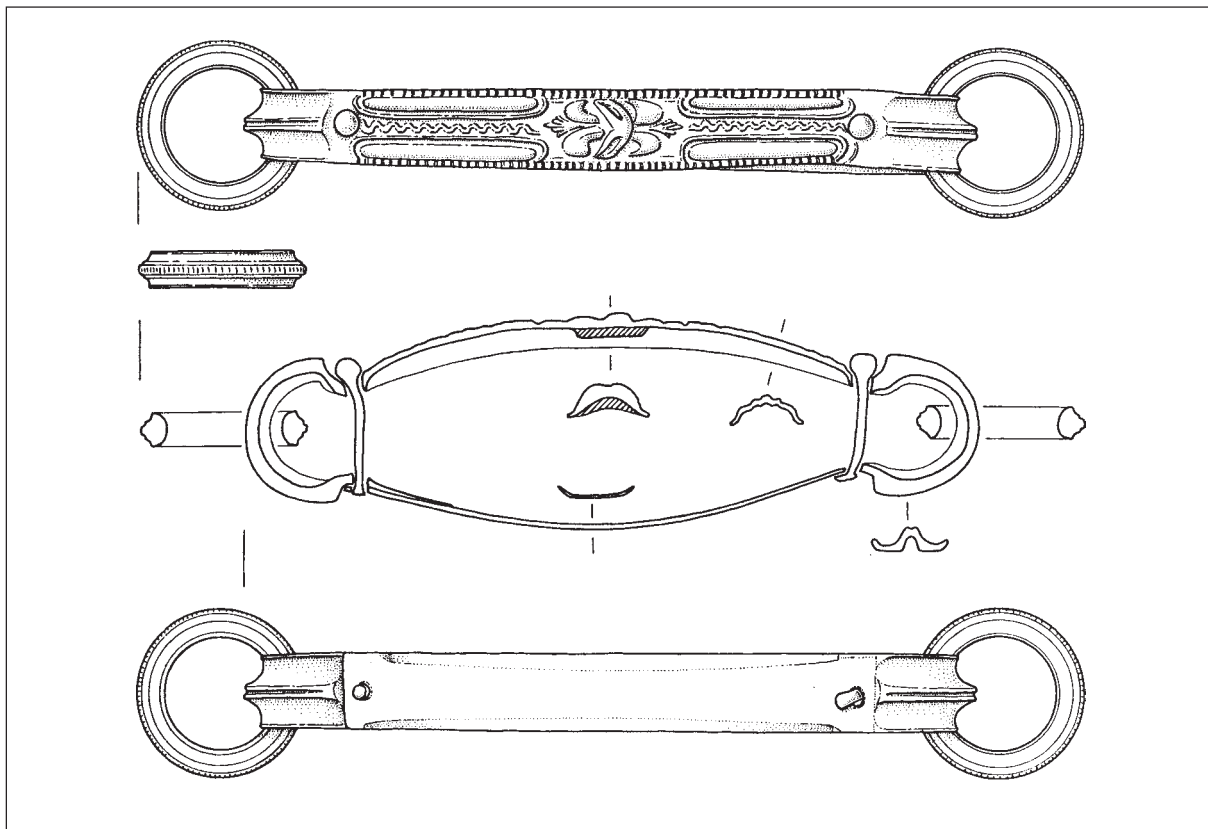


Fig. 2: The transverse fitment of the *gladius* scabbard (Zn 137-7) from the River Ljubljanica at Bevke. Scale = 1:1.
 Sl. 2: Prečni okov nožnice gladija (Zn 137-7) iz Ljubljani pri Bevkah. M. = 1:1.

closer to the right bank. The site lies in the Bevke sector, at least four kilometres east of Vrhnika/*Nauportus* (Fig. 6) and c. 400 metres upstream from the water-level station near Kamin farmhouse (Fig. 7: 1).

The fitment is 97 mm long, 10 mm wide and weighs 32.62 g. The surface is covered with an dark-grey even patina. A PIXE analysis of a small portion of the surface, where the patina had been removed, showed that the fitment was made of high quality silver alloy, containing a very high portion (around 95%) of silver, about 2-3% of copper, about 0.7% of gold and about 0.5% of lead (Appendix, Fig. 8/Table 1: 2-3). This composition is typical of high quality Roman silverware. The presence of less than 1.5% of gold in the alloy indicates that

this resulted from the extraction of silver from lead ore (galena), and that the gold had not been added intentionally (Hughes, Hall 1979, 325-335). Under a microscope, gilding is apparent in several places on the front side which lack any patina.³ This was confirmed by the PIXE and XRF analyses (Appendix, Fig. 8/Table 1: 5; Fig. 10/Table 2: side A, spot 4). The careful removal of the patina on a small portion of the surface next to the visible gilding has showed that the gilding was covered by the patina.

The basic shape of the fitment was made by hammering. The ornate relief decoration on the front face had been embossed from the back and chased from the front.⁴ In the middle of the front of the fitment, where the relief-decoration is highest, a split made in the manufacture is visible (Fig.

² All codes beginning with "Zn" relate to the identification numbers of items in the Register of archaeological finds in private possession, kept by the Archaeological Department of the National Museum of Slovenia.

³ The method of gilding was not examined in detail. From the photographs, Dr. Alessandra Giumlia-Mair infers that the gilding was done with thin foils. Cf. also Giumlia-Mair, Meriani, Lucchini 2002 and Maier 1998.

⁴ The technique of relief-decoration from the underside is described in Sherlock 1976 (17, 19), and of chasing, in Braun-Feldweg 1988, 184. The fitment from the rim of the scabbard of the *gladius* from the "Hoard of Vrhnika" was most likely also in the same technique, i.e. embossed from the back and chased from the front, and not made by pressing against a mould, as was suggested by Horvat (1990, 293-294).

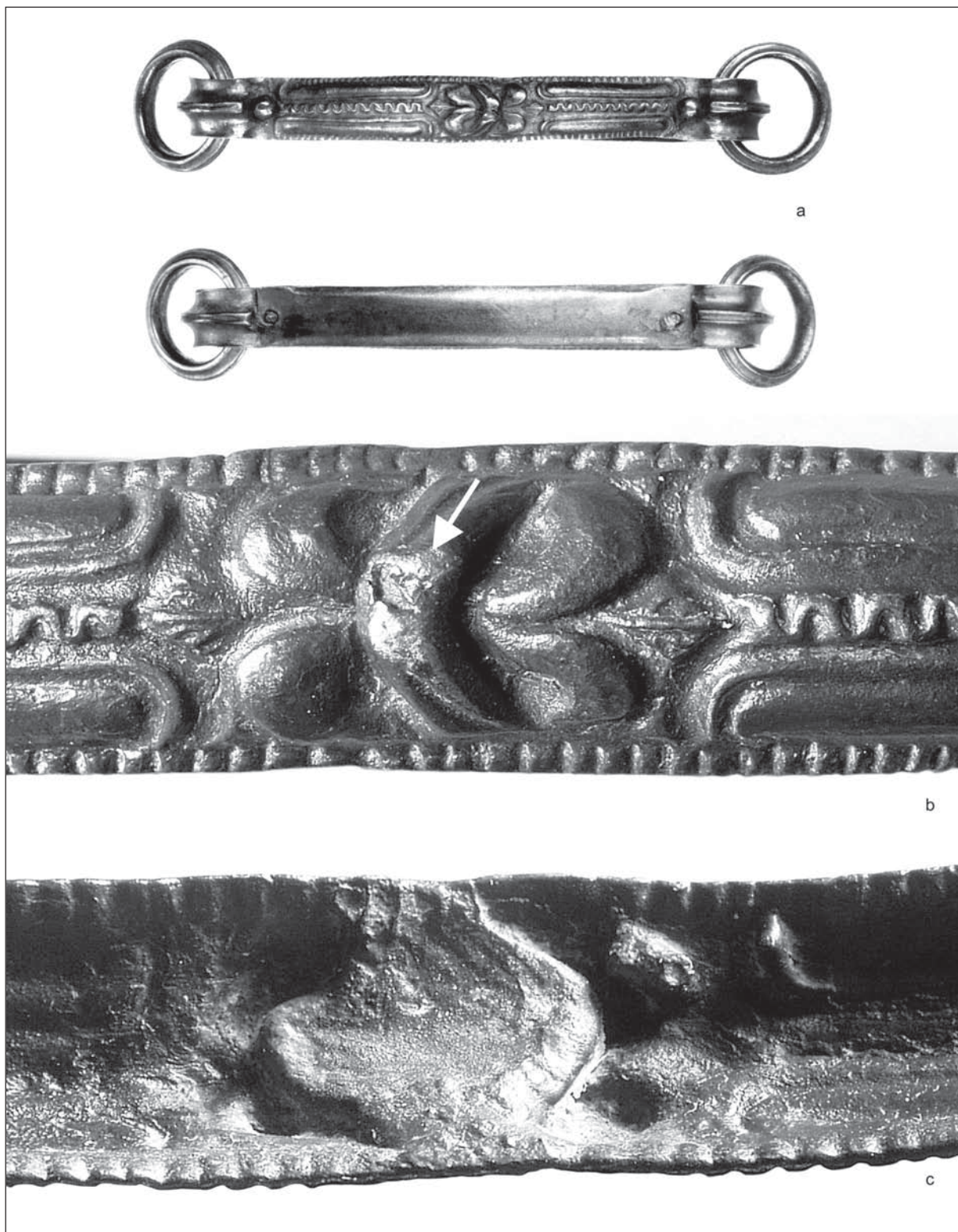


Fig. 3: The transverse fitment of the *gladius* scabbard (Zn 137-7) from the River-Ljubljanica at Bevke: (a) front and back; (b) detail of the central part of the fitment where a split, made during its manufacture, is visible; (c) the tin filling at the back of the fitment. Scale (a) = c. 1:1; (b),(c) = enlarged, not to scale. Photo archive of the Archaeological Department of the National Museum of Slovenia (photo: Marko Habič and Tomaž Lauko).

Sl. 3: Prečni okov nožnice gladija (Zn 137-7) iz Ljubljane pri Bevkah: (a) sprednja in hrbtna stran; (b) osrednji del okova na katerem je razpoka, ki je nastala pri izdelavi okrasa; (c) kositrna zalivka na hrbtni strani okova. M. (a) = približno 1:1; (b),(c) = povečano, brez merila. Fototeka Arheološkega oddelka Narodnega muzeja Slovenije (foto: Marko Habič in Tomaž Lauko).

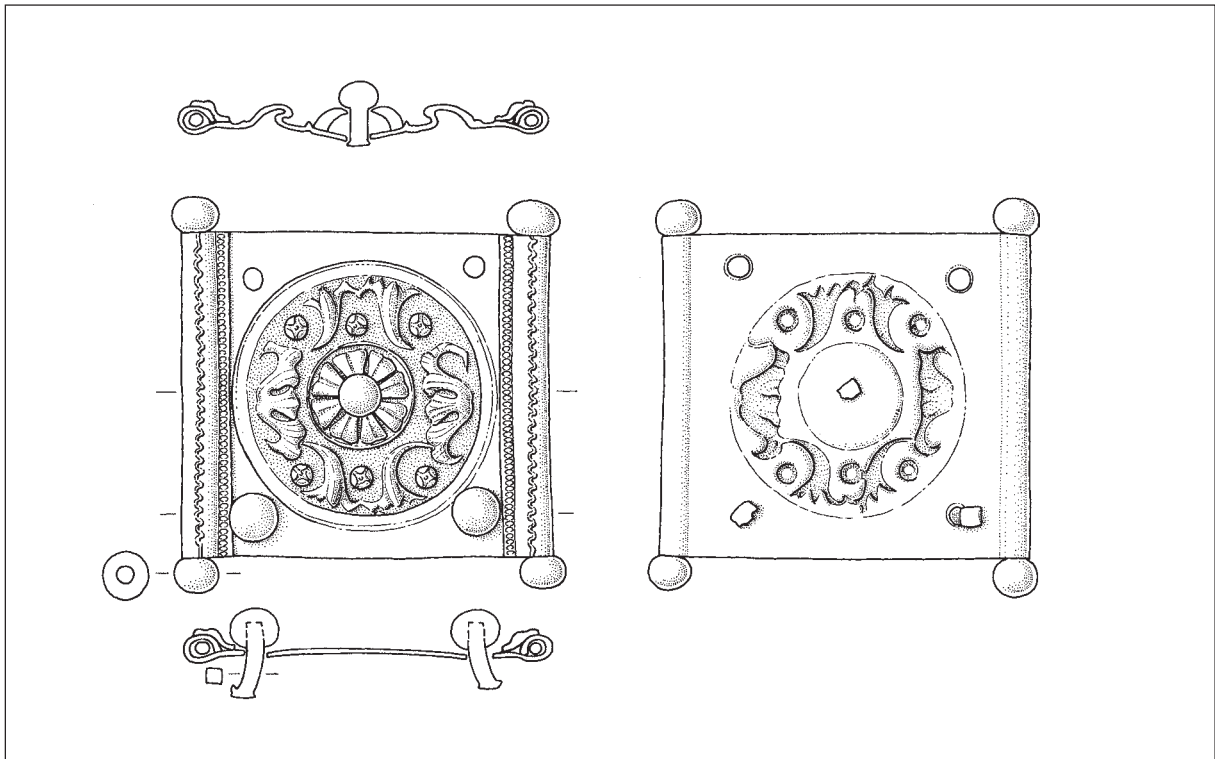


Fig. 4: A military belt-plate (Zn 149) from the River Ljubljanica at Bevke. Scale = 1:1.

Sl. 4: Okov vojaškega pasu (Zn 149) iz Ljublanice pri Bevkah. M. = 1:1.

3b). Because of this flaw, the back of this part of the fitment had been backed by an irregular (c. 10 mm long and 10 mm wide) tin filling (Fig. 3c; Appendix, Fig. 8/Table 1: 1; cf. Sherlock 1976, 19).⁵

The vegetable design in the central part of the fitment has two ribs on each side, separated by a thin wavy line incised from the front. The edges of the front of the fitment are decorated with a line of vertical "cuts" (approximately 1 mm long), also chased from the front. The shape of the loops on both sides is noteworthy. Inserted into each loop is a 17-mm ring with a distinctive exterior elevation comprising a protruding rib, itself ribbed transversely in a manner similar to the edges of the fitment.

The back of the fitment is thin. The ends overlap at approximately 15 mm length. Two massive silver rivets had pinned this transverse fitment to the scabbard, most likely to its guttering; the left rivet (considering Fig. 2) also secured the transverse fitment on the back.

3. A TRANSVERSE FITMENT OF THE *GLADIUS* SCABBARD: CLASSIFICATION, LINK TO THE *GLADIUS* FROM THE "HOARD OF VRHNIKA"

The fitment described here belonged to the scabbard of a *gladius* of Mainz Type. When compared with other transverse scabbard-fitments of this type, this example has unusually ornate relief-decoration on the front and a cross-section with slightly turned-up edges on the back. In size and materials, as well as in its design and execution, this fitment corresponds quite closely to the upper transverse fitment of the *gladius*-scabbard from the "Hoard of Vrhnika" (Fig. 1). Another link is the gilding. A closer inspection of the *gladius* from the "Hoard of Vrhnika" revealed clear traces of gilding on the transverse fitment and the fitment on the scabbard-mouth. Surprisingly, this has not been mentioned in previous publications.⁶

Gladii with silver fitments on their scabbards

⁵ The tin filler was detected also by the XRF analysis on the front of the fitment (Appendix, Fig. 10/Table 2: A 1).

⁶ Horvat (1990, 135-136, 238-239, 293-294) does not mention the gilding, while Künzl (1996, 458: M 36; 1988, 560-561, Cat. No. 386) specifically states that no signs of gilding are visible.

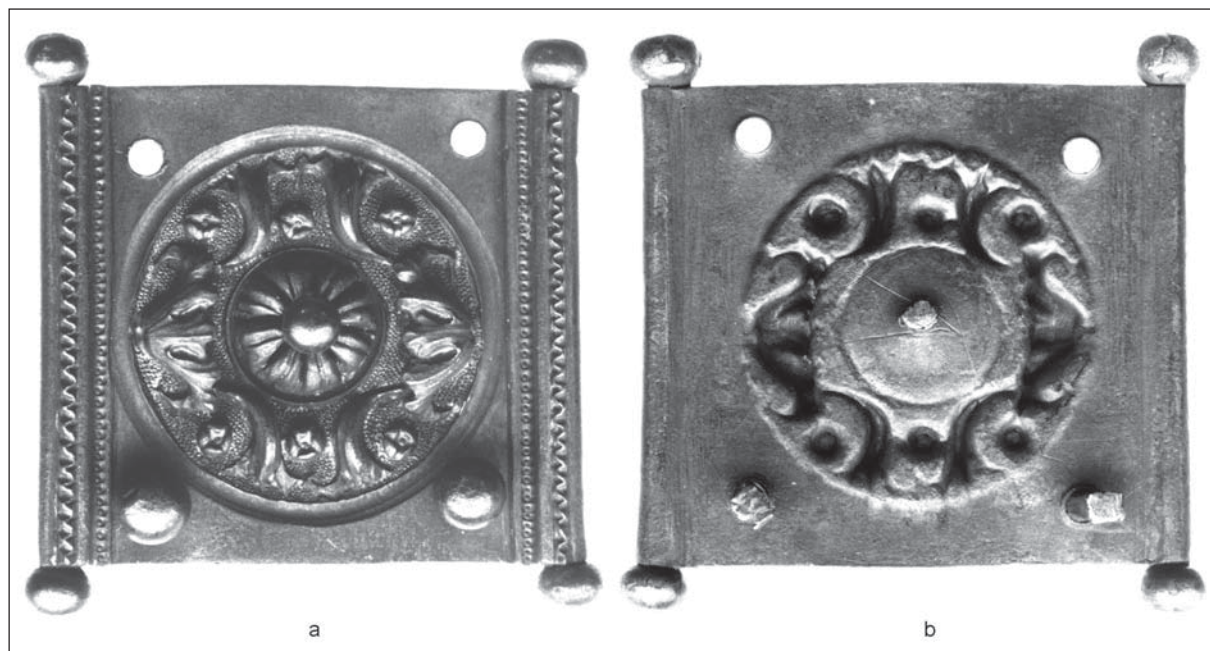


Fig. 5: A military belt-plate (Zn 149) from the River Ljubljanica at Bevke: (a) front, (b) back. Photo archive of the Archaeological Department of the National Museum of Slovenia (photo Tomaž Lauko). Scale = 1:1.5.

Sl. 5: Okov vojaškega pasu (Zn 149) iz Ljubljane pri Bevkah: (a) lice, (b) hrbtna stran. Fototeka Arheološkega oddelka Narodnega muzeja Slovenije (foto: Tomaž Lauko). M. = 1:1,5.

are extremely rare. The “Hoard of Vrhnika” scabbard with relief-decoration is unique. It is most unlikely that the transverse fitment found in Ljubljana does not belong to the scabbard from the “Hoard of Vrhnika”; therefore, it may be assumed that the find from the Ljubljana at Bevke is the missing lower fitment belonging to the scabbard of the *gladius* from the “Hoard of Vrhnika”.

4. A BELT-PLATE FROM A MILITARY BELT

The museum has also recorded a belt-plate from a military belt (Zn 149; Figs. 4; 5), which was also found in the River Ljubljanica, close to the water-level station near Kamin farm, and approximately 400 metres downstream from the site of the discovery of the transverse fitment already discussed (Figs. 6; 7: 2).

The belt-plate is very well preserved. The surface is covered by a thin layer of dark grey patina. It is rectangular in shape, almost a square, and was made by hammering. It is 48 mm long (51 mm including the bulbous terminals on the hinge) and 43 mm wide (53 mm including the terminals), relatively massive, and weighs 34.20 grams. Along the vertical sides, silver sheet metal less than a millimetre thick was rolled over to form a 3-4-mm-wide tube on each side. In each tube is a spindle, fixed into the

cylinder with a massive terminal on each side (c. 6 mm wide). The tube and the spindle form a cylindrical hinge, the function of which was purely decorative (i.e. a pseudo-hinge - cf. Bishop, Coulston 1993, 98). The area where the upper side of the belt-plate joins the rolled-over metal plate is covered by a band c. 4 mm wide and c. 1 mm thick. Its chased decoration includes a row of tiny circles on one inner side and a wavy line on the outer.

The central part of the belt-plate is circular in shape and defined by a shallow rib, c. 2 mm wide. It has a relief-decoration, embossed from the back and chased from the front, comprising symmetrically placed vegetable motifs: two wide acanthus leaves, each forming a *calyx*, two narrower leaves and six buds. The background is chased with tiny circles. In the middle of this decoration in a separate zone, is a rosette with eight petals, fastened by a rivet with a round decorative terminal.

The gilding is evident on the central, chased part of the belt-plate and was confirmed by the analyses (Appendix, Fig. 9/ Table 1: 16,17). Under a microscope, the traces of gilding can also be seen on the relief petals of the rosette and on both the bands of the hinges. On the acanthus leaves and other parts of the relief-decoration over the chased background, there is no sign of gilding, either under a microscope or with the PIXE analysis (Appendix, Fig. 9/ Table 1: 15). The analyses of the other parts

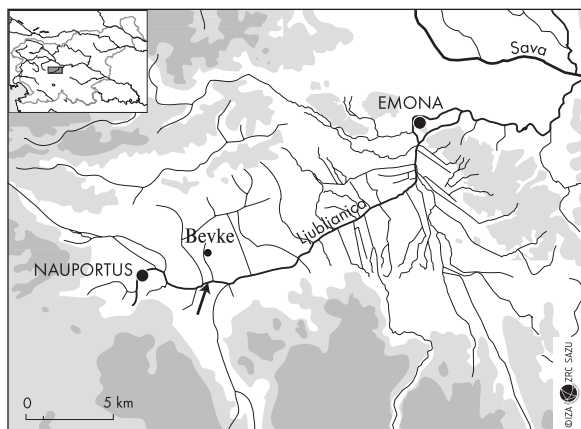


Fig. 6: The position of the find-spots of the transverse fitment of the *gladius* scabbard Zn 137-7 and the military belt-plate Zn 149 in its wider geographical location.

Sl. 6: Lega najdišča prečnega okova nožnice gladija Zn 137-7 in okova vojaškega pasu Zn 149 v širši okolici.

of the surface where the gilding is not visible (on both the front and the back), showed *c.* 1% of gold, implying that this surface had not been gilded (Appendix, Fig. 9/Tab. 1: 9-11). The analyses of the small surface where the patina had been removed provided results similar to the analyses of the *gladius* scabbard-fitment (see above): 95-96% of silver, *c.*

3.3% of copper, *c.* 1% of gold and 0.2-0.3% of lead (Appendix, Fig. 9/Tab. 1: 6-8). The patina-covered terminals of the spindles and rivets had also not been gilded, as the analyses showed (Appendix, Fig. 9/Tab. 1: 12-14). The *c.* 98% of silver and less than 1% of copper seems to imply that they had been made from an alloy, to which little or no copper had been added.⁷ To verify this assumption, the surface from which patina had been removed would have to be analysed.

It may therefore be safely assumed that the front of the belt-plate was only partially gilded and that the effect of the decoration was enhanced by the contrast of the gold and the silver surfaces. At the centre of the silver belt-plate, elevated above the chased golden background, was the silver relief-decoration of acanthus leaves and buds, and the gilded rosette with a silvery shiny rivet-terminal in the middle. The emphasis of the central decoration contrasted with the gilded decorative bands at the sides of the belt-plate. All the motifs are of high quality and skilfully made.

The belt-plate was fastened to the belt with four symmetrically-placed silver rivets, two of which are preserved, with the other two marked by two holes (3 mm in diameter). The preserved rivets are decorated with round terminals (*c.* 6 mm wide),

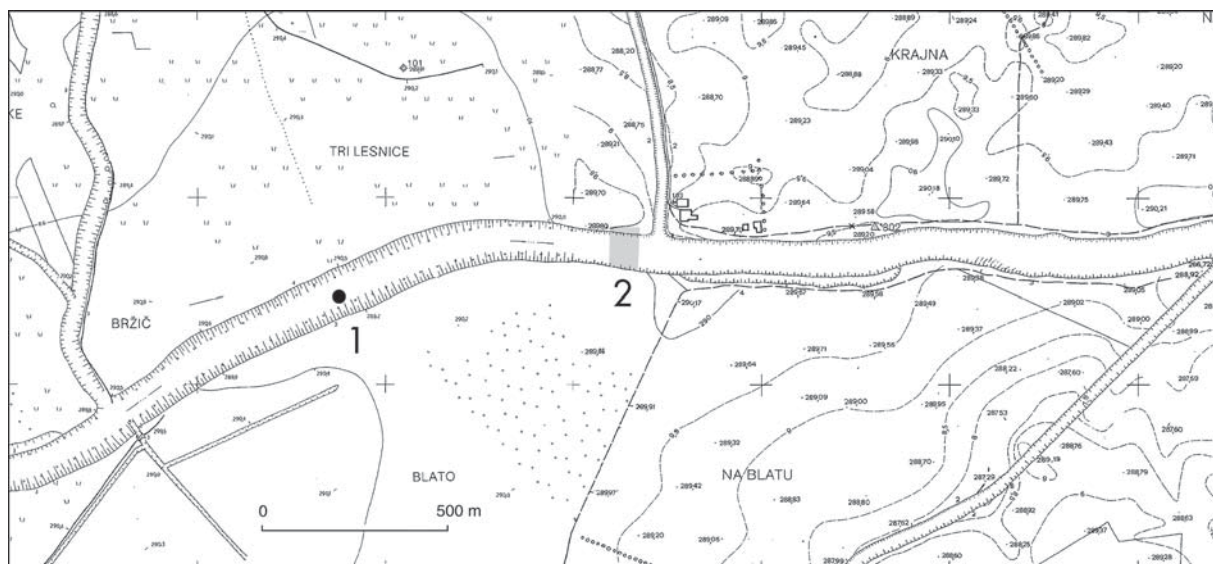


Fig. 7: Reduced general topographical map 5 (sector of Vrhnika sheets 28 and 29): the position of the find-spots of the transverse fitment of the *gladius* scabbard, Zn 137-7 (1) and the military belt-plate, Zn 149 (2). Scale = 1:10000.

Sl. 7: Pomanjšan temeljni topografski načrt 5, izsek iz Vrhnika list 28 in 29: lega najdišč-prečnega okova gladija Zn 137-7 (1) in okova vojaškega pasu Zn 149 (2). M. = 1:10.000.

⁷ A comparison of the analyses of the small surface from which patina had been removed (Appendix, Fig. 9/Tab. 1: 6-8) with the surface of patina (Appendix, Fig. 9/Tab. 1: 9, 11) showed a higher percentage of silver and a lower percentage of copper in the patina. This can be explained by elimination of less precious elements from the surface. Nevertheless, the high percentage of silver in analyses nos. 12-14 seems to be too high to be explained by this. Copper in silver-alloys is discussed in Huges, Hall 1979, 331-333.

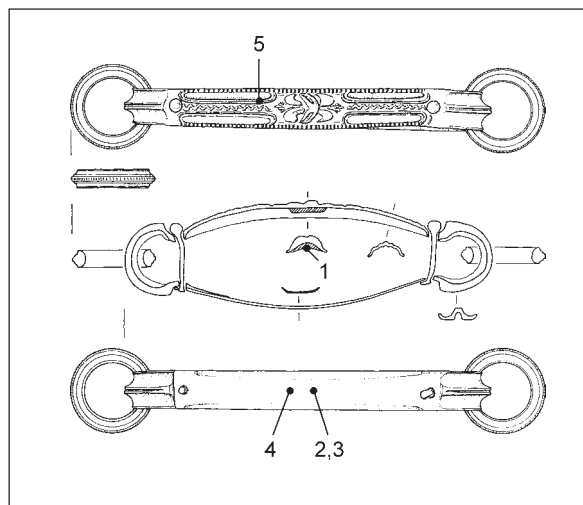


Fig. 8: Location of the PIXE analyses on the transverse fitment of the *gladius* scabbard (Zn 137-7). Scale = 1:2.

Sl. 8: Merske točke PIXE analiz na prečnem okovu nožnice gladija (Zn 137-7). M. = 1:2.

which are slightly larger than the terminals of the hinge-spindles (7 mm in diameter). The length of the shanks of the preserved rivets shows that the belt-leather was c. 4 mm thick.

5. THE CLASSIFICATION OF THE BELT-PLATE AND ITS LINKS TO THE SCABBARD OF THE *GLADIUS* FROM THE "HOARD OF VRHNIKA"

Silver belt-plates from military waist-belts with pseudo-hinges are known from Kalkriese (Germany), the site of the *clades Variana* of A.D. 9. in the Teutoburg Forest (Franzius 1999, 588-590, 597-598, 607, Figs. 14: 2-4, 7-8; 17: 1), from a hoard, buried during the reign of Domitian at Tekija/*Transdierna* (Serbia; Mano-Zisi 1957, 11-12, 22-23, Pl. 13: 18-21; 14: 19,20), from sites in the Bay of Naples (Künzl 1996, 461-462, C 11-13, 25-27, Pl. 50: 1-6; Künzl 1988, 562-3, Cat. No. 382), and from *Aquileia* (Künzl 1996, C 47, Pl. 50: 10).⁸ The belt-plate from Kalkriese and those from Tekija have relief-decoration of concentric circles, whereas the others have figured designs from mythology. Like the piece from Ljubljana, the belt-plate from Kalkriese and several of the belt-plates from Tekija (Mano-Zisi 1957, 23, Pl. 13: 18,20 bellow,21) have a decorative band on the hinges. The Kalkriese example is gilded like the one from the Ljubljana (Franzius 1999, 588, 607). The terminals of the rivets, which fastened the Kalkriese and Tekija belt-

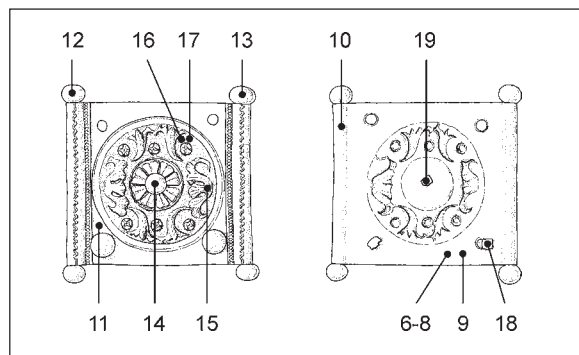


Fig. 9: Location of the PIXE analyses on the mount of a military belt-plate (Zn 149). Scale = 1:2.

Sl. 9: Merske točke PIXE analiz na okovu vojaškega pasu (Zn 149). M. = 1:2.

plates to the belt are also similar (Franzius 1999, Pl. 14: 2-4; 17: 1; Mano-Zisi 1957, Pl. 13: 18-21; 14: 19,20).

Crucial for the classification of the Ljubljana belt-plate is its decoration, which has fine decorative parallels on the fitment at the mouth of the *gladius*-scabbard from the "Hoard of Vrhnika" (Fig. 1). Here we find the same motif of broad acanthus leaves (forming an acanthus *calyx*), executed in the same style, and with the same background of small chased circles. The decoration of the belt-plate also finds parallels in the transverse fitments of this scabbard (Figs. 1-3). What they also have in common is a punched wavy line, decorating the most elevated part of the two fitments and the belt-plate. Moreover, the fitments of the *gladius* scabbard and the belt are made of the same material (silver alloy with a high portion of silver) and all have gilding (cf. Chapter 2).

The belt-plate from the military belt is therefore an exceptional artefact of high quality, which has no close parallels among known fragments of military belts, whereas the motif, style, technique and quality of its decoration perfectly match those on the fitments of the *gladius*-scabbard from the "Hoard of Vrhnika". Considering their unique character, the clear similarities between the fitments and the belt-plate would suggest that the waist-belt and the *gladius* with the scabbard probably belonged together, i.e. were a set. This is hardly surprising, since the early Roman military belt and *gladius* with a scabbard formed an iconographic unit (Künzl 1996, 406-408). The relatively large distance (400 metres) between the sites of discovery of the two objects might be attributed to the strong river current or to the possibly unprecise information regarding one of the find-spots.

⁸ For a review of other belt-plates with pseudo-hinges, see Bishop, Coulston 1993, 96-98, and Franzius 1999, 588-589, fn. 79-88.

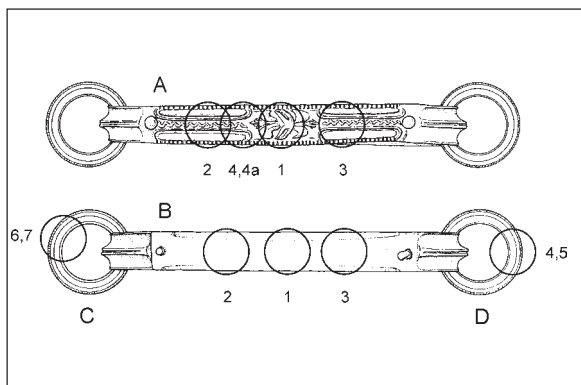


Fig. 10: Location of the XRF analyses on the transverse fitment of a *gladius*-scabbard (Zn 137-7). Scale = 1:2.

Sl. 10: Mesta XRF analiz na prečnem okovu nožnice gladija (Zn 137-7). M. = 1:2.

The stylistic traits, the motifs and the manufacturing quality of the decoration on the scabbard fitments and the military belt suggest an Augustan date and links with Italian relief-working traditions (cf. Künzl 1996, 422-423; Künzl 1988, 560-561, Cat. No. 386). The vine and the exuberant natural foliage represented on the scabbard fitment and (to a lesser degree) on the corresponding fitment of the military belt, constituted some of the favourite motifs of the Augustan Age (cf. e.g. *Ara Pacis Augustae*). They endorsed the fertility, prosperity and abundance of the new, Golden Age, which was deemed paradise on Earth. The beginning of the Golden Age (*saeculum aureum*, *Aurea Aetas*) was proclaimed in the spring of 17 B.C. during the Secular Games (Zanker 1990², 179-192; Künzl 1996, 421-423).

6. THE "HOARD OF VRHNIKA" - A COLLECTION OF FINDS FROM THE RIVER LJUBLJANICA

The transverse fitment of the *gladius*-scabbard, which is part of the "Hoard of Vrhnika", was found in the Bevke sector of the River Ljubljanica, about 4 kilometres east of Vrhnika. The possibility that the transverse fitment of the *gladius*-scabbard had been washed away from "the hoard", buried at the riverbank, is unlikely. Indeed, the contrary is suggested by the remark that the items from the "Hoard of Vrhnika" were covered on one side with sediment, which from the description suggests river sediments typical of finds from the Ljubljanica (see Chapter 1).

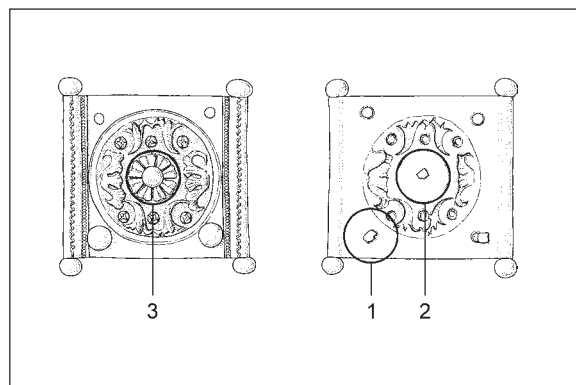


Fig. 11: Location of the XRF analyses on military belt-plate (Zn 149). Scale = 1:2.

Sl. 11: Mesta XRF analiz na okovu vojaškega pasu (Zn 149). M. = 1:2.

Thus, the items that Stare equated with a "Hoard of Vrhnika" come from the Ljubljanica river itself, and not from its banks, as stated in the original publication (Stare 1953) and accepted until now (e.g. Horvat 1990, 58, 135-136, 174, 238-239; Künzl 1996, 422-423, 458; M 36; same 1988, 560-561, Cat. No. 386). The question arises as to whether the objects from "the hoard" were indeed found together or (more likely) individually, in the river. The remark that, "*before the gladius was cleaned one could clearly see that another sword* (not evident, which one - note J. I.) *and the sickle were lying over its blade*" (Stare 1953, 94), may suggest that some of the finds were discovered together. Whatever the case, the objects from the "Hoard of Vrhnika" should not be treated as a hoard and, in view of their site of discovery, not even as objects closely linked.

It is quite possible that the finds from the "hoard" originated from the Bevke sector of Ljubljanica. The *gladius* with the scabbard fitments was certainly found there, and, according to Stare's report, so were the sickle and one of the two other swords. For the other items of the "hoard", we can only tentatively assume so. This part of the river is, in fact, full of archaeological artefacts dating from the Bronze Age onwards (Svoljšak et al. 1997, 258-261; Potočnik 1988-1989, 388-391; Šinkovec 1995, 46, 79, 101-102, 114-115; Fig. 19: 200, 227, 136; a short note on the sector from the mouth of River Bistra to Kamin farmhouse in Gaspari, Krempuš 2002, 448). The majority of Roman finds are dated to the second half of the 1st century B.C. and to the first half of the 1st century A.D. The most common finds comprise military equipment,⁹

⁹ Among the finds retained or recorded by National Museum of Slovenia are: *dona militaria* (Zn 137-8 and Istenič 2003), a helmet (Inv. No. R 18915), *pila* (Inv. Nos. V 1352, V 1454, R 8123), parts of military waist-belts (Inv. Nos. V 449, V 1453), swords and sword scabbards (Inv. Nos. V 405, R 17110, V 574) and *stimuli* (Acc. No. 94/4-3).

ceramic drinking vessels¹⁰ and coins.¹¹ This zone ends in the east at the site of the discovery of a boundary stone between the *Emona* and *Aquileia ager* (Šašel Kos 2002). The probable existence of a river crossing and a small village in the territory of Bevke (Šašel Kos 2002) does not exclude the possibility that some of the finds in this area had been deliberately thrown into the Ljubljana as ritual deposits.¹² This is believed to be the case with the statuettes of Apollo (Istenič 2002; 2001; Gaspari, Krempuš 2002).

7. CONCLUSION

A reconsideration of the records of the objects in the original publication (Stare 1953) and of the two finds from the River Ljubljana have shown that the so-called early Roman “Hoard of Vrhnika” is a collection of objects from the river; some, or perhaps all of them come from the Bevke sector.

The *gladius* and its scabbard with gilded relief-decorated silver fitments (from the “Hoard of Vrhnika”), and also the military belt-plate found in the River Ljubljana, are made of the same materials, bare the same style decoration and similar motifs. They constitute a set. They are products of the Augustan period and originate in Italian territory. Their unique character and their high quality workmanship make them out as exceptional items. This is supported by the gilding and the use of a high quality silver alloy with a small proportion of copper, which was added to make the alloy harder and more solid (Hughes, Hall 1979, 331-333). Such alloys were employed for luxury items (Hughes, Hall 1979; Giumlia-Mair 2000, 297-298; same 1998, 244; Riederer 1999). In view of the prestigious character of this set, it seems likely that it had belonged to a Roman officer. A *graffito* on an equally luxurious set from Kalkriese suggested that it had belonged to a centurion (Wiegels 1999).

Acknowledgements

I would like to thank the following people who helped me in writing this article with their literature suggestions, conversations and valuable comments: Polona Bitenc, Dr. Timotej Knific, B.Sc. Igor Ravbar, Andrej Šemrov, Dr. Neva Trampuž Orel and Dr. Peter Turk (all National Museum of Slovenia), as well as Dr. Paul Craddock (The British Museum), Dr. Alessandra Giumlia-Mair (AGM Archeoanalisi Lab), Dr. Dragan Božič and Dr. Jana Horvat (both Institute of Archaeology of ZRC SAZU). The drawings in Figs. 2 and 4 were made by Ida Murgelj and Uroš Stiškovski (National Museum of Slovenia). For editing of the English text, translated from Slovene by Katarina Jerin, I am grateful to Dr. Vivien Swan.

APPENDIX

Spectrometric analyses of the transverse fitment of a *gladius* scabbard and the military belt fitment

Janka ISTENIČ, Zoran MILIĆ and Žiga ŠMIT

1. INTRODUCTION

On the transverse fitment of the *gladius* scabbard (Zn 137-7) and on the military belt-plate (Zn 149) only non-destructive analyses were carried out, apart from a few analyses where the surface of the object was only slightly invaded. Invasive analyses were avoided because of the preciousness of the objects.

PIXE (proton induced X-ray emission) and XRF (X-ray fluorescence) techniques were used. In both methods a thin surface layer of the object is analysed. In the case of archaeological objects the surface is usually corroded and therefore differs to a various

¹⁰ Terra sigillata (e.g. Inv. Nos. V 621, V 869, V 870), vessels with black coating (e.g. Inv. Nos. V 1084, V 782), thin-walled pottery, (e.g. Inv. Nos. V 866, V 868, V 867, V 620, V 813), fragments of jugs and flagons (e.g. Inv. Nos. 783, V 814) and coarse pots (e.g. Inv. No. V 897).

¹¹ Rare individual coins (FMRS1 IV, 109/1), a “group” of Republican *denarii* deposited after 42. B.C. (FMRS1 IV, 109/2), a “group” of late Roman coins deposited after 352 (FMRS1 IV, 109/3), a “group” of Republican and Celtic coins at the confluence of Zrnica and Ljubljana deposited after 147 B.C. (FMRS1 IV, 110).

¹² In the interpretation of Roman finds in rivers there are firm advocates of both the theory “of lost objects” as well as the interpretation of “intentional votive” deposits (Künzl 1996, 438-449, with quoted literature; Bonnamour 2000, 45-52; Bonnamour, Dumont 1994; Schalles 1994; Thiel, Zanier 1994).

¹³ In the same way the extremely precious objects displayed in 1977 at the exhibition “Wealth of the Roman World” were prepared for about 200 XRF analyses (cf. Hughes, Hall 1979, 321-325).

extent from the core. High quality silver alloys, which were used for the fitments here discussed, usually change only little at the surface (cf. Voß, Hammer, Lutz 1998, 170). Nevertheless, we wanted to compare analysis of the patina on the surface with the layer beneath. For this reason patina was carefully removed from one or two small surface areas (c. 1.5 mm²) at the back of each fitment. These surfaces were analysed by the PIXE (*Table 1*: 1-3, 6-8) technique, which allows analysis of very small areas. In this way, at the price of very small damage to the surface of the objects¹³ we obtained a relatively precise determination of the alloy used for the fitments.

An important advantage of the PIXE and XRF methods, apart from their non-destructive nature, is a quick and simple qualitative determination of the composition of a thin layer on the surface of the object, such as gilding in the case of the objects discussed here.

Istenič, Milič

2. PIXE ANALYSES

The PIXE analyses were performed at the Tandetron accelerator of the Jožef Stefan Institute.

The measurements were executed with a 2.5 MeV proton beam in air. For the exit window, an 8 µm aluminum foil was used. The beam diameter on the target was normally approximately 1 mm, but it was 0.3 mm for measuring points 3, 5, and 6. The induced X-rays were detected with a silicon X-ray detector of 150 eV/5.9 keV resolution.

Due to the high counting rate of silver L rays, the detector was equipped with an aluminum absorber. For measuring points 1, 2, 4, 7, and 17, the absorber thickness was 0.3 mm. As an absorber of such thickness strongly attenuates the X-rays of iron, a thinner absorber of 0.1 thickness was used for measuring points 8-16 and 18-19. The measurements at points 3, 5 and 6 were made with a proton beam of 0.3 mm diameter, which was attained by collimating the beam with an exit slit. A narrower beam was selected for easier targeting of the chosen points on the objects where the corrosion layer had been removed. Since a narrow beam implied a low counting rate, a lighter absorber of 50 µm kapton foil was used. The experimental set-up was tested by measurements of the C1107 standard, which contains 1.04 % of tin. Concentrations of minor elements that are more likely subject to experimental errors were determined with an accuracy of 10%.

On the rear of the scabbard mounting we analysed

Table 1: PIXE analyses of the *gladius* scabbard fitment (Zn 137-7) and the belt-plate (Zn 149). The concentrations are given in weight %. Points 2, 3 and 6-8 refer to the same places but were measured using different absorbers and beam diameters. At points 1-3 and 6-8, the patina layer was removed.

Tab. 1: PIXE analize prečnega okova nožnice gladija (Zn 137-7) in okova vojaškega pasu (Zn 149). Koncentracije so navedene v utežnih %. Meritve 2, 3 in 6-8 so bile izmerjene na istih točkah z različnimi absorberji in velikostmi žarka. Pri meritvah 1-3 in 6-8 je bila merjena površina, s katere je bila odstranjena patina.

Analysis/ meritev	Object/predmet	Note/opomba	Ag	Cu	Au	Pb	Sn	Fe
1	Zn 137-7	no patina/ni patine	1.20 1.33	2.30 2.56		0.39 0.43	88.1 95.7	7.9 0
2	Zn 137-7	no patina/ni patine	95.6	2.30	0.70	0.51		0.9
3	Zn 137-7	no patina/ni patine	95.2	2.80	0.74	0.48		0.82
4	Zn 137-7	patina	89.1	1.30	1.00	0.42		8.1
5	Zn 137-7	gilding/pozlata	63	1.10	33.9	0.20		1.8
6	Zn 149	no patina/ni patine	95.2	3.20	0.99	0.24		0.36
7	Zn 149	no patina/ni patine	95.2	3.20	1.00	0.27		0.30
8	Zn 149	no patina/ni patine	95.1	3.40	0.93	0.29		0.30
9	Zn 149	patina	96.2	1.50	0.88	0.16		1.3
10	Zn 149	patina	95.3	2.80	0.86	0.32		0.72
11	Zn 149	patina	96.3	1.60	0.95	0.19		0.93
12	Zn 149	patina	98.0	0.76	0.69	0.38		0.18
13	Zn 149	patina	98.5	0.14	0.30	0.14		0.90
14	Zn 149	patina	98.7	0.22	0.46	0.16		0.42
15	Zn 149	patina	96.9	1.20	1.10	0.22		0.56
16	Zn 149	gilding/pozlata	90.0	1.00	7.3	0.10		1.5
17	Zn 149	gilding/pozlata	76	0.91	20.7	0.07		2.3
18	Zn 149	patina	89.9	3.90	2.70	0.69		2.9
19	Zn 149	patina	94.1	3.50	1.30	0.34		0.77

two points of the shiny surface where the patina had been removed (Fig. 8/Table 1: 2,3). The composition of the filling at the rear of the embossed decoration of the mounting was also analysed (Fig. 8/Table 1: 1). The high concentration of iron (7.9%) indicated that the beam also hit an iron-rich patina. So the second line for point 1 in Table 1 shows calculated concentrations obtained by subtracting the iron yield. The metal is quite pure tin (96%). Iron of approximately the same concentrations (8.1%) was also detected in the patina at the back of the mounting (Fig. 8/Table 1: 4). The analysis of the gold-like surface in the grooved channel of the front-side of the mounting confirmed the presence of gilding (Fig. 8/Table 1: 5).

On the belt mount we measured a small shiny surface at the place where the patina had been removed (Fig. 9/Table 1: 6-8), a small patinated surface in its vicinity (Fig. 9/Table 1: 9) and the patinated surface at the front side (Fig. 9/Table 1: 11). The concentration differences between the patinated and cleaned surfaces of the plate are much smaller than for the scabbard mounting. The gilt coat was studied on the punched surface where it was best preserved (Fig. 9/Table 1: 16,17). The analyses of the bulbs of the central rivet and of the pseudo-hinge suggest they were made of purer silver than the other parts of the plate (about 98% Ag; Fig. 9/Table 1:

12-14). The rivets were also made of silver (Fig. 9/Table 1: 18,19); one of them surprisingly exhibits a larger amount of gold (about 2.7%), which may suggest gilding (Fig. 9/Table 1: 17).

By an additional calculation we estimated that the gold layer at the measuring points of the scabbard mounting (Fig. 8/Table 1: 5) and of the belt mount (Fig. 9/Table 1: 17) was 0.7-1.5 µm thick.

Šmit

3. XRF Analyses

Analyses with the EDS XRF technique were carried out in the Restoration and Conservation Department of the National Museum of Slovenia. A model PEDUZO 01/Am/Sip-250 X-Ray Analyser, designed by the Jožef Stefan Institute (Ljubljana) was used. The analyser is designed for elemental analysis of various samples utilizing excitation by a 25 mCi Am-241 radioisotope source and an X-ray spectrometer which is based on a Si PIN detector with a resolution of 250 eV at 5.9 keV. The spectrum acquisition is performed by a 1024 channel analyser with the successive approximation ADC, differential non-linearity < 2% and integral non-linearity < 1%. The detector is positioned in a vacuum and has a

Table 2: XRF analyses of the transverse fitment of a *gladius* scabbard (Zn 137-7). The concentrations are given in weight %.
Tab. 2: XRF analize prečnega okova nožnice gladija (Zn 137-7). Koncentracije so navedene v utežnih %.

note/ opomba	side/ stran	area/mesto meritve	Ag	Cu	Au	Pb	Sn
	A	1	95.2	1.9	1.3	0.7	0.8
		2	96.3	1.6	1.4	0.7	
		3	96.0	1.7	1.5	0.8	
		4	94.4	1.9	2.8	1.0	
gilding/pozlata		4a	94.0	2.2	2.8	1.0	
	B	1	95.9	2.3	1.0	0.8	
		2	96.2	2.1	0.9	0.7	
		3	96.1	2.0	1.1	0.8	
	D	4	95.6	2.5	1.1	0.7	
		5	95.3	2.8	1.1	0.8	
	C	6	95.7	2.6	1.0	0.8	
		7	96.7	1.7	0.8	0.8	

Table 3: XRF analyses of the belt-plate (Zn 149). The concentrations are given in weight %.
Tab. 3: XRF analize okova vojaškega pasu (Zn 149). Koncentracije so navedene v utežnih %.

opomba/note	side/stran	area/mesto meritve	Ag	Cu	Au	Pb
gilding/pozlata	front/spredaj	3	93.1	1.5	4.6	0.7
	back/zadaj	1	95.9	2.4	1.1	0.6
		2	95.1	3.3	1.0	0.6

25 microns thick Be window. A Peltier cooler is incorporated in the system amplifier and maintains the PIN diode at a temperature of 235°K. All the settings of the system are adjusted in the factory so that the energy range of the spectrum is from 3-30 keV with a dispersion of approximately 30 eV/channel.

A circular area of 11 mm diameter was analysed in each measurement. The apparent content of lead in the sample is somewhat higher as a result of the contribution of the collimator of the XRF analyser. The count rate of Pb contributed by the collimator is c. 0.060 c/s. At high lead concentrations this contribution is negligible, but at low concentrations

must be taken into consideration. The uncertainty originating from the contribution of the collimator in the analysis of the *gladius* scabbard fitment and the belt-plate amounts to 10-20%.

The transverse fitment of the *gladius* scabbard was analysed at four areas on the front (Fig. 10/Table 2: A 1-4), at three areas at the back (Fig. 10/Table 2: B 1-3) and at two places on each ring (Fig. 10/Table 2: B,C). The belt-plate was analysed in the middle of the front side (Fig. 11/Table 3: 3) and at two areas of the back (Fig. 11/Table 3: 1,2).

Milić

- BISHOP, M. C. and J. C. N. COULSTON 1993, *Roman military equipment*. - London.
- BITENC, P. 1997, *Rimskodobne in srednjeveške sekire iz Ljubljane*. - Seminarska naloga, Univerza v Ljubljani, Filozofska fakulteta, Ljubljana.
- BÖHME-SCHÖNBERGER, A. 1998, Das Grab eines vornehmen Kriegers der Spätlatènezeit aus Badenheim. Neue Forschungen zu den Schwertscheiden mit *opus interrabile*-Zierblechen. - *Germania* 76, 217-256.
- BONNAMOUR, L. 2000, *Archéologie de la Saône*. - Paris.
- BONNAMOUR, L. and A. DUMONT 1994, Les armes romaines de la Saône: état des découvertes et données de fouilles. - *Journal of Military Equipment Studies* 5, 141-154.
- BRAUN-FELDWEG, W. 1988, *Metall. Werkformen und Arbeitsweisen*. - Hannover.
- FMRSI IV: A. Šemrov, *Die Fundmünzen der römischen Zeit in Slowenien* 4. - Berlin 1998.
- FRANZIUS, G. 1999, Beschläge einer Gladiusscheide und Teile eines *cingulum* aus Kalkriese, Lkr. Osnabrück. - *Germania* 77, 567-608.
- FREY, O.-H. 1986, Einige Überlegungen zu den Beziehungen zwischen Kelten und Germanen in der Spätlatènezeit. - In: *Gedenkschrift für Gero von Merhart*, Marburger Studien zur Vor- und Frühgeschichte 7, 45-79.
- GASPARI, A. and R. KREMPUŠ 2002, Bronze "donor" from the votive site in the River Ljubljana. - In: A. Giunlia-Mair (ed.), *I bronzi antichi. Produzione e tecnologia*, XV Congresso Internazionale sui Bronzi Antichi, Grado-Aquileia, 22-26 maggio 2001, Monographies Instrumentum 21, 446-449, Montagnac.
- GIUMLIA-MAIR, A. 1998, Argento romano e ricette alchimistiche: tre esempi di leghe d'argento da Emona. - *Arh. vest.* 49, 243-249.
- GIUMLIA-MAIR, A., S. MERIANI and E. LUCCHINI 2002, Indagini archeometallurgiche su dorature antiche: analisi; tecniche e varianti. - In: A. Giunlia-Mair (ed.), *I bronzi antichi. Produzione e tecnologia*, XV Congresso Internazionale sui Bronzi Antichi, Grado-Aquileia, 22-26 maggio 2001, Monographies Instrumentum 21, 338-343, Montagnac.
- HUGHES, M. J. and J. A. HALL 1979, X-ray Fluorescence Analysis of Late Roman and Sassanian Silver Plate. - *Journal of Archaeological Science* 6, 321-344.
- HORVAT, J., 1990, *Nauportus (Vrhnika)*. - Dela 1. razr. SAZU 33.
- ISTENIČ, J. 2001, Un bronzetto di Apollo (Beleno?) dal fiume Ljubljana (Slovenia). - *Aquil. Nos.* 72, 2001, 73-86.
- ISTENIČ, J. 2002, Bronze statuette of Apollo from the River Ljubljana. - In: A. Giunlia-Mair (ed.), *I bronzi antichi. Produzione e tecnologia*, XV Congresso Internazionale sui Bronzi Antichi, Grado-Aquileia, 22-26 maggio 2001, Monographies Instrumentum 21, 450-455, Montagnac.
- ISTENIČ, J. 2003, A uniface medallion with a portrait of Augustus from the River Ljubljana (Slovenia). - *Germania* 81/1, forthcoming.
- KÜNZL, E. 1996, Gladiusdekorationen der frühen römischen Kaiserzeit: dynastische Legitimation, Victoria und Aurea Aetas. - *Jb. Röm. Germ. Zentmus.* 43, 383-474.
- KÜNZL, E. 1988, Katalog. - In: *Kaiser Augustus und die verlorene Republik*, 552-580, Berlin.
- ŁUCZKIEWICZ, P. 2000, Zur späteisenzeitlichen Bewaffnung in Polen. Stand der Forschung. - *Jb. Röm. Germ. Zentmus.* 47, 355-437.
- MAIER, F. 1998, Manching und Tarent. Zur Vergoldungstechnik des keltischen Kultbäumchens und hellenistischer Blattkränze. - *Germania* 76, 177-216.
- VOß, H.-U., P. HAMMER and J. LUTZ 1998, Römische und germanische Bunt- und Edelmetallfunde im Vergleich. - *Ber. Röm. Germ. Komm.* 79, 107-381.
- MANO-ZISI, D. 1957, *Nalaz iz Tekije*. - Antika 2, Beograd.
- POTOČNIK, M. 1988-1989, Bakreno-in bronzodobne podvodne najdbe iz Bistre in Ljubljane na Ljubljanskem Barju (German summary: Die kupfer- und bronzzeitlichen Flussfunde aus dem Bach Bistra und dem Fluss Ljubljana im Gebiet von Ljubljansko Barje). - *Arh. vest.* 39-40, 387-400.
- RIEDERER, J. 1999, Die Analyse silberner Beschläge einer Gladiusscheide und Teilen eines *cingulum* aus Kalkriese. - In: Franzius 1999, 603-605.
- SCHALLES, H.-J. 1994, Frühkaiserzeitliche Militaria aus einem Altrheinarm bei Xanten-Wardt. - *Journal of Military Equipment Studies* 5, 155-165.
- SHERLOCK, D. 1976, Silver and Silversmithing. - In: D. Strong, D. Brown (eds.), *Roman Crafts*, 11-23, London.
- STARE, F. 1953, Pomembni zaklad z Vrhnike (Nauportus). - *Arh. vest.* 4, 94-104.
- SVOLJŠAK, D. et al. 1997, Novo gradivo v Arheološkem oddelku Narodnega muzeja v Ljubljani (pridobljeno v letih od 1987 do 1993). - *Var. spom.* 36, 224-294.
- ŠAŠEL KOS, M. 2002, The boundary stone between Aquileia and Emona. - *Arh. vest.* 53, 373-382.
- ŠINKOVEC, I. 1995, Katalog posameznih kovinskih najdb bakrene in bronzaste dobe (Catalogue of Individual Metal Finds from the Eneolithic and Bronze Ages). - In: B. Teržan (ed.), *Depojske in posamezne kovinske najdbe bakrene in bronzaste dobe na Slovenskem (Hoards and Individual Metal Finds from the Eneolithic*

and Bronze Ages in Slovenia). - Kat. in monogr. 29, 29-127.
THIEL, A. and W. ZANIER 1994, Römische Dolche -
Bemerkungen zu den Fundumständen. - *Journal of Military
Equipment Studies* 5, 59-81.

WIEGELS, R. 1999, Die Inschrift auf der Klammer. - In: Franzius
1999, 600-602.
ZANKER, P. 1990², *The Power of Images in the Age of Augustus*.
- Ann Arbor.

Zgodnjerimski "Zaklad z Vrhnike": zbirka najdb iz reke Ljubljanice

1. UVOD

Pojem "Zaklad z Vrhnike" je uvedel dr. France Stare v objavi železnega gladija z bogato reliefno okrašenimi okovi nožnice (sl. 1), poznolatskega meča z nožnico, okrašeno v predrti tehniki, železnega meča z ostanki lesene nožnice, srpa, dvozoba in trozoba iz "vojnozgodovinske zbirke višjega preparatorja Janka Vertina iz Ljubljane" (Stare 1953, sl. 1; 2; t. 4).¹

France Stare (1953) navaja, da je te predmete Janko Vertin "pridobil pred okoli 25 leti od nekega upokojenega žandarmerijskega stražmojstra iz Vrhnike" (o. c., 94). Stare kot edini podatek o kraju in okoliščinah najdbe navaja Vertinov zapis, da so vse predmete, ki naj bi "zakladu" pripadali, "našli na istem mestu in sicer v neposredni okolici Vrhnike ob bregu Ljubljanice okoli 1 m globoko v zemlji." (o. c., 94). Stare kot argumente, "ki opravičujejo domnevo o zakladu", navaja, da "predmeti niso močno patinirani, železo je relativno dobro ohranjeno, površina predmetov pa je na nekaterih mestih pokrita s tanko plastjo apnenca; ta je najbrž ostanek nekih alg, ki so predmete prerasle. Značilno je, da so n. pr. vsi trije meči in kosa pokriti s plastjo apnenca le na eni od širših ploskev, pač na tisti, ki je bila obrnjena navzgor, značilno pa je tudi, da se je pred očiščenjem gladiusa še dobro opazilo, da sta preko rezila ležala drug meč in kosa" (l. c.).

Vse predmete iz "zaklada", v katerem so prisotni zgodnjerimski in poznolatski predmeti, je ponovno, z boljšimi risbami, objavila Jana Horvat (1990, 135-136, 238-239, 293-294, t. 27-29). Najdiščne podatke je povzela po prvotni objavi (Stare 1953), vprašanja, ali predmeti res predstavljajo zaklad, pa ni obravnavala (Horvat 1990, 58, 135-136, 174, 238-239, 293-294). Posamezni predmeti iz "zaklada", tj. avgustejski gladij s srebrnimi okovi nožnice in poznolatski meč z nožnico, okrašeno v predrti tehniki, so bili obravnavani v specialističnih študijah in v preglednih delih (Künzl 1996, 422-423, 458; M 36, t. 57: 3,4; Frey 1986, 49-52, oba s citiranimi starejšimi objavami; za poznolatski meč prim. tudi Böhme-Schönberger 1998, 235-239 in Łuczkiwicz 2000, 369-376).

Pozorno čitanje Staretovega opisa predmetov, ki sestavljajo "zaklad", zbudi dvom o verodostojnosti najdiščinskih podatkov. Za sloj apnenca, ki je "najbrž ostanek nekih alg" na "eni od širših ploskev" je namreč težko verjeti, da je nastal v zemlji, pa čeprav je bila močvirna. Malo verjetno je namreč, da bi se tam nabrale alge, še bolj pa, da bi se le na eni strani. Plast alg je značilna za vodne najdbe, npr. najdbe iz reke Ljubljanice. Alge se naberejo

na tisti strani predmeta, ki ne leži v blatu, temveč gleda navzgor. Poleg tega smo pri registriranju arheoloških najdb v privatnih zbirkah, ki ga izvaja Arheološki oddelek Narodnega muzeja Slovenije, odkrili nove podatke, ki pomembno osvetljujejo najdišče omenjenega "zaklada" in odpirajo vprašanje, ali gre res za zaklad.

2. PREČNI OKOV NOŽNICE GLADIJA: NAJDIŠČE, OPIS

Prečni okov nožnice meča s pripadajočima obročkoma (Zn 137-7²; sl. 2; 3) je našel nepooblaščen potapljač 10. januarja 1998 v reki Ljubljanici, na s travo poraslem dnu bližje desnemu bregu (gledano nizvodno). Najdišče leži na odseku pri Bevkah dobre 4 km vzhodno od Vrhnike/*Nauportus* (sl. 6) in je pribl. 400 m oddaljeno od gladinometra pri kmetiji Kamin v smeri proti toku (sl. 7: 1).

Okov je 97 mm dolg, 10 mm širok in tehta 32,62 g. Površina je pokrita z enakomerno temnosivo patino. PIXE analize majhnega dela površine, s katere je bila odstranjena patina, je pokazala, da je okov izdelan iz visoko kvalitetne srebrove litine, ki vsebuje zelo visok delež (okoli 95 %) srebra, okoli 2-3 % bakra, okoli 0,7 % zlata in okoli 0,5 % svineca (Dodatek, sl. 8/tab. 1: 2-3). To je običajna sestava rimskih srebrnih predmetov. Delež zlata, ki je manjši od 1,5 %, kaže, da zlato ni bil dodano namerno, temveč je posledica pridobivanja srebra iz svinčeve rude, tj. svinčevega sijajnika ali galenita (Hughes, Hall 1979, 325-335). Na več mestih sprednje strani, kjer ni patine, je pod mikroskopom jasno vidna pozlata.³ To so potrdili izsledki PIXE- in XRF-analiz (Dodatek, sl. 8/tab. 1: 5; sl. 10/tab. 2: stran A, mesto 4). Previdna odstranitev patine na majhnem delu površine ob mestu vidne pozlate je pokazala, da pozlato prekriva patina.

Osnovna oblika okova je nastala s kovanjem. Bogat reliefni okras na sprednji strani je bil iztolčen s hrbtne strani in punciran z lica.⁴ V sredini sprednje strani okova, na mestu, kjer je reliefni okras najvišji, je na licu vidna drobna razpoka (sl. 3: b), ki je nastala pri izdelavi okrasa. Zaradi te napake so na tem delu okova hrbtne stran podložili s pribl. 10 mm dolgo in 10 mm široko kositrno zalivko (Dodatek, sl. 8/tab. 1: 1)⁵ nepravilne oblike (sl. 3: c; prim. Sherlock 1976, 19).

V osrednjem delu okova upodobljeni rastlinski motiv je ob straneh obdan s po dvema rebroma, ki ju loči drobna valovnica,

¹ Predmete hrani Mestni muzej v Ljubljani, inv. št. 510:LJU;32582 (poznolatski meč z nožnico), 510:LJU; 32583 (železen meč), 510:LJU;32617 (gladius z okovi nožnice), 510:LJU;32825 (trizob), 510:LJU;32601 (dvozob) in 510:LJU;32826 (železna kosa).

² Vse v članku navedene oznake, ki se začenjajo z "Zn", predstavljajo identifikacijsko številko predmeta in se nanašajo na register arheoloških najdb v zasebni lasti, ki ga vodi Arheološki oddelek Narodnega muzeja Slovenije.

³ Načina pozlatitve nismo podrobno raziskali. Dr. Alessandra Giumlia-Mair na podlagi fotografij domneva, da gre za pozlatitev s tenkimi folijami. Prim. Giumlia-Mair, Meriani, Lucchini 2002 in Maier 1998.

⁴ Postopek izdelave reliefnega okrasa s hrbtne strani je opisan v Sherlock 1976 (17, 19), tehnika punciranja pa v Braun-Feldweg 1988, 184. V enaki tehniki, tj. z iztolčenjem s hrbtne strani in punciranjem s sprednje strani, in ne z iztisom v kalup (cf. Horvat 1990, 293-294), je bil najverjetneje okrašen tudi okov ob ustju nožnice gladija iz "vrhniškega zaklada".

⁵ Kositrno zalivko je zaznala tudi XRF-analiza sprednje strani okova (Dodatek, sl. 10/tab. 2: stran A, analiza 1).

izvedena s punciranjem z lica. Robova sprednjega dela okova sta okrašena z linijo prav tako z lica punciranih pokončnih, pribl. milimeter dolgih "zarezi". Zanki ob straneh okova sta na zunanji strani izrazito profilirani. V vsako zanko je vdrt po en obroček premera 17 mm, ki je na zunanji strani izrazito profiliran, najbolj izstopajoče rebro pa je drobno narebreno na enak način kot robova sprednjega dela okova.

Hrbtni del okova je tanko skovan. Zaključka se presegata pribl. v dolžini 15 mm. Masivna srebrna žeblička sta pripenjala prečni okov na nožnico meča, najverjetneje na njen robni okov; levi žebliček (glede na *sl. 2*) je obenem spenjal prečni okov na hrbtnem delu.

3. PREČNI OKOV NOŽNICE GLADIJA: OPREDELITEV, POVEZAVA Z GLADIJEM IZ "VRHNIŠKEGA ZAKLADA"

Obravnavani okov pripada nožnicam gladijev tipa Mainz. V primerjavi z drugimi prečnimi okovi nožnic tega tipa je nenavaden bogat reliefni okras na licu in prečni profil hrbtnega dela tega okova z rahlo zavihanima robovoma. Po merah in materialu ter motivu in izvedbi okrasa je ta okov enak zgornjemu prečnemu okovu nožnice gladija iz "vrhniškega zaklada" (*sl. 1*). Obema okovoma je skupna tudi pozlata. Ob ogledu gladija iz "vrhniškega zaklada" sem namreč ugotovila doslej v objavah neopažene,⁶ vendar jasno vidne ostanke pozlate na prečnem okovu in okovu ob ustju nožnice.

Gladiji s srebrnimi okovi nožnic so izredno redki, nožnica z reliefnim okrasom iz "vrhniškega zaklada" pa je edinstven. Možnost, da v reki Ljubljanici najdeni prečni okov ni pripadal nožnici iz "vrhniškega zaklada", se torej zdi zanemarljivo majhna, zato sklepam, da je bil v Ljubljani pri Bevkah najden doslej manjkajoči spodnji okov nožnice gladija iz "vrhniškega zaklada".

4. OKOV VOJAŠKEGA PASU

Dokumentirali smo tudi okov vojaškega pasu (Zn 149; *sl. 4; 5*), ki je bil prav tako najden v reki Ljubljani v neposredni bližini gladinometra pri kmetiji Kamin, pribl. 400 m nizvodno od mesta najdbe zgoraj opisanega prečnega okova nožnice gladija (*sl. 6; 7; 2*).

Okov je odlično ohranjen. Površina je pokrita s tanko plastjo temnosive patine.

Je pravokotne, skoraj kvadratne oblike, izdelan je bil s kovanjem. V dolžino meri 48 mm (z glavicami na tečaju 51 mm), v širino pa 43 mm (z glavicami 53 mm). Je precej masiven in tehta 34,20 g. Manj kot 1 mm debela srebrna pločevina je na podolžnih straneh zavita navznoter oziroma navzgor tako, da na vsaki strani tvori 3-4 mm široko cevko. V obeh cevkah je palčka (os), ki je v cevko pritrjena s po eno masivno, pribl. 6 mm široko glavico na vsaki strani. Cevka in os tvorita cevast tečaj, ki pa ni imel uporabnega, temveč zgolj okrasni namen (t. i. pseudo-tečaj; cf. Bishop, Coulston 1993, 98). Stik zgornje strani okova in nazaj zavite pločevine tečaja je prekrit s pribl. 4 mm širokim in okoli 1 mm debelim trakom. Ta je na eni stranici okrašen z linijo drobnih punciranih krogcev, na drugi pa z drobno valovnico, ki je bila prav tako narejena s punciranjem.

Osrednji del okova je krožne oblike in omejen s pribl. 2

mm širokim in plitvim žlebom. Okrašen je z reliefnim okrasom, ki je bil iztolčen s hrbtni strani in punciran z lica. Upodobljeni so simetrično postavljeni rastlinski motivi: dva široka akantova lista, štirje ožji listi in šest popkov. Ozadje je puncirano z drobnimi krogci. V sredino tega okrasa je z zakovico, ki ima okroglo okrasno glavico, pritrjena posebej izdelana rozeta z osmimi listki.

Pozlata je jasno vidna na osrednjem punciranem delu okova in potrjena z izsledki analiz (Dodatek, *sl. 9/tab. 1: 16-17*). Pregled pod mikroskopom je pokazal ostanke pozlate tudi na reliefno izvedenih listih rozete in na obeh trakovih na tečajih. Na akantovih listih in drugih delih reliefnega okrasa, ki je dvignjen nad punciranim ozadjem, pozlata ni vidna niti pod mikroskopom niti zaznavna s PIXE-analizo (Dodatek, *sl. 9/tab. 1: 15*). Tudi analize ostalih delov površine, kjer pozlata ni vidna, na licu in na hrbtni strani, so pokazale pribl. 1 % zlata, kar nakazuje, da površina tu ni bila pozlačena (Dodatek, *sl. 9/tab. 1: 9-11*). Analize površine, s katere je bila odstranjena patina, so pokazale podobno srebrovo zlitino kot pri okovu nožnice meča (glej zgoraj): 95-96 % delež srebra, pribl. 3,3 % bakra, okoli 1 % zlata in 0,2-0,3 % svinca (Dodatek, *sl. 9/tab. 1: 6-8*). Analize patinirane površine glavic tečaja in osrednje zakovice so pokazale, da prav tako niso bile pozlačene (Dodatek, *sl. 9/tab. 1: 12-14*). Delež srebra okoli 98 % in manj kot 1 % bakra nakazuje, da so bile izdelane iz zlitine, ki so ji dodali zelo malo ali nič bakra.⁷ Za potrditev te domneve bi morali analizirati površino, s katere bi odstranili patino.

Utemeljeno torej lahko domnevamo, da je bila sprednja stran okova le deloma pozlačena in da je učinkovitost okrasa povečalo nasprotje med zlato in srebrno svetlečo se površino. V sredini srebrnega okova se je nad punciranim zlatim ozadjem dvigoval srebren reliefni okras listov ter popkov, v sredini pa je bila pozlačena rozeta s srebrno svetlečo se glavico zakovice. Poudarjen osrednji okras sta uravnotežila pozlačena okasna trakova ob straneh okova. Vsi okrasni so izvedeni večje in zelo kvalitetno.

Okov je bil na pas pritrjen s štirimi simetrično postavljenimi srebrnimi zakovicami, od katerih sta ohranjeni dve, na mestu drugih dveh pa sta vidni luknjici premera pribl. 3 mm. Ohranjeni zakovici krasita pribl. 6 mm široki okrogli glavici, ki sta malo večji (premer 7 mm) kot zaključki osi tečajev. Dolžina trnov ohranjenih zakovic kaže, da je bil usnjeni del pasu debel pribl. 4 mm.

5. OPREDELITEV PASNEGA OKOVA IN NJEGOVA POVEZAVA Z NOŽNICO GLADIJA IZ "VRHNIŠKEGA ZAKLADA"

Srebrni okovi vojaških pasov z navideznimi tečaji, zaključenimi z okrasnimi glavicami, so znani z najdišča Kalkriese, mesta katastrofalnega Varovega poraza v Teutoburškem gozdu l. 9 n. š. (Franzius 1999, 588-590, 597-598, 607, *sl. 14: 2-4, 7-8; 17: 1*), iz zaklada, zakopanega v domicijanovem času v Tekiji/*Transdierna* (Srbija; Mano-Zisi 1957, 11-12, 22-23, t. 13: 18-21, 14: 19-20), z najdišč v Neapeljskem zalivu (Künzl 1996, 461-462, C 11-13, 25-27, t. 50: 1-6; Künzl 1988, 562-3, Kat. 382) in iz Aquileije (Künzl 1996, C 47, t. 50: 10).⁸ Okov iz Kalkrieseja in tekijski okovi so okrašeni z reliefnimi koncentričnimi krogi,

⁶ Horvat (1990, 135-136, 238-239, 293-294) pozlate ne omenja, Künzl (1996, 458: M 36; 1988, 560-561, kat. št. 386) pa izrecno omenja, da ni sledov pozlate.

⁷ Primerjava izsledkov analiz svetleče se površine (Dodatek, *sl. 9/tab. 1: 6-8*) in patine (Dodatek, *sl. 9/tab. 1: 9,11*) pokaže, da je vsebnost srebra na patinirani površini višja, vsebnost bakra pa nižja. To je razumljivo, ker se manj žlahtni elementi na površini izlužijo. Vendar se zdi, da sta odstopanji vsebnosti srebra in bakra pri meritvah št. 12-14 previsoki, da bi bili le posledici selektivne korozije. Glede bakra v srebrovih zlitinah glej Huges, Hall 1979, 331-333.

⁸ Za pregled ostalih okovov s pseudo tečaji glej Bishop, Coulston 1993, 96-98 in Franzius 1999, 588-589, op. 79-88.

ostali pa s figuralnimi okraši mitološke vsebine. Okov iz Kalkrieseja in nekateri izmed tekijških okovov (Mano-Zisi 1957, 23, t. 13: 18,20 spodaj,21) imajo, tako kot primerek iz Ljubljane, na tečajih okrasni trak. Ta je na okovu iz Kalkrieseja, tako kot na okovu iz Ljubljane, pozlačen (Franz 1999, 588, 607). Zelo podobne so tudi glavice zakovic, s katerimi so bili okovi iz Kalkrieseja in Tekije pritrjeni na pas (Franz 1999, t. 14: 2-4; 17: 1; Mano-Zisi 1957, t. 13: 18-21; 14: 19,20).

Za opredelitev pasnega okova iz Ljubljane je odločil en okras, ki ima le eno ustrezno primerjavo. To je okras na okovu ob ustju nožnice gladija iz "vrhniškega zaklada" (sl. 1). Tu najdemo isti in v enakem stilu izvedeni motiv akantovih listov (*Akanthuskelche*) ter puncirano podlago. Okras pasnega okova je povezan tudi s prečnima okovoma te nožnice (sl. 1-3). Druži jih v tehniki punciranja narejena valovita linija, ki krasi najvišje dele vseh treh okovov. Okovom nožnice gladija in pasu je skupen tudi material (srebrova zlitina z visokim deležem srebra) in pozlata (prim. 2. poglavje).

Okov vojaškega pasu iz Ljubljane je torej izjemen in visoko kvaliteten izdelek, ki med znanimi ostanki vojaških pasov nima ustrezne primerjave, njegov okras pa po motivih, stilu, načinu in kvaliteti izdelave odlično ustreza okrasom na okovih nožnice gladija iz "vrhniškega zaklada". Izrazita podobnost okovov nožnice in pasu, upošteva njihove izjemnosti, kaže, da sta pas in gladij z nožnico verjetno predstavljala celoto, t. i. garnituro. To ne preseneča, saj so zgodnjorimski vojaški pas in meč z nožnico tvorili ikonografsko celoto (Künzl 1996, 406-408). Razmeroma velika razdalja (pribl. 400 m) med najdiščema obeh predmetov je morda posledica močnega rečnega toka ali pa nenatančnosti najdiščnih podatkov.

Stilne značilnosti, motivi in kvaliteta izvedbe okrasov na okovih nožnice gladija in vojaškega pasu kažejo na avgustejski čas ter vključenost v italško toreutsko tradicijo (cf. Künzl 1996, 422-423; Künzl 1988, 560-561, kat. št. 386). Motiv vitic in cvetoče narave, upodobljen na okovu nožnice gladija in na pripadajočem okovu vojaškega pasu, sodi med priljubljene motive avgustejske dobe (prim. npr. *Ara Pacis Augustae*). Oznanjal je plodnost, razcvet in obilje nove, zlate dobe (*saeculum aureum*, *Aurea Aetas*), ki je bila pojmovana kot paradiz na zemlji. Pričetek te dobe je bil razglašen spomladi leta 17 pr. n. š. med Stoletnimi igrami (Zanker 1990², 179-192; Künzl 1996, 421-423).

6. "VRHNIŠKI ZAKLAD" - ZBIRKA NAJDB IZ REKE LJUBLJANICE

Prečni okov nožnice gladija, ki je sestavni del "vrhniškega zaklada", je bil najden v reki Ljubljanici pribl. 4 km vzhodno od Vrhnike na odseku pri Bevkah. Možnost, da je bil prečni okov nožnice gladija odplaknjen iz "zaklada", zakopanega ob rečnem bregu, je malo verjetna. Proti tej govoritvi v prvi objavi izražena omemba, da so bili predmeti iz "vrhniškega zaklada" na eni strani pokriti s sedimentom, ki po opisu ustreza rečnim sedimentom, kakršni so značilni za najdbe iz Ljubljane (glej 1. pogl.).

Predmeti, ki po Staretu sestavljajo "vrhniški zaklad", torej izvirajo iz reke Ljubljane in ne z njenega brega, kakor je bilo navedeno v prvotni objavi (Stare, o. c.) in je veljalo doslej (npr. Horvat 1990, 58, 135-136, 174, 238-239; Künzl 1996, 422-423, 458; M 36; isti 1988, 560-561, kat. št. 386). Zastavlja se vprašanje, ali so bili predmeti iz "zaklada" res najdeni skupaj ali (verjetneje) posamič v reki. Omemba, "da se je pred očiščenjem gladiusa še dobro opazilo, da sta preko rezila ležala drug meč (ni jasno kateri - op. J. I.) in kosa" (Stare 1953, 94) nakazuje, da je bil del najdb morda najden skupaj. Vsekakor pa predmetov iz "vrhniškega zaklada" ne kaže obravnavati kot zaklad niti kot, glede na najdišče, ožje povezane predmete.

Možno je, da najdbe iz "zaklada" izvirajo iz odseka Ljubljane pri Bevkah. Gladij z okovi nožnice je bil gotovo najden tu, glede na Staretovo poročilo pa tudi kosa in eden od preostalih dveh mečev. Za preostale predmete iz "zaklada" to lahko previdno domnevamo. Na omenjenem odseku je namreč izrazita gostota najdb arheoloških predmetov, ki časovno segajo od bronaste dobe dalje (Svoljšak et al. 1997, 258-261; Potočnik 1988-1989, 388-391; Šinkovec 1995, 46, 79, 101-102, 114-115; sl. 19: 200,227,136; za odsek od izliva Bistre do Kamina kratka informacija v Gaspari, Krempuš 2002, 448). Glavnina rimskih najdb sodi v obdobje druge pol. 1. st. pr. n. š. in prve pol. 1. st. n. š. Med najdbami po pogostosti izstopajo vojaška oprema,⁹ keramično pivsko posodje¹⁰ ter novci.¹¹ To območje na vzhodu zaključuje najdišče mejnika med emonskim in akvilejskim agrom (Šašel Kos 2002). Domneva, da sta na območju Bevk obstajala prehod čez Ljubljanico in zaselek (Šašel Kos 2002), ne izključuje možnosti, da je bil del najdb na tem območju v Ljubljanico odvržen namenoma iz ritualnih vzgibov.¹² To na primer domnevamo za kipca Apolona (Istenič 2002; 2001; Gaspari, Krempuš 2002).

7. SKLEP

Analiza opisa predmetov v prvotni objavi (Stare 1953) in najdbi iz reke Ljubljane so pokazale, da je tako imenovani zgodnjorimski "vrhniški zaklad" zbirka predmetov iz reke Ljubljane, deloma ali morda v celoti z odseka pri Bevkah.

Gladij in nožnica s pozlačenimi srebrnimi okovi, okrašenimi z reliefnim okrasom (iz "vrhniškega zaklada"), ter v Ljubljanici najdeni okov vojaškega pasu iz enakega materiala, okrašen v enakem stilu in s podobnimi motivi, tvorijo garnituro. Predstavljajo izdelke avgustejskega časa in italškega prostora. Njihova enkratnost in visoka kvaliteta izdelave kažeta na izjemne izdelke. To potrjuje pozlata in uporaba visoko kvalitetne srebrove zlitine z majhnim deležem bakra, ki je bil dodan namenoma, da je povečal trdoto in trdnost zlitine (Hughes, Hall 1979, 331-333). Take zlitine so bile namenjene luksuznim predmetom (Hughes, Hall 1979; Giomlia-Mair 2000, 297-298; ista 1998, 244; Riederer 1999). Glede na prestižnost garniture se zdi verjetno, da je bila last rimskega oficirja. Grafit na podobno luksuzni granituri iz Kalkrieseja nakazuje, da je ta pripadala centurijonu (Wiegels 1999).

⁹ Med najdbami, ki jih hrani ali jih je registriral Narodni muzej Slovenije npr. *dona militaria* (Zn 137-8 in Istenič 2003), čelada (inv. št. R 18915), pilumi (inv. št. V 1352, V 1454, R 8123), deli vojaških pasov (inv. št. V 449, V 1453), meči in nožnice mečev (inv. št. V 405, R 17110, V 574) ter stimuli (akc. št. 94/4-3).

¹⁰ Terra sigillata (npr. inv. št. V 621, V 869, V 870), keramika s črnim premazom (npr. inv. št. V 1084, V 782), keramika tankih sten (npr. inv. št. V 866, V 868, V 867, V 620, V 813), deli vrčev (npr. inv. št. V 783, V 814) in grobi lonci (npr. inv. št. V 897).

¹¹ Redki posamični novci (FMRSI IV, 109/1), skupinska najdba republikanskih denarijev, deponiranih po 42 pr.n.š. (FMRSI IV, 109/2), skupinska najdba poznorimskih novcev, deponiranih po 352 (FMRSI IV, 109/3), na sotočju Zrnice in Ljubljane skupinska najdba republikanskih in keltskih novcev, deponirana po 147 pr. n. š. (FMRSI IV, 110).

¹² Pri interpretaciji rimskih rečnih najdb imata vnete zagovornike tako teorija "izgubljenih predmetov" kot "namernih votivnih" depozitov (Künzl 1996, 438-449, s citirano literaturo; Bonnamour 2000, 45-52; Bonnamour, Dumont 1994; Schalles 1994; Thiel, Zanier 1994).

Zahvale

Pri pisanju članka so mi bili z nasveti glede literature, s pogovori in z dragocenimi pripombami v pomoč Polona Bitenc, dr. Timotej Knific, ing. Igor Ravbar, Andrej Šemrov, dr. Neva Trampuž Orel in dr. Peter Turk (vsi Narodni muzej Slovenije) ter dr. Paul Craddock (The British Museum), dr. Alessandra Giumlia-Mair (AGM Archeoanalisi Lab), dr. Dragan Božič in dr. Jana Horvat (oba Inštitut za arheologijo ZRC SAZU). Risbe predmetov 2-4 sta naredila Ida Murgelj in Uroš Stiškovski (oba Narodni muzej Slovenije).

DODATEK

Spektralne analize prečnega okova gladija in okova vojaškega pasu

Janka ISTENIČ, Zoran MILIČ in Žiga ŠMIT

1. UVOD

Na prečnem okovu gladija in na okovu vojaškega pasu so bile izvedene le spektralne analitske raziskave, ki niso posegle v predmet, ali pa je bil poseg komajda zaznaven. Zaradi izjemnosti in dragocenosti predmetov invazivnih analiz nismo izvedli.

Analize so bile izvedene s tehnikama PIXE (protonsko vzbujena rentgenska spektrometrija) in EDS XRF (rentgenska fluorescenčna spektrometrija). Pri dosledni neinvazivnosti je z obema metodama lahko analizirana le tanka površinska plast, ki je pri arheoloških predmetih običajno bolj ali manj spremenjena (se torej razlikuje od jedra) zaradi korozije. Čeprav so pri kvalitetnih srebrovih zlitinah, iz kakršnih sta izdelana obravnavana predmeta, spremembe zlitine na površini običajno razmeroma majhne (prim. Voß, Hammer, Lutz 1998, 170), smo želeli preveriti razliko med rezultati analiz patinirane površine in pa plasti pod njo. V ta namen smo na enem oziroma dveh mestih na hrbtu vsakega predmeta s skalpelom odstranili patino z majhnega dela površine (pribl. $1,5 \text{ mm}^2$). Te točke smo analizirali z metodo PIXE (tab. 1: 1-3, 6-8), ki omogoča analizo izrazito majhnih delov površine. Minimalen poseg v površino arheoloških predmetov¹³ je tako omogočil razmeroma natančno analitsko opredelitev zlitine, iz katere sta bila izdelana predmeta. Z metodo XRF smo analizirali le patinirano površino.

Izrazita prednost obeh uporabljenih metod je, poleg neinvazivnosti, hitro in enostavno kvalitativno določanje sestave tanke plasti na površini predmeta, v obravnavnih primerih pozlate.

Istenič, Milič

2. ANALIZE PIXE

Meritve z metodo PIXE smo izvedli na tandemske pospeševalniku Inštituta Jožef Stefan. Merili smo s protonskim žarkom energije 2,5 MeV v zraku. Za izstopno okence smo uporabili aluminijevo folijo debeline 8 μm . Premer žarka na tarči je bil približno 1 mm, pri meritvah št. 3, 5 in 6 pa 0,3 mm. Rentgenske žarke smo zaznavali s polprevodniškim silicijevim detektorjem z ločljivostjo 150 eV pri 5,9 keV.

Zaradi velikega pridelka mehkih srebrovih žarkov L smo detektor opremili z absorberjem. Pri meritvah točk 1, 2, 4, 7 in 17 smo uporabili aluminijev absorber z debelino 0,3 mm; ker smo s tako debelim absorberjem preveč zmanjšali pridelok

železovih žarkov, smo pri meritvah točk 8-16 in 18-19 uporabili tanjši aluminijev absorber debeline 0,1 mm. Meritve v točkah 3, 5 in 6 smo opravili s protonskim žarkom premera 0,3 mm, tako da smo žarek obrezali z izstopno zaslonko. Tako ozek žarek smo izbrali zato, da smo lažje zadeli izbrana mesta na predmetu, kjer je bila odstranjena korozijska plast. Ker je bila pri meritvah z zoženim žarkom hitrost štetja precej majhna, smo za absorber uporabili le 50-mikrometrsko kaptonsko folijo. Umeritev sistema smo preverili z meritvijo standarda C1107, ki vsebuje 1,04 % kositra. Koncentracije manjšinskih elementov, ki jih eksperimentalne napake najbolj prizadenejo, so bile določene z natančnostjo 10 %.

Na hrbtu okova nožnice smo z dvema meritvama izmerili svetlečo površino, kjer je bila odstranjena patina (sl. 8/tab. 1: 2,3). Izmerili smo tudi sestavo svetle kovine na notranji strani okova (sl. 8/tab. 1: 1). Razmeroma velika koncentracija železa (7,9 %) kaže, da smo pri tem zadeli tudi patino, bogato z železom. Zato je v tabeli 1 pri točki 1 v drugi vrstici prikazan izračun koncentracij, pri katerem železovega pridelka nismo upoštevali. Kovina je precej čist kositer (96 %). Približno enako koncentracijo železa (8,1 %) smo dobili tudi pri merjenju patinirane površine na hrbtni strani okova (sl. 8/tab. 1: 4). Merjenje zlato svetleče se površine v toru žleba na licu okova (sl. 8/tab. 1: 5) je potrdilo, da je tu pozlata.

Na pasnem okovu smo izmerili majhno svetlečo se površino na mestu, kjer je bila odstranjena patina (sl. 9/tab. 1: 6-8), patinirano površino v bližini (sl. 9/tab. 1: 9) in patinirano površino na licu (sl. 9/tab. 1: 11). Razlike koncentracij med patiniranimi in očiščenimi površinami so tu precej manjše kot pri okovu nožnice meča. Pozlato smo analizirali na puncirani površini, kjer je bila najbolj ohranjena (sl. 9/tab. 1: 16,17). Analize glavice osrednje zakovice in dveh glavic navideznega tečaja nakazujejo, da so izdelane iz čistejšega srebra kot drugi deli pasnega okova (okoli 98 % Ag; sl. 9/tab. 1: 12-14). Srebrni so bili tudi žeblički (sl. 9/tab. 1: 18,19); pri enem od njih preseneča vrednost zlata okoli 2,7 %, ki nakazuje pozlato (sl. 9/tab. 1: 17).

Z dodatnim računom smo ocenili, da je bila zlata plast na merjenem mestu na okovu nožnice meča (sl. 8/tab. 1: 5) in na pasnem okovu (sl. 9/tab. 1: 17) debela 0,7-1,5 μm .

Šmit

3. XRF-ANALIZE

Analize smo opravili v laboratoriju Narodnega muzeja Slovenije z metodo EDS XRF (rentgensko fluorescenčno spektroskopijo). Pri tem smo uporabili napravo X-Ray Analyzer Model PEDUZO 01/Am/Sip-250, ki so jo izdelali v Inštitutu Jožef Stefan. Ta analizator je oblikovan za analizo kemičnih elementov različnih vzorcev. Kot vir žarčenja se uporablja 25 mCi Am-241 radioizotop. Rentgenski spektrometer uporablja Si PIN detektor z ločljivostjo 250 eV pri 5,9 keV. Spekter analizira 1024 kanalni analizator z diferencialno nelinearnostjo $< 2 \%$ in integralno nelinearnostjo $< 1 \%$. Detektor je nameščen v vakumu in ima 25 mikronov debelo Be okno. Peltierov hladilnik je vgrajen v ojačevalni sistem in vzdržuje 235°K na PIN-diodi. Vse nastavitve sistema so opravljene v tovarni tako, da je spektralno energijsko območje 3-30 keV z razpršitvijo približno 30 eV/kanal.

Meritve zajame krog s premerom 11 mm. Omenjena metoda analizira površinsko plast predmeta, saj seže le nekaj deset μm (mikronov) v globino.

Vsebnost svinca v vzorcih je nekoliko višja zaradi prispevka kolimatorja iz XRF-analizatorja. Intenziteta svinca, ki jo prispeva kolimator, je pribl. 0,060 c/s. Pri visokih koncentracijah svinca

¹³ Enak postopek je bil izveden na številnih izredno dragocenih predmetih (okoli 200 analiz), ki so bili leta 1977 na razstavi "Wealth of the Roman World" v British Museumu v Londonu (cf. Hughes, Hall 1979, 321-325).

je ta prispevek neznaten in zanemarljiv, pri nizkih koncentracijah svinca pa ga je treba upoštevati. Napaka, ki izhaja iz prispevka kolimatorja, pri okovu nožnice gladija in pri pasnem okovu znaša 10-20 %.

Prečni okov nožnice gladija smo analizirali na štirih mestih na sprednji strani (*sl. 10/tab. 2: A 1-4*), na treh mestih na hrbtni strani (*sl. 10/tab. 2: B 1-3*) in na po dveh mestih na obročkih (*sl. 10/tab. 2: C,D*). Pasni okov smo analizirali v sredini lica (*sl. 11/tab. 3: 3*) in na dveh mestih na hrbtu (*sl. 11/tab. 3: 1,2*). Visoka vsebnost zlata na licu potrjuje, da je tu pozlata. Ta analiza je le kvalitativna.

Milić

Janka Istenič
Narodni muzej Slovenije
Prešernova 20
SI-1000 Ljubljana
e-mail: janka.istenic@narmuz-lj.si

Žiga Šmit
Fakulteta za matematiko in fiziko
Oddelek za fiziko
Univerza v Ljubljani
Jadranska 19
SI-1000 Ljubljana
e-mail: smit@fiz.uni-lj.si

in
Inštitut Jožef Stefan
Jamova 39, p.p. 3000
SI-1001 Ljubljana

Zoran Milić
Narodni muzej Slovenije
Prešernova 20
SI-1000 Ljubljana
e-mail: zoran.milic@narmuz-lj.si