

CAVALRY IN THE ROMAN WORLD

Edited by J. C. N. Coulston

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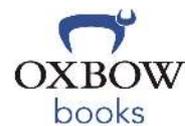


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Front cover: Roman auxiliary cavalry re-enactment (photo © Comitatus)

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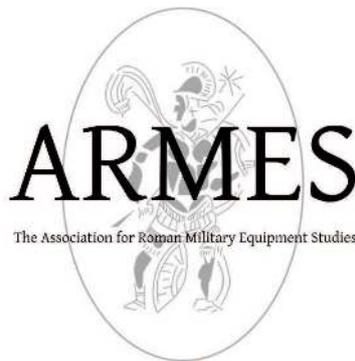
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Roman cavalry equipment and other *militaria* from the 2010 and 2011 excavations at Ptuj (Slovenia)

J. Istenič, M. Janežič, E. Lazar and Ž. Šmit

1. INTRODUCTION

Poetovio (present-day Ptuj, north-eastern Slovenia) has an important strategic position on the main route from north-eastern Italy (*Aquileia/Aquileia*, Italy) towards the middle Danube basin (*Vindobona/Vienna*, *Carnuntum/Petronell*, *Deutsch Altenburg*, Austria) and further to the Baltic Sea (Amber Road), at the point where the road crossed the River Drava. A fortress was sited here in the time of the Roman occupation of what later became the province of Pannonia, probably about 15 BC,¹ though its exact location has not yet been established.²

Epigraphic evidence suggests that the earliest military unit stationed at *Poetovio* was *legio VIII Augusta*.³ *Poetovio* became the site of its winter quarters at end of the Pannonian-Dalmatian rebellion (AD 9) at the latest;⁴ Tacitus mentions it as one of the legions in Illyricum in AD 14.⁵ In the beginning of Claudius' reign, it was replaced by *legio XIII gemina*, which arrived here from *Vindonissa*.⁶ *Poetovio* as a garrison of the *legio XIII* is explicitly mentioned by Tacitus for AD 69,⁷ which is supported by stamped brick and tiles.⁸

After the evacuation of the last legion at the beginning of Trajan's reign, the colony of *Ulpia Traiana Poetovio* was established with the settlement of veterans, who were primarily from northern Italy.⁹ Smaller military units (occasionally) stayed here after the abandonment of the fortress,¹⁰ while there is abundant epigraphic evidence revealing the presence of detachments of *legiones XIII gemina* and *V Macedonica* in the period of Gallienus.¹¹

Rescue excavation in 2010 and 2011 in Ptuj

The rescue excavations conducted in Ptuj from October 2010 to August 2011 were located in Vičava, a part of the town on the left bank of the River Drava (Fig. 1). The excavations took place in advance of the renovation of a military building constructed in 1905 and examined its interior, as well as the strip of land directly abutting its exterior walls. Due to concerns over the stability of the building, excavations were limited to the depth necessary for renovation works. They unearthed the remains of a

Roman road flanked on both sides by buildings with porticoes, dated to the beginning of the 2nd century at the earliest. In areas where the entire archaeological record could be researched, archaeologists found the remains of wooden buildings (postholes and imprints of wooden beams) beneath the 2nd century structures, with the small finds and stratigraphy indicating a 1st-century dating.¹²

2. ROMAN CAVALRY AND MILITARY EQUIPMENT FROM THE 2010/2011 EXCAVATIONS: CATALOGUE¹³

Cavalry Equipment

1. Rear left-hand piece of a saddle horn (Fig. 2a–b, 6.1); 196mm high, about 1mm thick, weight 191.6g. It is deformed, damaged at the top and the base, the tip of the extension is missing. It was hammered into shape from unalloyed sheet copper, with no traces of coating (Fig. 9: PN 387). Along the periphery is a series of irregular 2–3mm wide holes punched from the front at irregular intervals (9 to 13mm). Two raised ribs (c.2mm wide and c. 2mm apart) run along the periphery and join at the tip of the lateral extension. A semi-circular aperture is indicated at the base, asymmetric in relation to the upper part of the horn.

Acc. No. PN 387. No dating by context (from a 19th/20th century fill).

2. Round pendant (Fig. 3a–b, 6.2); 86mm in diameter, weight 67.5 g. It is composed of two sheets (c. 1 mm thick) of brass (Fig. 9: PN 95/1, 3–4): the flat undecorated back and the moulded front. The front bears a raised (c.8mm high and 10mm wide) circular moulding along the rim that passes into a slightly concave part and then into two c. 1.5mm wide circular mouldings (the outer one is chased from the front to give the impression of tiny dots). The two ribs alternate with two narrow and shallow (c.1mm) grooves to delimit the inner circle which rises towards the centre where a 14mm wide hemispherical rivet head is fixed. The inner circle bears relief decoration of a rosette with dots between the petals, probably embossed with the aid of a stamp.

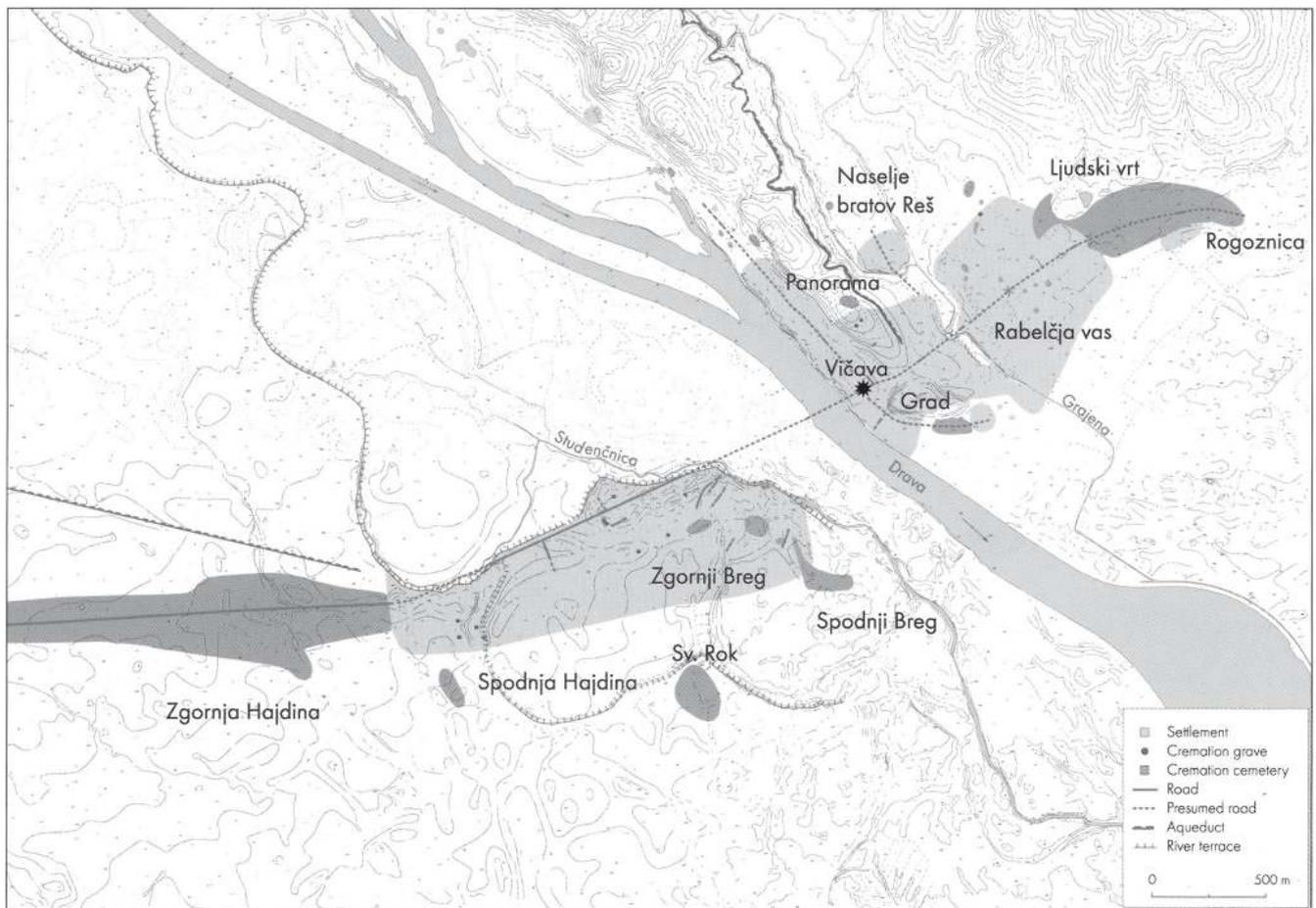


Fig. 1: Map of Poetovio/Ptuj at its greatest extent (after HORVAT et al. 2003, fig. 3) and location of the 2010/2011 excavation (*).

The pendant has a simple suspension loop at the rim made integrally with the front sheet.

Five small circular projections, 4.5 mm in diameter, survive along the rim. They protrude from both the front and the back sheets, fastened together with pins measuring c. 1.5 mm in diameter and probably made of copper (as indicated by the characteristic colour); several of the pins were beaten flat. Originally there were 15 such projections, spaced at an interval of about 16 mm. In addition to the pins, the front and the back sheets are joined in the centre by a copper pin (Fig. 9: PN 95/5) which was beaten flat at the back and also held the hemispherical head on the front.

The original surface is best preserved in the concave part on the front. This patinated surface has a slightly silvery appearance and its analysis has shown 2.6% of tin, which is significantly more than in the brass sheets (0.24 and 0.33%: Fig. 9: PN 95/1, 3), but not high enough to positively prove tinning. Tinning of brass surfaces, with a very thin layer of tin applied directly (without solder) onto the brass surface, was widely practised in Roman military equipment.¹⁴

Acc. No. PN 95. Dating by context: second quarter/middle of the 1st century.

3. Junction *phalera* with a central perforation (Figs 4a–b, 6.3); 48.5 mm in diameter, weight 51.8 g. It was cast from a copper-zinc-lead-tin alloy and its front face silvered (Fig. 9: PN 459). There is a thin groove along the rim, followed inwards by a slightly raised part of the front bearing poorly preserved incised floral decoration, a pair of grooves and finally a sunken circle with perforation in the centre. The floral decoration was originally presumably inlaid with *niello* (Ag₂S), although the PIXE analysis detected no sulphur in the incised decoration.¹⁵

Three flat hoops (strap holders) and two brackets of a hinge on the rear of the *phalera* were cast together with the roundel. The two brackets indicate that a pendant was suspended from the *phalera*. The strap holders measure 15–16 mm in inner width and 3.5–4 mm in minimum height, which indicates the size of the leather straps to which the *phalera* was attached.

Acc. No. PN 459. Dating by context: second quarter of the 1st–beginning of the 2nd century.

4. Flat, heart-shaped pendant and lower part of a strap fitting (Figs 5a–b, 6.4); 75 mm long, 2.7 mm thick, weight



Fig. 2: Ptuj. Rear left-hand piece of a saddle horn, a) front, b) rear.



Fig. 3: Ptuj. Round pendant, a) front, b) rear.



Fig. 4: Ptuj. Junction phalera, a) front, b) rear.



Fig. 5: Heart-shaped pendant and lower part of a strap fitting, a) front, b) rear.

35.9g. The pendant is brass (Fig.9: PN 515/2) and was made by cold working (hammering, cutting). The results of the PIXE analysis (Fig.9: PN 515/1) and the parallels¹⁶ suggest that a silver foil was attached to the front with soft solder (alloy of tin and lead). The results of the analysis on the patina at the back (Fig.9: PN 515/6) did not give an answer as to whether the back was coated.¹⁷ No trace of inlaid decoration could be found.

The fitting (surviving length 32.5 mm, 0.9 mm thick) with a relatively thick (3 mm) loop, measuring 13 mm across, is made of brass and was not coated (Fig.9: PN 515/4, 5). A rivet hole suggests it was originally riveted to a leather strap.

Acc. No. PN 515. Dating by context: second quarter of the 1st –beginning of the 2nd century.

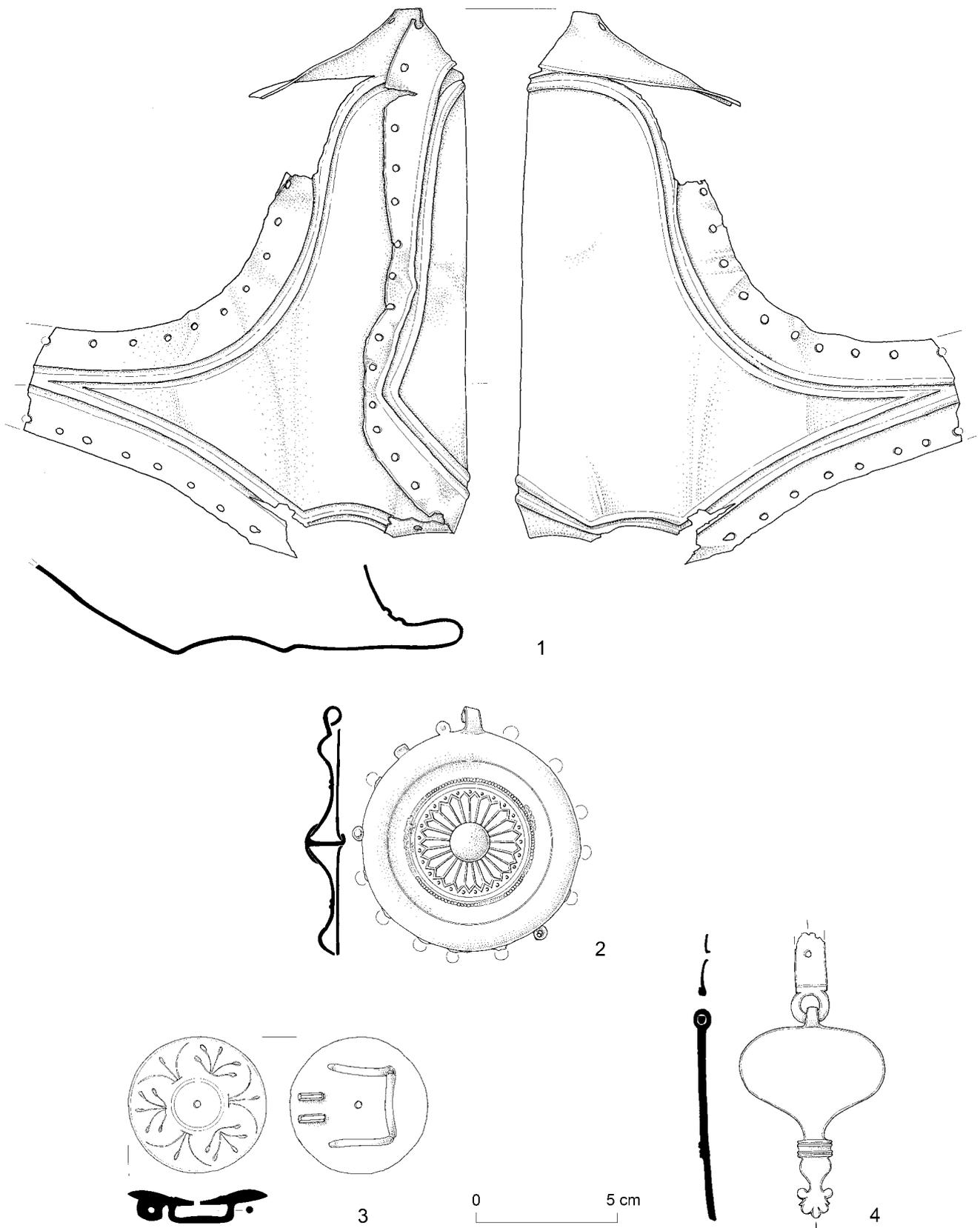


Fig. 6: Ptuj. Cavalry equipment. 1 rear left-hand piece of a saddle horn, 2 round pendant, 3 junction phalera, 4 heart-shaped pendant and lower part of a strap fitting.

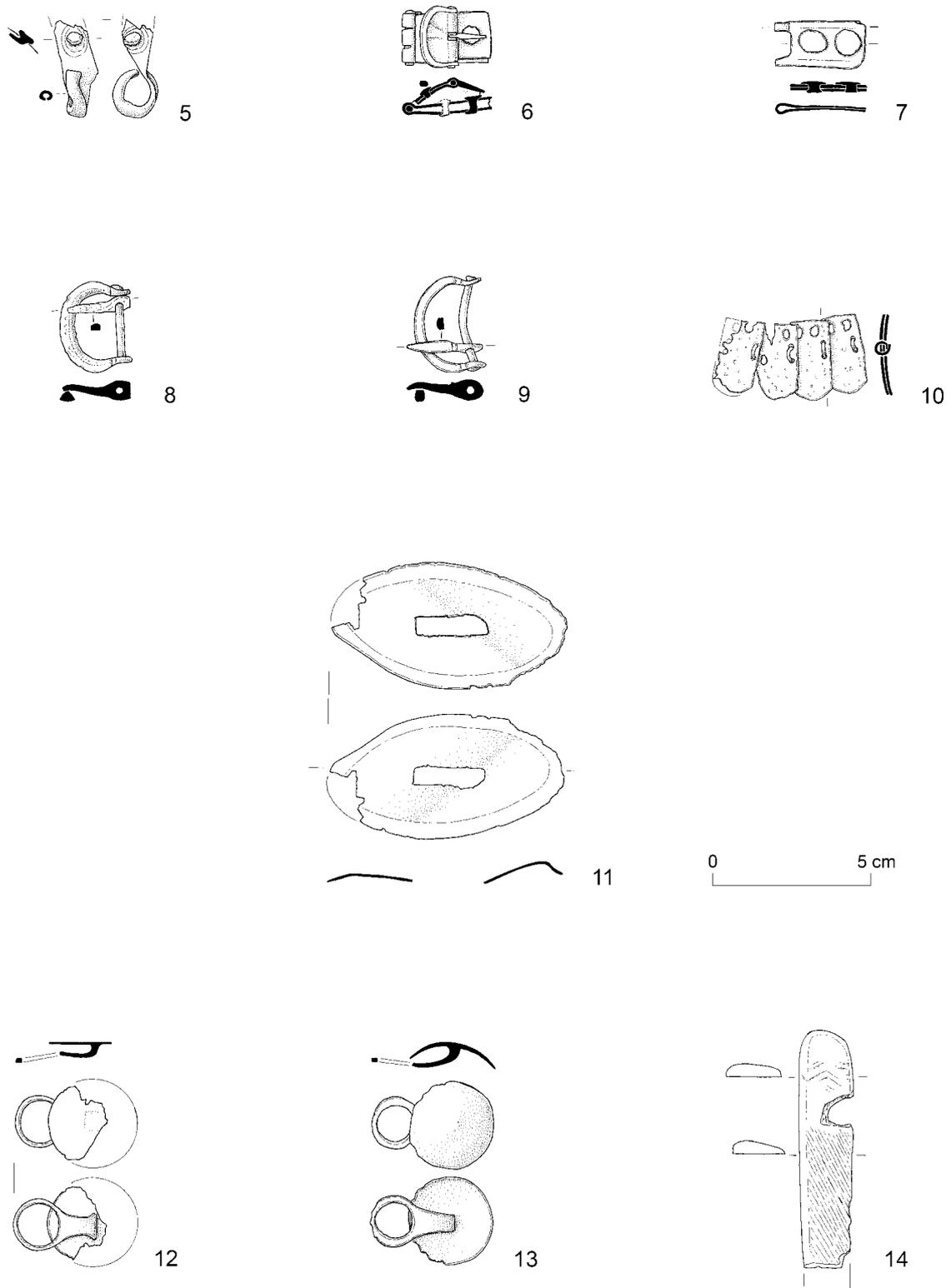


Fig. 7: Ptuj. Military equipment. 5 tie loop, 6 hinged fitting with buckle, 7 fragment of a hinged fitting, 8–9 buckles, 10 scales, 11 handguard plate of a sword, 12–13 button-and-loop fasteners, 14 composite bow ear-lath.

Military equipment

5. Tie loop with a rivet (Fig. 7.5), from '*lorica segmentata*'; surviving length 30.5 mm, weight 3.3 g. It is made of a beaten brass plate (0.5 mm thick) rolled up and bent into a loop at one side, no coating (Fig. 10: PN 203/1, 2). The brass (Fig. 10: PN 203/3) rivet with a rectangular-sectioned (3×1.2 mm) shank encircled with thin concentric grooves at the front. Corbridge type (dating: c. 40–130).¹⁸

Acc. No. PN 203. Dating by context: second quarter of the 1st–beginning of the 2nd century.

6. Hinged fitting with a buckle (Fig. 7.6), from '*lorica segmentata*'. The buckle (19.5 mm wide, 12 mm long, weight 11.8 g) and fitting are brass (Fig. 10: PN 554/1, 3), while the two rivets that fixed the leather strap between the upper and lower sheets of the fitting and the third rivet (on the fitting between the hinge and the buckle) are of unalloyed copper (Fig. 10: PN 554/2) and were hammered flat at the back. Corbridge type (dating: c. 40–130).¹⁹

Acc. No. PN 554. Dating by context/stratigraphy: later than the beginning of the 2nd century.

7. Fragment of a hinged fitting (Fig. 7.7), from '*lorica segmentata*'; length 28.5 mm, weight 3.7 g. The fitting is of brass, rivet of copper, probably no coating (Fig. 10: PN 214).²⁰ Corbridge type (dating: c. 40–c. 130).²¹

Acc. No. PN 214. Dating by context: second quarter of the 1st–beginning of the 2nd century.

8. Buckle (Fig. 7.8), perhaps from '*lorica segmentata*'; width 29 mm, weight 4.7 g. It is of brass, no coating (Fig. 10: PN 549). Possibly Corbridge type (dating: c. 40–130).²²

Acc. No. PN 549. Dating by context: end of the 1st–2nd century.

9. Buckle (Fig. 7.9), possibly from '*lorica segmentata*'; width 30.5 mm, weight 6.2 g. It is of brass, no coating (Fig. 10: PN 41).

Acc. No. PN 41. No dating by context.

10. Scales of '*lorica squamata*' (Fig. 7.10); weigh 4.7 g; one scale: 25 mm high, 12 mm wide, 0.5 mm thick). They are of copper alloy, no coating.

Acc. No. PN 202. Dating by context: second quarter of the 1st–beginning of the 2nd century.

11. Handguard plate of a sword (Fig. 7.11); surviving width 73 mm, weight 8.2 g. It is of bronze, tinned on the convex and perhaps also on the concave side²³ (Fig. 10: PN 104). Mainz type (Augustan–Claudian).²⁴

Acc. No. PN 104. Dating by context: second quarter of the 1st–beginning of the 2nd century.

12. Button-and-loop fastener (Fig. 7.12); loop diameter

16 mm, weight 2.3 g. The button and loop are both of unalloyed copper (Fig. 10: PN 435).

Acc. No. PN 435. Dating by stratigraphy: end of the 1st–2nd century.

13. Button-and-loop fastener (Fig. 7.13); button diameter 27 mm, weight 5.8 g. The loop and probably also the button are of unalloyed copper (Fig. 10: PN 464).

Acc. No. PN 464. Dating by context: second quarter of the 1st–beginning of the 2nd century.

14. Composite bow ear-lath, bone (Fig. 7.14); surviving length 75 mm, weight 5.7 g.

Acc. No. PN 736. Dating by context: second quarter of the 1st–beginning of the 2nd century.

3. CAVALRY FINDS: DISCUSSION

The remains of saddle horns have come to light at several sites across Europe. The last list of the published saddle horns²⁵ should be extended to include the front horn piece from the Roman fort at Boljetin on the Danube in Đerdap (Serbia).²⁶ Conversely, the piece from Vinkovci should be removed from the list as it is not a horn but a cheek-piece of a helmet.²⁷

Several saddle horns come from dated contexts, which span from the Middle/Late Augustan period (front horn from Haltern) to 140/211 (set of four horns from Newstead).²⁸ The findspots of the horns, the depictions of horned saddles (most of them on tombstones) and a written source²⁹ suggest they were related to mounted military personnel.

The horns at the front differ in form from those at the rear of the saddle, and the left/right-hand pieces are mirror images of each other, hence the shape of each horn clearly reveals its position on the saddle. The basic shape and appearance (including the lines of holes along the periphery of horns) of front/rear horns is the same, but there are variations in details such as the edging, the presence/absence and form of the opening at the base, and presence/absence of 'pockets' at the top.³⁰ For now, there is no indication as to these variations having chronological implications.

The surviving remains of leather on the two sets of saddle horns from Newstead indicate the horns were sewn onto leather in such a way that they were supporting the horn parts of the leather saddle from the inside.³¹

The horn from Ptuj (Fig. 2a–b, 6.1) is a rear left-hand piece and does not come from a dated context. It does not conform to any of the five types described by Bishop,³² as none of them has the semi-circular aperture at the base. The closest parallels come from *Asciburgium*/Moers-Asberg where a set of horns was found. These probably had a semi-circular aperture (asymmetrically positioned in relation to the upper part of the horn) at the base and also a raised line along the periphery inside the line of holes.³³

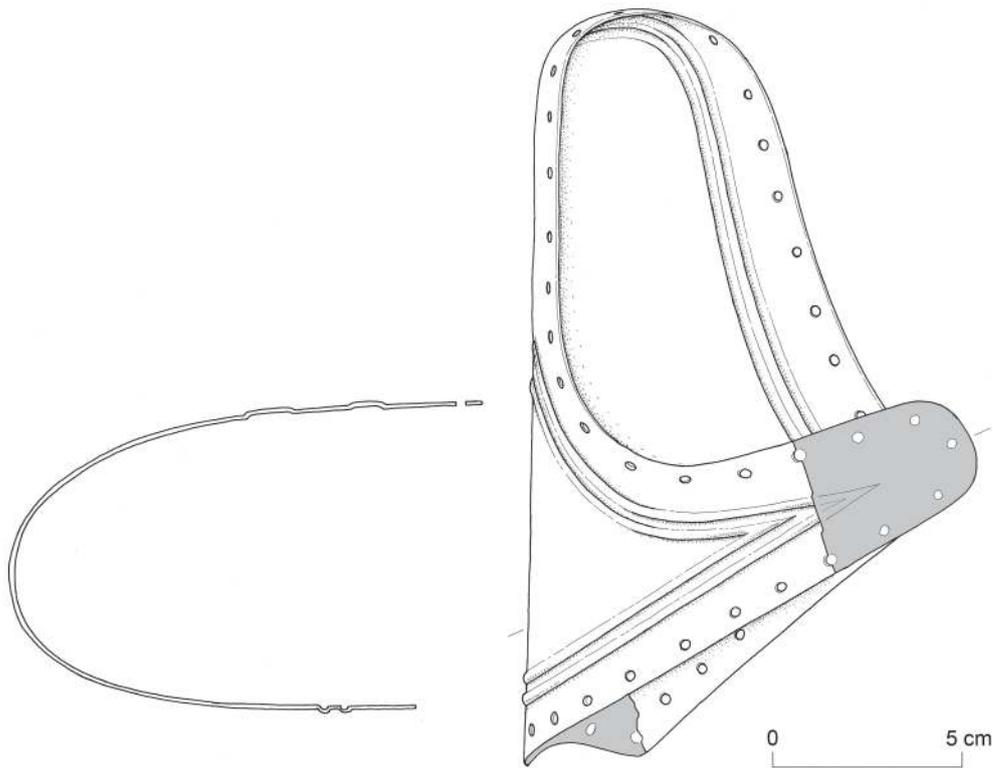


Fig. 8: Ptuj. Reconstruction of the rear left-hand piece of a saddle horn shown in Fig. 2, 6.1.

The aperture at the base was observed in horns from several other sites and was probably related to a strap passing beneath the horn and perhaps fixing the saddle to the horse.³⁴

The proposed reconstruction of the original form of the Ptuj horn (Fig. 8) shows an approximately 20 cm high horn with an inwardly curving extension and a rounded tip.

The saddle horn from Ptuj was made of unalloyed copper (Fig. 9: PN 387). To the authors' knowledge, no scientific characterisation of other saddle horns has as yet been published and the publications only describe the pieces as being of bronze or copper alloy. It is assumed that these artefacts were generally made of unalloyed copper, which seems to be the best choice of metal for saddle horns. As a soft, malleable and ductile metal, copper is easy to beat into shape and responds well to various stresses. For the same reason it was regularly used for rivets in the pieces of Roman military equipment.³⁵

The closest parallel for the brass pendant with relief decoration and (originally 15) small circular projections along the rim (Fig. 1.2, 6.2), in shape and form, but not in function (pendant *vs.* *phalera*), is the lavishly decorated *phalera* from Newstead (UK; site context date: late 1st to mid-2nd century).³⁶ It is slightly larger than the Ptuj piece (94.5 mm in diameter) and has 28 projections at the rim. It is described as being of brass, decorated with silver and copper plating (no scientific analyses), with the small

circular projections overlaid with copper.³⁷ The published photograph suggests that the circular projections were fastened together with copper pins that were then beaten flat, as is also the case on the pendant from Ptuj.

Another comparable piece comes from the Ribchester (UK) hoard, dated from the later 1st to the early 2nd century.³⁸ It is an ornate, but badly-damaged, corroded and heavily-cleaned junction *phalera* (85 mm in diameter), with a convex back and dished (concave) front face. The perimeter of the flat rim is ornamented with a regular series of small perforated circular projections. In the five surviving complete projections a pin of contrasting copper-alloy occupies the perforation. The fine decoration of the loop and the complexity of the *phalera* are in contrast to the rough finish of its front face, where a decorative overlay, probably a silver foil, was once attached with tin-lead solder.³⁹ The configuration of the edges of the torn centre of the disc implies a raised central boss about 25 mm in diameter, which is consistent with the ornamentation of the Newstead *phalera*. The Ribchester *phalera* was probably a two-way strap junction with pendant. It was hammered of fresh undiluted cementation brass,⁴⁰ as was the Ptuj pendant.

The fine workmanship of the decoration on the front of the Ptuj pendant and the results of the PIXE analyses suggest that the front had a soldered decorative overlay, as on the *phalerae* from Newstead and Ribchester. The general idea of a round hammered decorative piece of horse

Object, analysed spot	Fe	Cu	Zn	As	Sr	Ag	Sn	Au	Pb	Ni
PN 387, (1*)	0.12	99.9	0	0	0	0	0	0	0	0
PN 387, (2)	1.22	98.8	0	0	0	0	0	0	0.012	0
PN 387, (3*)	0.05	99.95	0	0	0	0	0	0	0	0
PN 95, (1*, back)	0.40	76.8	22.0	0	0	0.05	0.33	0	0.43	0
PN 95, (3*, front)	0.36	76.9	22.1	0	0	0.05	0.24	0	0.34	0
PN 95, (4, front)	1.33	83.6	11.4	0	0	0.11	2.60	0	0.94	0
PN 95, (5, back, pin)	0.17	99.1	0.70	0	0	0	0	0	0.05	0
PN 459, 2, coating	1.2	84.6	0.75	0	0	6.3	2.9	0	3.98	0.30
PN 459, 2H, coating	0	68.8	0	0	0	22.6	6.0	0	2.58	0
PN 459, 5*	1.5	78.6	10.7	0	0	0.22	3.1	0	5.61	0.24
PN 515, pendant (6°, back)	4.63	75.3	13.0	0	0	0.14	3.09	0	3.85	0
PN 515, fitting (3*)	0.23	81.1	18.4	0.03	0	0.02	0.11	0	0.16	0
PN 515, fitting (4, back)	1.8	90.2	6.75	0.06	0	0.05	0.39	0	0.64	0.20
PN 515, fitting (5, front)	1.12	78.5	17.4	0	0	0.05	1.20	0	1.70	0

Fig. 9: Elemental concentrations (in wt%) measured by PIXE on the pieces of cavalry equipment. For details of the analysis see ISTENIĆ & ŠMIT 2007, 143–46, No. 12. Key: * patina removed; □ narrow beam; q qualitative (not quantitative) analysis.

harness, with a central boss and protrusions along the rim fastened together with copper pins, is the same. The context of the Ptuj pendant indicates its dating in the second quarter/middle of the 1st century, which is earlier than the dating of the parallels from Ribchester and Newstead (late 1st/early 2nd century).

The cast junction *phalera* of copper-zinc-lead-tin alloy with a silver sheet coating at the front bears (originally probably niello) floral decoration (Fig. 1: 3, 6: 3). It has parallels in the *phalerae* from several sites.

Similar harness *phalerae* come from a group of horse-trappings found in the Rhine near Doerwerth (Netherlands).⁴¹ They were cast of copper alloy, the front silvered and decorated with *niello*. Their dating is based on parallels to the Claudian-Neronian period and on comparing their decorative style to the style of the Roman wall paintings to AD 35–45.⁴² They are of various size groups (diameter about 39, 45, 60, 75, 85 and 105 mm) and suspension types. The size group with a diameter of about 45 mm corresponds well with the piece from Ptuj. Regarding the suspension type (Bishop 3c⁴³), only one *phalera* from Doerwerth matches the piece from Ptuj, but is larger (diameter 89 mm).⁴⁴

Very similar harness *phalerae* are part of the horse-trappings from the Freminton Hagg (UK) hoard dated to the (late) 1st century. Scientific analysis has shown the body metal to be copper-zinc-lead(-tin) alloy, while a silver foil was soldered to the front with soft solder (tin-lead alloy) and the inlaid decoration is of copper (red) and silver sulphide (*niello*; Ag₂S).⁴⁵ One of the *phalerae* is of the same suspension type as the Ptuj piece,⁴⁶ but larger (73 mm in diameter).

Similar harness *phalerae*, but of different suspension types, come from the late 1st/early 2nd century Ribchester hoard. The published photograph is not clear, but the descriptions are very informative. The *phalerae* are of two size groups (diameters about 86–91 mm and c.44 mm),

with a slightly convex back and a shallow saucer-shaped front. Analyses have shown that copper-zinc-lead alloy was used to cast them. Originally, their front was plated with a silver sheet soldered with tin-lead alloy. The floral decoration was incised in the silver foil and filled with red (copper) in grey-black (*niello*?). The shank of a small copper rivet that passes through a rivet hole to the rear survives in the centre of several *phalerae*.⁴⁷ A photograph of one of the *phalerae* (Cat. No. 13) is published in the British Museum online collection⁴⁸ and shows decoration similar to the Ptuj piece.

A hoard of horse-trappings from *Castra Vetera*/Xanten (Germany), dated to the middle of the 1st century AD, includes several groups of *phalerae* cast of brass (with up to 3% of lead that was most probably added deliberately), with a thin silver sheet soldered to the front surface by means of a soft solder (tin-lead alloy) and then decorated with inlaid copper and *niello* floral motifs. The group of 15 *phalerae* (with pendants hinged to them) with a 50–56 mm diameter corresponds well to the Ptuj *phalera*.⁴⁹

Several examples of substantial copper-alloy *phalerae* with *niello* decoration are published, for example from *Augusta Raurica*,⁵⁰ *Vindonissa*,⁵¹ *Asciburgium*⁵² and from sites in Pannonia.⁵³

A decorative stud with a head that takes up the whole of the central circle survives on several of the *phalerae* from Doerwerth,⁵⁴ on a few of the ones from Ribchester⁵⁵ and on one *phalera* from Freminton Hagg.⁵⁶ They might suggest that the *phalera* from Ptuj had a similar central decoration, attached by a rivet. On the other hand, *phalerae* with *niello* decoration in the central part, for example from Framington Hagg, indicate that several *phalerae* did not have a decorative central stud.

Parallels suggest that the silver-lead-tin deposit on the front face of the Ptuj *phalera* indicates a silver foil soldered to it using a tin-lead alloy, but also that the incised

Object, analysed spot	Fe	Cu	Zn	As	Se	Ag	Sn	Sb	Au	Pb	Ni
PN 41, (1*)	0.30	85.2	13.5	0.040	0	0.06	0.67	0	0	0.17	0
PN 41, (2)	2.02	90.1	6.12	0.038	0	0.08	1.04	0	0	0.57	0
PN 104, (1*)	0.28	94.8	0	0.03	0	0.16	4.74	0	0	0	0
PN 104, (2, coating concave side)	5.4	79.5	0	0.04	0	0.31	14.50	0	0	0.11	0.2
PN 104, (3, coating convex side)	23.2	69.4	0	0.15	0	0	6.58	0	0	0.14	0.5
PN 203, (1*)	0.28	81.8	17.5	0.067	0	0.07	0	0.06	0	0.31	0
PN 203, (2)	2.58	88.4	8.24	0.096	0	0.19	0	0.11	0	0.38	0
PN 203, (3*, rivet)	0.34	81.6	17.8	0.043	0	0.05	0	0.07	0	0.08	0
PN 214, (1*)	0.34	77.2	21.7	0.013	0.025	0.03	0.38	0	0	0.33	0
PN 214, (2, front)	4.28	84.5	4.89	0.13	0.055	0.28	3.37	0	0	2.55	0
PN 214, (3*, rivet)	0.27	99.7	0	0.029	0	0	0	0	0	0	0
PN 368, (1*)	0.55	81.5	11.6	0	0	0.32	4.02	0	0	2.05	0
PN 368, (2*)	0.66	4.33	0.22	0	0	91.7	1.76	0	0.64	0.73	0.64
PN 464, (2*)	0.28	99.6	0	0	0	0	0.07	0	0	0.04	0
PN 435, (1, front)	0.56	99.0	0	0	0	0.29	0	0	0	0.13	0
PN 435, (2*)	0.16	99.8	0	0	0	0.06	0	0	0	0.03	0
PN 523, (1*)	0.05	91.3	0.42	0	0	0.08	3.98	0	0	4.21	0
PN 523, (2*)	0.88	77.4	0.40	0	0	0.09	3.65	0	0	17.6	0
PN 525, (1*)	0	78.8	0.40	0	0	0.06	3.89	0	0	16.9	0
PN 525, (2*)	0.06	80.1	0.45	0	0	0	3.56	0	0	15.8	0
PN 549, (1*)	0.37	82.0	14.7	0.073	0	0.08	2.62	0	0	0.11	0
PN 549, (2)	4.86	89.4	3.09	0.094	0	0	1.53	0	0	1.00	0
PN 554, (1*, fitment)	0.48	80.7	17.2	0.014	0	0.11	1.19	0	0	0.35	0
PN 554, (2*, rivet)	0.47	99.4	0	0.046	0	0.04	0.06	0	0	0.04	0
PN 554, (3*, buckle)	1.36	79.4	16.2	0.024	0.008	0.21	1.91	0	0	0.84	0

Fig. 10: Elemental concentrations (in wt%) measured by PIXE on the pieces of military equipment. For details of the analysis see ISTENIČ & ŠMIT 2007, 143–46, No. 12. Key: * patina removed.

decoration was filled with *niello*.

We may conclude that the *phalera* from Ptuj falls into a group of the 1st-century horse-trappings cast of brass with a substantial lead content, with a silver foil soldered (using tin-lead alloy) to the front and decorated with an inlaid *niello* (sometimes in combination with inlaid copper) floral motif.

The hearth-shaped brass pendant from Ptuj (Fig. 5, 6.4) formally conforms to the horse harness pendants with ovoid bodies, that is to Bishop's pendants of Type 2 (precisely 2a)⁵⁷ or to *ovale Anhänger mit Querriegel und Öse* according to Deschler-Erb's typology.⁵⁸ Such pendants were normally suspended from *phalerae* (by a hinge or neck),⁵⁹ but the pendant from Ptuj was suspended from a ring at the end of a strap fitting.

Pendants of this type are usually silvered (or perhaps tinned? – few analyses are published) on the front and decorated with floral motifs in *niello* inlay or with ornamental discs.⁶⁰ They span from the Augustan to the Neronian periods and are most common in the Claudian–Neronian period,⁶¹ which is in agreement with the find-context of the Ptuj pendant.

The discussed cavalry items from Ptuj are of four different metals: unalloyed copper (saddle horn, Fig. 6.1), pure cementation brass (both pendants, Fig. 6.2, 4) and brass with lead (*phalera*, Fig. 6.3). It seems that the choice of metal was above all related to the technique by which an object was made and decorated.

As previously stated, unalloyed copper, a soft, malleable and ductile metal, seems to be the best choice for a saddle horn since copper is easy to beat into shape and copper objects respond well to stress. Pure cementation brass (copper-zinc alloy with unintentional addition of other metals, usually tin and lead, which do not sum to more than 2–3%) is typical of Roman coinage and military decorative metalwork mostly made and/or decorated by cold working. The mechanical properties of brass are very suitable for such use, although they are also appropriate for cast objects, such as brooches.⁶² The pendant (Fig. 6.2) was no doubt made by cold working, as was probably also the pendant (Fig. 6.4).

For hammered objects, lead in brass would have been detrimental.⁶³ On the contrary, the deliberate addition of lead to pure brass improved its casting properties and was therefore chosen to produce cast objects such as the *phalera* (Fig. 6.3) and the horse trappings from Xanten, Fremington Hagg and Ribchester.

The published scientific research of the 1st-century horse-trappings kept in the British Museum (from the Ribchester, Fremington Hagg and Xanten hoards) has shown that their fronts were silvered with silver foil soldered to the surface with tin-lead alloy.⁶⁴ This evidence was extremely helpful in interpreting the analyses of the surface on the junction *phalera* and the heart-shaped pendant from Ptuj (Fig. 6.3–4), which were probably silvered in the same way.

4. CONCLUSIONS

The archaeological context and the parallels of the Roman military equipment and cavalry finds excavated in 2010/2011 at Ptuj span from the second quarter/middle of the 1st century (Cat. No. 2) to at least the late 1st/early 2nd century (Cat. No. 6, 8). The excavated area lies within the presumed centre of Poetovio.⁶⁵ The relatively numerous *militaria* are not surprising in this area because there was a fortress at Poetovio in the 1st century AD. Further investigations should provide better insights into the earliest Roman structures (of wood) in this part of Ptuj.

NOTES

1. SARIA, 1951, 1170–1; MÓCSY, 1959, 28; ŠAŠEL, 1980, 158; OLDENSTEIN-PFERDEHIRT, 1984, 397; ŠAŠEL KOS, 1986, 158–61, 194–7; HORVAT *et al.*, 2003, 156; RADMAN-LIVAJA, 2012, 164.
2. HORVAT *et al.*, 2003, 156.
3. Inscribed gravestones of three active soldiers and a veteran of *legio VIII*: *CIL* III 10878 = *AIJ* 371; *CIL* III 10879 = *AIJ* 381; *CIL* III 4060 = 10869 = *AIJ* 260; *AIJ* 262 (RITTERLING, 1925, 1645–6; SARIA, 1951, 1170; OLDENSTEIN-PFERDEHIRT, 1984, 397, n. 6; RADMAN-LIVAJA, 2012, 169).
4. SARIA, 1951, 1171; OLDENSTEIN-PFERDEHIRT, 1984, 397; HORVAT *et al.*, 2003, 156.
5. *Tac. Ann.* 1.16–30; RADMAN-LIVAJA, 2012, 169.
6. RITTERLING, 1925, 1714; SARIA, 1951, 1171.
7. *Tac. Hist.* 3, 1; SARIA, 1951, 1171.
8. *Ibid.*, 1172.
9. SARIA, 1951, 1172–3; MANN, 1983, 32–3.
10. SARIA, 1951, 1173; HORVAT *et al.*, 2003, 156–7.
11. RAGOLIČ, 2015.
12. JANEŽIČ & LAZAR, 2015, 258–9.
13. In the time after the JANEŽIČ & LAZAR, 2015 paper, a full evaluation of the excavated evidence caused several changes in the dating of the context that yielded the cavalry and other military finds.
14. ISTENIČ, 2016; 2019, 198, 200, 202.
15. Cf. CRADDOCK & LAMBERT, 1985, 162.
16. See below.
17. Relatively small concentrations of lead and tin could be traces of soft alloy or corrosion products that are not related to a coating at the back.
18. BISHOP, 2002, 31–45, 92, Fig. 10.1.
19. See n. 18.
20. Tin and lead measured in the analysis of the patina on the front of the fitting may be the result of corrosion products, as no traces of coating can be observed under a microscope.
21. See n. 18.
22. See n. 18.
23. The results of the patina analysis on the convex side do not give a clear answer as to the presence of a coating; the substantial percentage of iron most probably originates from corrosion products.
24. DESCHLER-ERB, 1999, 23; BISHOP & COULSTON, 2006, 78–83.
25. BISCHOF, 2012, 75–7, Fig. 33.
26. VUJOVIĆ, 1994, 119, 123, Fig. 1.
27. KLUMBACH, 1973, 12; RADMAN-LIVAJA, 2007.
28. BISCHOF, 2012, 75–7, Fig. 33.
29. BISHOP, 1988, 79–81, 88–9, Fig. 15; JUNKELMANN, 1992, 35–9, Fig. 31–6, 38; BISCHOF, 2012, 71, 75–7, Fig. 33. Marcus Cornelius Fronto, *Epistulae, ad Verum imperatorem* II.1.22.
30. BISHOP, 1988, 92–3, Fig. 22–3.
31. LAWSON, 1982, 146; CONNOLLY & DRIEL-MURRAY, 1991, 44–5; CURLE, 1911, Pl. 32; JUNKELMANN, 1992, 41, 43; BISCHOF, 2012, 73.
32. BISHOP, 1988, 127–8, Table 1, Fig. 35.
33. BISCHOF, 2012, 74, 125, D79–D80, pl. 16. The aperture at the bases of the horns is not ascertained with complete reliability because the horns were heavily corroded at the lower edges, but they do seem probable (see conservation report HORN, 1977). The depictions of horns in BISCHOF (2012, 77, Fig. 34, Pl. 13–16) and BURKHARDT & DESCHLER-ERB (2016, 50, fig. 10) show reconstructed horns without apertures.
34. JUNKELMANN, 1992, 44, Fig. 46, 49, 50.
35. ISTENIČ, 2016, 281; 2019, 196, 202.
36. BISHOP, 1988, 95, 136–41, Table 5, Fig. 40: 6a.
37. CURLE, 1911, 298–9, Pl. 72: 9.
38. JACKSON & CRADDOCK, 1995, 99.
39. *Ibid.*, 82–4, Fig. 49, Cat. No. 7; photograph: http://www.britishmuseum.org/research/collection_online/collection_object_details.aspx?objectId=1364340&partId=1 (British Museum inv. n. 1814,0705.7).
40. JACKSON & CRADDOCK, 1995, 91, 92, Table 5: No. 7.
41. BROUWER, 1982, 168–74, Cat. No. 106–91, Pl. 1–6.
42. *Ibid.*, 164–5, 167.
43. BISHOP, 1988, 135, 140, Fig. 39, Table 5.
44. BROUWER, 1982, 173, t. 3: 176a.
45. CRADDOCK *et al.*, 1973.
46. *Ibid.*, Fig. 7; WEBSTER, 1971, 111, Fig. 3.
47. JACKSON & CRADDOCK, 1995, 77, 84–5, 89, 92, 99–100, Cat. No. 9–15, 32–4, Fig. 47, Table 5.9, 11, 12, 14, 15, 32.
48. British Museum Inv. No. 1814,0705.13, http://www.britishmuseum.org/research/collection_online/collection_object_details.aspx?objectId=1360852&partId=1&searchText=ribchester+hoard&page=1
49. CRADDOCK & LAMBERT, 1985; JENKINS, 1985, 145–8, 157–9, Cat. B1–B12, B15–B16, B18, B20–B23, Pl. VIIA, Fig. 7–9.
50. DESCHLER-ERB, 1999, 58–9, 187, Pl. 34: 661.
51. UNZ & DESCHLER-ERB, 1997, 48, Pl. 65: 1868, 1871, 1875.
52. ZÜRCHNER & CARAVATTI, 2012, 66–7, 119, D20, Pl. 11.
53. MRÁV, 2010, Fig. 6: 4, 8.
54. BROUWER, 1982, 148, 151.

55. CRADDOCK & LAMBERT, 1985, Cat. No. 31–3; and Cat. No. 9–12, 34 the shank of a small copper rivet survives.
56. WEBSTER, 1971, Fig. 9.4.
57. BISHOP, 1988, 96–8, 146, Fig. 44.2a.
58. DESCHLER-ERB, 1999, 52–3, Pl. 25.501–5.
59. BISHOP, 1988, 96; DESCHLER-ERB, 1999, 52–3.
60. BISHOP, 1988, 96; DESCHLER-ERB, 1999, 52–3, Pl. 25.501–5.
61. BISHOP, 1988, 96, 146, Table 6, Fig. 44.2a.
62. ISTENIČ, 2016.
63. Cf. JACKSON & CRADDOCK, 1995, 91.
64. CRADDOCK *et al.*, 1973; CRADDOCK & LAMBERT, 1985; JACKSON & CRADDOCK, 1995.
65. HORVAT *et al.*, 2003, 161–163, Fig. 8.
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