

## Roman bronze helmets from the Republican period and the Early Principate in Slovenia

### Rimske bronaste čelade republikanske dobe in zgodnjega principata v Sloveniji

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#### Izvleček

K rimskim bronastim čeladam poznorepublikanske in zgodnjecesarске dobe v Sloveniji sodi šest čelad, več odlomkov ene čelade, pet vrhnjih delov petih čelad in morda en lični ščitnik. Štiri čelade sodijo k čeladam etruščansko-italskega tipa, med katerimi je najmlajši datiran primerek iz let okrog 70 pr. Kr. Skupaj z gumbom so narejene v enem kosu in na zunanji strani spolirane. Ostale čelade oziroma njihovi deli pripadajo tipoma Buggenum (vrh z gumbom ene čelade) in Haguenau (dve čeladi, dva gumba, dva odlomka z gumbom vrhnjega dela čelad) oziroma prehodu med omenjenima tipoma (ena čelada) in so iz zgodnjega principata.

Z analizami PIXE ugotovljena približna elementna sestava uporabljenih materialov je pokazala, da je osnovni material obravnavanih čelad bron, ki vsebuje srednje veliko kositra (okoli 6 do 12 %) in nič (ali zelo malo) svınca ali drugih elementov. Zanke za pritrditev ličnih ščitnikov so iz brona ali (na eni čeladi) železa. Za zakovice so uporabili baker, pri eni čeladi železo. Medenina in spajkanje se pojavita na čeladah najmlajšega tipa (Haguenau) oziroma na čeladi, ki je na prehodu med tipoma Buggenum in Haguenau.

**Ključne besede:** Slovenija, rimska doba, čelade, bronaste zlitine, analize PIXE

#### Abstract

Archaeological sites in Slovenia have yielded a number of Roman bronze helmets from the Late Republican and Early Imperial periods. More precisely, there are six (nearly) complete examples, several fragments of another helmet, five pieces of five different other helmets and possibly a cheek-piece. Four of the helmets belong to the Etrusco-Italic type, with the bowl and knob made in a single piece and with a polished exterior, of which the latest dated example is from around 70 BC. The other helmets or their parts are of the Buggenum (upper part of one helmet with a crest-knob) and Haguenau types (two helmets, two crest-knobs, two upper part fragments with a crest-knob), one also of the transitory form between the two types; all these date to the Early Principate.

The helmets have been subjected to PIXE analyses to determine the approximate elemental composition. The results have shown that the helmets proper are mainly made of bronze with a medium amount of tin (roughly 6 to 12%) and no or very little lead or other elements, the hinges for attaching the cheek-pieces are of bronze and on one helmet of iron, rivets are of copper and on one helmet of iron, while the use of brass and the practice of soldering have been recorded on the helmets of the latest type (Haguenau) and on the helmet of the transitory Buggenum/Haguenau form.

**Keywords:** Slovenia, Roman period, helmets, bronze alloys, PIXE analyses

## INTRODUCTION

The earliest Roman helmets trace their origin to the bronze<sup>1</sup> helmets that began to be produced in Etruria in the 4<sup>th</sup> century BC.<sup>2</sup> They are known in literature under different names: Etrusco-Italic (knob helmets),<sup>3</sup> Etrusco-Roman,<sup>4</sup> Montefortino type<sup>5</sup> and conical helmets with a crest-knob.<sup>6</sup> They formed part of the Roman armament from the 3<sup>rd</sup> century BC to the first third of the 1<sup>st</sup> century BC.<sup>7</sup> In this contribution, I refer to them as Etrusco-Italic helmets.

They also represent the origins of the bronze Buggenum and Haguenu helmets,<sup>8</sup> which the Roman soldiers wore in the second half of the 1<sup>st</sup> century BC and the first two thirds of the 1<sup>st</sup> century AD.<sup>9</sup>

The 'missing link' between the Etrusco-Italic and Buggenum helmets are probably the bronze Mannheim helmets, which are without a crest-knob and share a similar decoration with the Etrusco-Italic helmets.<sup>10</sup> Roughly contemporary with and similar (but lighter and almost undecorated) to the Mannheim helmets are those of the Coolus type. It is not certain whether these are Celtic or Roman; part of the known Coolus helmets come from contexts suggesting a connection with the Gauls, while one such helmet was recovered together with other items from a ship that sank around 70 BC at Madrague de Giens (France) and was worn by a Roman soldier.<sup>11</sup>

In the Augustan period, the Romans began using predominantly iron helmets of the Weisenau type alongside the bronze helmets.<sup>12</sup>

Sites in Slovenia have thus far yielded four helmets of the Etrusco-Italic type, one crest-knob of a Buggenum helmet, one helmet of the transitory Buggenum/Haguenu type, as well as two complete examples, five crest-knobs and possibly one cheek-piece of Haguenu helmets. Most of these helmets and their parts have not yet been discussed in detail.

## DESCRIPTIONS OF HELMETS<sup>13</sup>

### 1. Etrusco-Italic helmet from the Ljubljana

(Figs. 1–2; site: Fig. 18: 1; Pl. 1)

The 1984 underwater archaeological survey in the River Ljubljana (at Blatna Brezovica, Tri Lesnice site; Fig. 18: 1) revealed a bronze helmet (Pl. 1; Fig. 1) that is 223 mm high, has a roughly 1 mm thick bowl and weighs 1182 g. It is kept in the Narodni muzej Slovenije (Inv. No. R 18915).<sup>14</sup>

It is made of bronze with approx. 88% copper and 12% tin, without added lead.<sup>15</sup> It has clear forging marks on the interior, which are also well visible on the X-ray image (Fig. 2). The bowl is made in a single piece with a hollow crest-knob and a neckguard. The lower part of the bowl and the neckguard show flaws that occurred during the production process.

The exterior was polished and originally probably had an appearance similar to the one achieved after the concluded conservation in 1985 (Fig. 1a–e).

<sup>1</sup> The word bronze is used here to refer to an alloy of copper and tin if positively established or likely. For the undetermined nonferrous alloys, I use the term copper alloy.

<sup>2</sup> Junkelmann 2000, 56; Pernet 2010, 72.

<sup>3</sup> E.g. Feugère 1994a, 37–41; Pernet 2010, 72–75.

<sup>4</sup> Schaaff 1988, 318–322.

<sup>5</sup> Junkelmann 2000, 52–65. The same name is also used to refer to similar Celtic helmets with a separately made knob attached to the top of the helmet (Pernet 2010, 72–73).

<sup>6</sup> E.g. Ortisi 2015, 27.

<sup>7</sup> Schaaff 1988, 318–322, 353, Fig. 3; Egg et al. 1988, No. 110; Feugère 1993, 83–87, 118, 119; Feugère 1994a, 37–41, 43, 45; Feugère 1994b, 10, 12, 20, Fig. 8; Junkelmann 2000, 59, 60; Pernet 2010, 72–75.

<sup>8</sup> Authors often use the German name of the site (Haguenu), which lies at the eastern border of France, in Alsace.

<sup>9</sup> Schaaff 1988, 325, 326, 353, 354; Waurick 1988, 327–333, 350–352; Pernet 2010, 75.

<sup>10</sup> Pernet 2010, 116–122 (with references).

<sup>11</sup> Pernet 2010, 116–122. Contrary to Pernet, I was not able to find any strong indications of the Coolus helmets predating those of the Mannheim type (cf. Pernet 2010, 118, 119, Fig. 83).

<sup>12</sup> Waurick 1988, 333–335, 352, 353; Junkelmann 2000, 68–85; Pernet 2010, 76. Of importance for dating the beginnings of the type is the helmet from Oberaden (Müller 2006).

<sup>13</sup> The designations of left and right in the descriptions take the viewer's point of view, with the object facing the viewer and with its knob (i.e. top) facing upwards.

The results of metal characterisation in the paper are given in mass percentages and were obtained by the method of proton-induced X-ray emission analysis (PIXE). The analytical work was performed by Žiga Šmit on the Tandetron accelerator at the Jožef Stefan Institute in Ljubljana. For details on the apparatus see Istenič 2003, 197. If not otherwise specified, the measurements were taken in places where the patina had been removed.

<sup>14</sup> Istenič 2009b.

<sup>15</sup> The elemental composition of the helmet bowl was measured in two spots: Ni 0.3%, Cu 88.1%, As 0.10%, Pb 0.12%, Sn 11.4% and Ni 0.2%, Cu 87.6%, As 0.14%, Pb 0.07%, Sn 11.9%. For details see: Šmit, Istenič 2018, C1.



Fig. 1: River Ljubljanica at Blatna Brezovica (helmet Cat. No. 1). **a** – front; **b** – right side; **c** – back; **d** – left side; **e** – neckguard (detail); **f** – interior, view towards the hollow crest-knob.

Sl. 1: Reka Ljubljanica pri Blatni Brezovici (čelada kat. št. 1). **a** – spredaj; **b** – desna stran; **c** – zadaj; **d** – leva stran; **e** – vratni ščitnik (detajl); **f** – notranjost, pogled proti votlemu gumbu.

(Photo / Foto T. Lauko, NMS)



Fig. 2: River Ljubljana at Blatna Brezovica (helmet Cat. No. 1). **g** – interior, visible traces of forging and a scratched inscription forming the letter A; **h** – X-ray image (100 kV, 4 mA, 30 seconds) with clearly visible forging marks on part of the bowl.

Sl. 2: Reka Ljubljana pri Blatni Brezovici (čelada kat. št. 1). **g** – notranjost, vidni so sledovi kovanja in grafit v obliki črke A; **h** – rentgenski posnetek (100 kV, 4 mA, 30 sekund) dela kalote jasno kaže, da je bila kovana.

(Photo / Foto T. Lauko, NMS)

The decoration on the crest-knob, along the rim and on the neckguard was made by punching<sup>16</sup> (Fig. 1a–e).

There is a 6 mm wide hole in the middle of the neckguard.

Attached to each interior side of the helmet is a hinge made from a piece of sheet bronze; apart from copper, the bronze of the hinges contains 4 and 8% tin, respectively.<sup>17</sup> They are fastened to the bowl with a pair of copper<sup>18</sup> rivets and represent the upper part of the hinges for fastening the cheek-pieces.<sup>19</sup> The loop on the right side holds a piece

of the iron axis bar. In front of the hinges, there is a roughly 4 mm wide hole on each side (Pl. 1).

In this pair of holes, the item from the Ljubljana differs from other Etrusco-Italic helmets. Similar holes can only be seen on a helmet of the Montefortino/Canosa subtype from an unknown site, though the holes there are located both in front and behind the hinges.<sup>20</sup>

The underside of the neckguard bears a scratched inscription that probably represents the letter A (Fig. 2g), while the interior of the bowl bears a graffito that reads XI (viewed with the knob above the inscription; Pl. 1).

<sup>16</sup> Description of the punching technique: Braun-Feldweg 1988, 184.

<sup>17</sup> Elemental composition of the left loop: Ni 0.6%, Cu 95.1%, As 0.06%, Pb -, Sn 4.3%; right loop: Ni 0.3%, Cu 91.7%, As 0.35%, Pb 0.08%, Sn 7.6%. For details see: Šmit, Istenič 2018, C1.

<sup>18</sup> Elemental composition of the left rivet: Ni 0.3%, Cu 99.3%, As 0.04%, Pb 0.15%, Sn 0.2%; right rivet: Ni 0.4%, Cu 99.1%, As 0.41%, Pb 0.07%, Sn -. For details see: Šmit, Istenič 2018, C1.

<sup>19</sup> Cf. the Etrusco-Italic helmets with surviving cheek-pieces, e.g. Junkelmann 2000, 58, 59 and Junkelmann, Thüry 2000, 94–96, Figs. 7, 8, 11, 27, Pls. 1–3, Cat. Nos. AG 193, AG 323, AG 425, AG 441.

## 2. Etrusco-Italic helmet from Kovačevše

(Fig. 3; site: Fig. 18: 2; Pl. 2)

Numerous fragments of metal, ceramic and glass items spanning from the 5<sup>th</sup> century BC to the 1<sup>st</sup> century AD have been found in poorly known circumstances, presumably at Kovačevše, part of the

<sup>20</sup> Born 1991, Pl. 13; Junkelmann, Thüry 2000, 106, Fig. 29.



Fig. 3: Kovačevše in Lokavec (?) (fragments of helmet Cat. No. 2). Pieces positively ascribed to the helmet **a–e**: **a** – crest-knob; **b** – fragment of the front; **c,d** – neckguard; **e** – fragment with lower part of the bowl and rim (cf. drawn reconstruction, Pl. 2). Other, unmarked pieces may also be parts of the bowl. Visible traces of intentional breakage, deformation and fire damage.

Sl. 3: Kovačevše v Lokavcu (?) (odlomki čelade kat. št. 2). Zanesljivo so del čelade odlomki **a–e**: **a** – vrhni gumb; **b** – odlomek sprednjega dela; **c,d** – vratni ščitnik; **e** – odlomek roba s spodnjim delom kalote (prim. risarsko rekonstrukcijo, t. 2). Preostali (neoznačeni) odlomki so morda del kalote. Vidni so sledovi namernega razbitja in deformiranja ter poškodb od ognja.

(Photo / Foto T. Lauko, NMS)

village of Lokavec northwest of Ajdovščina.<sup>21</sup> They show traces of intentional breakage and deformation, as well as fire damage, which suggests that the items originate either from an offering place<sup>22</sup> or from cremation burials. The metal fragments include those of a helmet.<sup>23</sup>

Four rim and bowl fragments, as well as a crest-knob certainly belong to the same helmet (*Fig. 3a–e*; reconstruction on *Pl. 2*). They are kept in the Goriški muzej (knob, Inv. No. 16, *Pl. 2*: a; neckguard fragment, Inv. No. 43, *Pl. 2*: d) and the Narodni muzej Slovenije (front rim fragment, Inv. No. P 12969a, *Pl. 2*: b; rim and bowl fragment, Inv. No. P 12969b, *Pl. 2*: e; large neckguard fragment with a rivet hole, Inv. No. P 12970, *Pl. 2*: c).

The fragments are made of a copper alloy with roughly 10% tin.<sup>24</sup> In addition, the helmet might also be ascribed one large and numerous smaller, heavily deformed and fire damaged fragments, the thickness of which varies from 0.7 to 1.4 mm (*Fig. 3*).<sup>25</sup>

The crest-knob is hollow (th. at the neck 1.3 mm) and bears punched decoration on the exterior (*Fig. 3a*; *Pl. 2*).

The decoration on a fragment of the thickened rim shows that this particular piece was located in the middle of the front side (*Fig. 3b*; *Pl. 2*). Two other fragments fit together to form a large part of the neckguard (*Fig. 3c,d*; *Pl. 2*). Its rim has a trapezoid field, decorated with punched dots at midpoint and flanked on both sides by punched oblique lines running in opposite directions, thus

<sup>21</sup> Svoljšak 1983, 5, 6. The items were found in a pit that archaeologists investigated in 1945; it seems likely that the pit with prehistoric and Early Roman items was actually dug in the 20<sup>th</sup> century (shortly before 1945?) and that the items deposited in it were collected in the surrounding area (Svoljšak, pers. comm. on 30 August 2017).

<sup>22</sup> Gleirscher 2002, 258, Cat. No. 187; Božič 2011, 262.

<sup>23</sup> Svoljšak 1983, 19, 20, 23, Nos. 11, 42, 43, 116–118, *Pl. 5*: 153–157 (the publication lacks the specification that the descriptions of Nos. 116 and 117 correspond with the drawings in *Pl. 5*: 157 and *Pl. 5*: 155); Guštin 1991, 22, 23, 52, *Pl. 42*: 2.

<sup>24</sup> Elemental composition of fragment P 12969: Fe 0.31%, Ni 0.11%, Cu 88.7%, As 0.11%, Sn 10.8%, Pb -; fragment P 12970: Fe 0.31%, Ni 0.17%, Cu 89.5%, As 0.08%, Sn 9.9%, Pb -.

<sup>25</sup> Goriški muzej, Inv. Nos. 39, 40. Part of the pieces kept in this museum certainly does not belong to a helmet (e.g. moulded fragment and a fragment with a small hole and an indicated second hole – the two holes are too small and too close to one another to have been the holes for the rivets of a cheek-piece hinge).

forming a cable pattern, which can be seen on all the surviving rim fragments of the helmet; on the neckguard it is bordered above by a pair of parallel horizontal lines of punched dots. There is also an irregular (roughly lozenge-shaped) and approximately 5 × 6 mm large hole in the middle of the neckguard (*Fig. 3c*).

Two fragments make up part of the rim on one of the bowl sides; bowl thickness varies between 1.1 and 1.5 mm (*Fig. 3e*; *Pl. 2*).

### 3. Etrusco-Italic helmet from the area of Sv. Anton

(*Fig. 4*; site: *Fig. 18*: 3; *Pl. 3*)

This bronze helmet (*Fig. 4*) was probably found at a hillfort near Sv. Anton, though the circumstances of its discovery are poorly known.<sup>26</sup> The

<sup>26</sup> Archäologie und Münzkabinet, Universalmuseum Joanneum GmbH, Inv. No. 10077 (later new Inv. No.: 18102). The inventory book (for Inv. No. 10077) states that the helmet was found at *S. Antonius bei Pirano*, while the publication in the *Jahresberichte Joanneum* 1900 (p. 32) reports where the item was found (*gefunden zu St. Antonius bei Pirano*), but also that the helmet was purchased.

Reinecke (1942, 190–191, Fn. 132) supposed that the helmet was found at the *15 km südlich von Triest gelegene Monte S. Antonio*, on which Marchesetti (1903, 73) mentioned a poorly surviving site: “*Ben poco, come dissi, si conservò del castelliere di S. Antonio, posto al di sopra dell’omonimo villaggio (357 metri). Ridotto in buona parte a coltura, le sue cinta sono quasi completamente distrutte, sicchè non è possibile rilevarne la forma. Solo i cocci disseminati scarsamente per i campi, ci fanno fede dell’esistenza dell’uomo preistorico.*”

The hillfort mentioned by Marchesetti lies on a 356 m high hill south of the village of Dvori and approx. 2 km southeast of the village of Sv. Anton (Truhlar 1975). Modern maps do not state the name of the hill, while the locals refer to it as Sv. Anton or Hrib (source: letter by Matej Župančič, dated 21 May 1997; kept in the archives of the Inštitut za arheologijo ZRC SAZU, Ljubljana (*Arheološki kataster Slovenije*: ARKAS ID 040109.11 [<http://arkas.zrc-sazu.si>])).

Reinecke offered no supporting evidence for his supposition. It is not impossible that the helmet originates from the hillfort north of Sv. Anton, from the hill of Kortina (257 m asl) that revealed a triple rampart, prehistoric pottery sherds, a bronze dagger from the beginning of the Bronze Age, as well as Roman building remains (drystone walls, roof tiles, bricks) and a water cistern (Strenar, Šribar 1974). It is also not possible to exclude the possibility that the name of the hill with the remains of a hillfort changed after World War II. Such a possibility at Sv. Anton and its surroundings is indicated by the information in *KLS I*



Fig. 4: Area of Sv. Anton (helmet Cat. No. 3). **a** – front; **b** – right side; **c** – back; **d** – left side; **e** – top; **f** – interior.  
 Sl. 4: Okolica Sv. Antona (čelada kat. št. 3). **a** – spredaj; **b** – desna stran; **c** – zadaj; **d** – leva stran; **e** – zgoraj; **f** – notranjost.  
 (Photo / Foto T. Lauko, NMS)

204 mm high helmet weighs 916.3 g. It is kept in the Universalmuseum Joanneum in Graz, Austria.

It is made in a single piece together with the hollow crest-knob. It has not yet been subjected to conservation. The exterior surface is covered with an uneven patina (brown, dark green-brown and small patches of intensely green) and in parts with a beige calcareous sinter (reacts with HCl solution). In the parts with a dark green-brown patina, the surface is very smooth, which indicates polishing.

On the interior, calcareous sinter covers a much larger part of the surface; it is thickest in the crest-knob and on the upper part of the bowl. There is at least one patch with a dark green-brown patina with a smooth surface. It is possible to discern forging marks that run horizontally from the knob down; forging is consistent with the uneven thickness of the bowl.

The helmet suffered several blows: at the back on the right (approx. 65 mm long straight indentation), above the neckguard, where the bowl is pierced in the length of about 2 cm (the bowl is less than a millimetre thick here), and on the left side (shallow indentation caused by a blunt object); the bowl also has a crack along the middle of the left side.

The crest-knob is undecorated and has a roughly 3 mm wide and 1 mm deep hole in the centre.

There are six holes at the rim: a pair of holes is on the left and right sides, one hole is above the thickened rim roughly in the middle of the front and another one is roughly in the middle of the neckguard. The holes measure around 4 mm across.

All decoration is made by punching.

The bowl bears three parallel grooves that delimit and separate two bands of oblique lines; the lines in the lower band form a herringbone pattern.

The rim of the bowl and the narrow neckguard are thickened (th. approx. 3 and 2 mm). Except for the central parts of the neckguard and the front, the rim is decorated with unevenly spaced pairs of oblique lines forming a cable pattern. At the front, they meet to form a trapezoid field filled with tiny lines. At the back, the rim of the neckguard bears a row of ring-and-dots flanked above and below by grooves, above which is a wave pattern

(141–142): *Pridvor, prejšnji Sv. Anton pri Koprju* (translated as 'Pridvor, previously Sv. Anton near Koper').

Moreover, it is not clear whether the helmet was found in the village of Sv. Anton (less likely) or on the hill of the same name in the vicinity. The information in *Jahresberichte Joanneum* 1900, 32 (*zu St. Antonius*) does indicate the village, but it is also true that in those days a nearby village was often cited as the actual findspot.

(*Wellenranke*; Fig. 4c), with each wave (on the right side, where they are best preserved) bordered by lines and filled in with dots. There are five waves on one side and only three on the other (very little survives of the last wave); the waves run towards the midpoint of the neckguard.

Reinecke claimed (without offering any arguments) that the helmet from the former collection of Franz von Lipperheide (according to Schaaff found in Istria) was unearthed at the same site as the helmet kept in the Joanneum in Graz.<sup>27</sup>

#### 4. Etrusco-Italic helmet from Grad near Krn

(Figs. 5–9; site: Fig. 18: 4)

The helmet (Fig. 5) recently found at Grad, near the village of Krn in the valley of the River Soča,<sup>28</sup> is heavily deformed.<sup>29</sup> The uneven green and green-grey patina on the surface shows that it was exposed to fire. The 204 mm high helmet weighs 746 g and is made of a copper alloy with roughly 6% tin.<sup>30</sup> It is kept in the Tolminski muzej, Tolmin (Inv. No. TM 2650) and has not yet been subjected to conservation. It is made in a single piece. The inside shows forging marks, while the

<sup>27</sup> Reinecke 1942, 190, 191, Fn. 132; Schaaff 1988, 525, Cat. No. 109.

<sup>28</sup> At this (previously unknown) site, unauthorised individuals using a metal-detector have found numerous items from the Late Hallstatt and Late La Tène periods; they include several copper alloy vessels (among them two situlae from the late part of the Early Iron Age and an Idrija type jug (dating between the second half/last third of the 2<sup>nd</sup> century and 80/60 BC – cf. Fn. 143), jewellery ('bronze' basket-shaped pendants, bracelet fragments, glass beads with layered eyes) and presumably many iron objects that include two fragments of Late La Tène swords (LT D1), a fragment of a Late La Tène sword scabbard (LT D1) and three fragments of Late La Tène swords in their scabbards (LT D1), Late Hallstatt socketed and shaft-hole axes, Late La Tène shaft-hole axes and numerous spearheads. The finds are kept in the Tolminski muzej and the Narodni muzej Slovenije. Cf. Laharnar, Turk 2017, 170, Fig. 197.

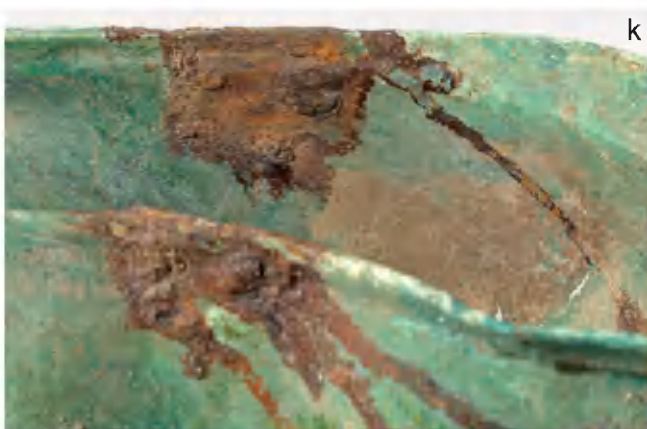
<sup>29</sup> Christoph Steidl Porenta (Ljubljana), a gold and silversmith skilled in the traditional techniques who produces unique pieces of jewellery, believes that the deformation was caused by a great force, possibly by a heavy object placed on top of the helmet lying on its side. Similar, but even greater and intentional damage has been observed, for example, on the Early La Tène helmet from Vasella di Domegge in Veneto, Italy (Marzatico, Gleirscher 2004, 681–682, Cat. No. 8.25).

<sup>30</sup> The alloy was analysed in one spot; elemental composition: Fe 0.16%, Ni -, Cu 93.9%, As -, Sn 5.86%, Pb 0.10%.





Fig. 5: Grad near Krn (helmet Cat. No. 4). **a** – front; **b** – back; **c** – left side; **d** – right side; **e** – top; **f** – interior.  
 Sl. 5: Grad pri vasi Krn (čelada kat. št. 4). **a** – spredaj; **b** – zadaj; **c** – leva stran; **d** – desna stran; **e** – zgoraj; **f** – notranjost.  
 (Photo / Foto T. Lauko, NMS)





*Fig. 6:* Grad near Krn (helmet Cat. No. 4), details. **g** – punched decoration on the crest-knob; **h** – remains of rivets fastening the hinge on the right side; **i** – decoration on the front rim; **j** – remains of rivets fastening the hinge on the left side and punched decoration above the bowl rim; **k** – traces of the hinge and rivets on the right side; **l** – traces of the hinge and rivets on the left interior side.

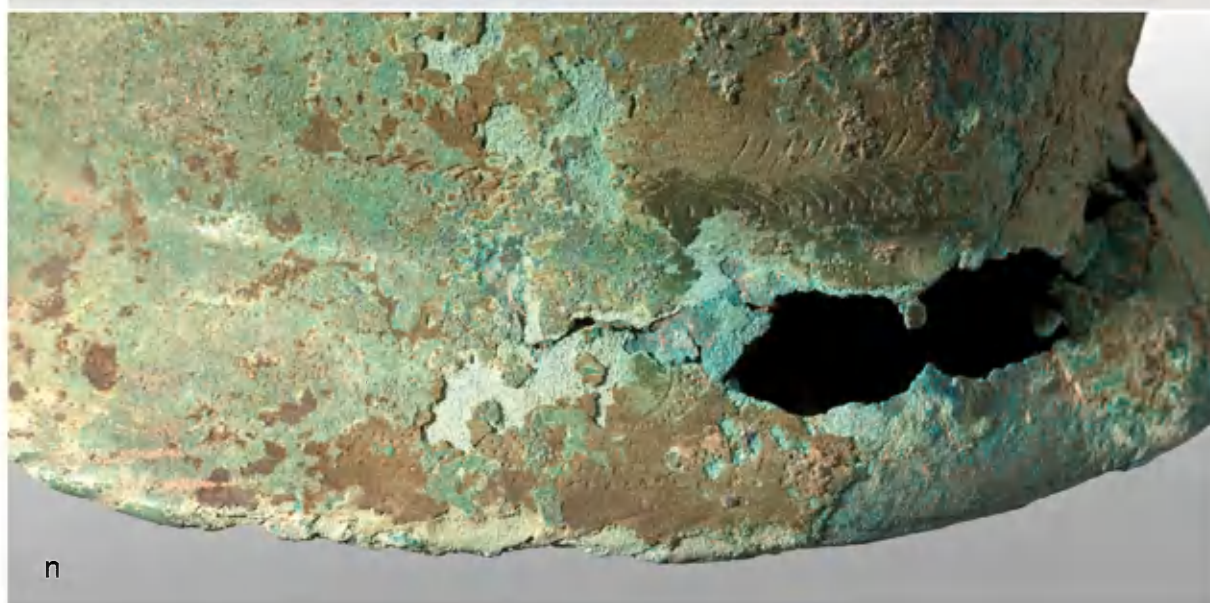
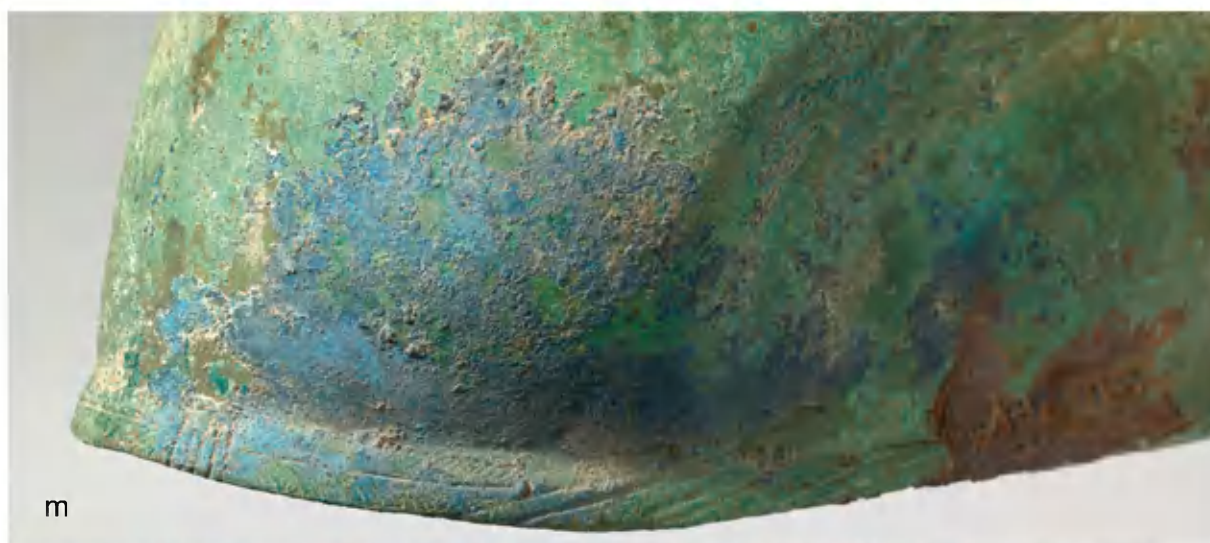
*Sl. 6:* Grad pri vasi Krn (čelada kat. št. 4), detajli. **g** – punciran okras na obodu gumba; **h** – ostanki zakovic, ki sta pripenjali zanko na desni strani; **i** – okras na robu spredaj; **j** – ostanki zakovic, ki sta pripenjali zanko na levi strani, in punciran okras ob spodnjem robu kalote; **k** – sledovi zanke tečaja in zakovic na desni notranji strani; **l** – sledovi zanke tečaja in ostanki zakovic na levi notranji strani.

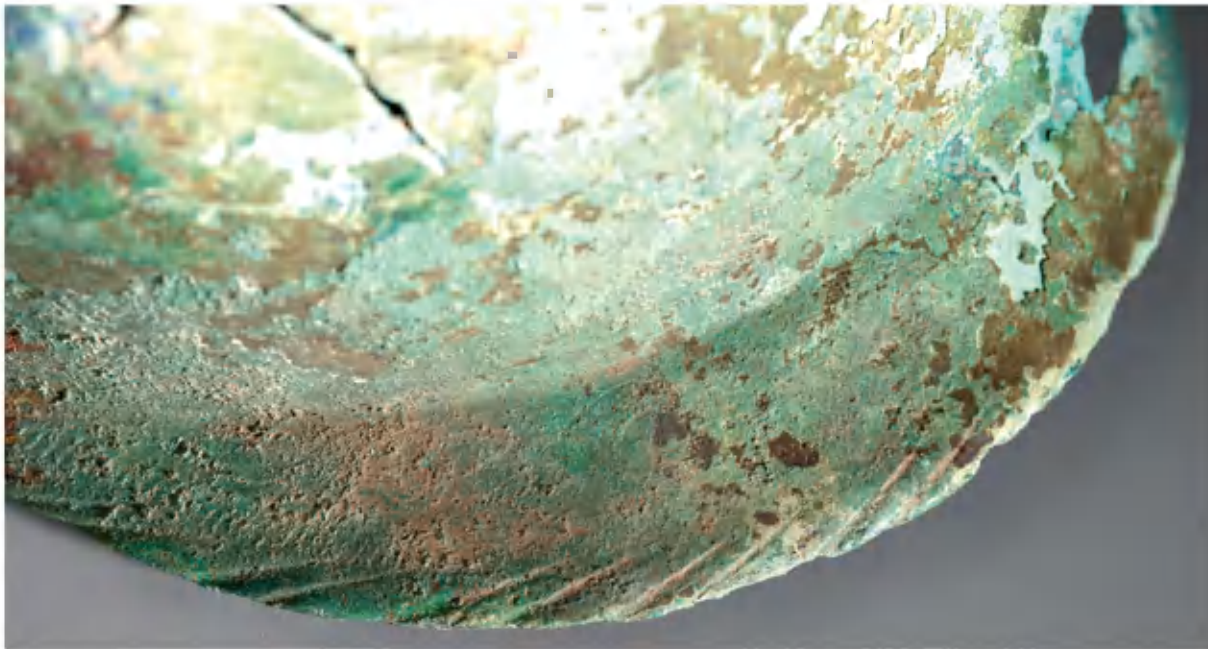
(Photo / Foto T. Lauko, NMS)

*Fig. 7:* Grad near Krn (helmet Cat. No. 4), details. **m** – decoration on the front rim; **n** – remains of the wave pattern roughly in the middle of the neckguard.

*Sl. 7:* Grad pri vasi Krn (čelada kat. št. 4), detajli. **m** – okras na robu spredaj; **n** – ostanek okrasa valovite vitice približno v sredini vratnega ščitnika.

(Photo / Foto T. Lauko, NMS)





*Fig. 8:* Grad near Krn (helmet Cat. No. 4), detail. Remains of the wave pattern on the neckguard and cable pattern on the lower part of the bowl.

*Sl. 8:* Grad pri vasi Krn (čelada kat. št. 4), detajl. Ostanki okrasa valovitih vitic na vratnem ščitniku in punciran okras na spodnjem delu kalote.

(Photo / Foto T. Lauko, NMS)

*Fig. 9:* Grad near Krn (helmet Cat. No. 4). Reconstruction of the neckguard decoration. (Scale = 1:3).

*Sl. 9:* Grad pri vasi Krn (čelada kat. št. 4). Rekonstrukcija okrasa na vratnem ščitniku (M. = 1:3).

(Drawing / Risba I. Murgelj, NMS)

outside bears traces of polishing that are poorly visible even under a microscope.

The bowl is very thin (less than 1 mm) and terminates at the top in a roughly 24 mm wide crest-knob that bears minute punched decoration along the perimeter (*Fig. 6g*).

The neckguard is 28 mm long; it begins immediately behind the spot where the hinges are attached and gradually widens.

The rim (including that on the neckguard) is thickened (max. th. approx. 4.5 mm) and decorated: the front bears a 106 mm long symmetric punched decoration (vertical lines in the middle, flanked left and right by a sprig or palm leaf motif with a pronounced central line; *Fig. 6i*), flanked on both

sides by variously long (approx. 10 do 38 mm) punched oblique lines that form a cable pattern on the neckguard (*Figs. 6h,j; 7m; 8*). Roughly 6 mm above the thickened rim of the bowl on the front and on both sides, as well as at the back above the line of the neckguard, is a roughly 11 mm high band of slightly curved and symmetrically positioned oblique lines that form a herringbone pattern (*Fig. 6i*).

On the neckguard, there are poorly discernible remains of a punched wave pattern (*Figs. 7n; 8*) above the short, roughly 3 mm long oblique punched lines forming the cable pattern above the rim (surviving on the right; *Fig. 5d*). On the left side of the neckguard, this decoration is visible

in several spots that show the pattern in that part to be composed of four waves oriented towards the middle of the neckguard. Each wave is filled with punched dots and bordered on one side by a punched line. The poorly preserved part of the punched decoration near the middle (Figs. 7n; 8; 9) suggests that the centre of the neckguard, probably above the rivet hole, was decorated with a different motif (not waves) made in the same technique of punched dots and lines.

The magnet test showed that the remains of the hinge loop (for attaching the cheek-pieces) on the left interior side of the helmet (Fig. 6l) and the two pairs of rivets with roughly 10 mm wide heads (Fig. 6h,j,k) that fastened the loop to the bowl are iron. This observation is confirmed by the iron rust surviving on these spots both inside and outside. The surviving part of the loop and its traces on the surface of the bowl show that the loop was originally approx. 51 mm long and reached approx. 22 mm high onto the bowl (estimated metal sheet th.: 2–3 mm).

### 5. Buggenum/Haguenau helmet from the Ljubljana

(Figs. 10–12; site: Fig. 18: 5; Pl. 4)

The River Ljubljana at Vrhnika yielded a 193 mm high helmet that weighs 1136 g and has a roughly 1 mm thick lower part of the bowl.<sup>31</sup> It is made of bronze with approx. 10% tin.<sup>32</sup> It is kept in the Narodni muzej Slovenije (Inv. No. V 1950).

The bowl, crest-knob and neckguard were made in a single piece. Running circularly on the inside of the bowl, from the knob downwards, are forging marks (Fig. 10); forging is confirmed by the X-ray image (Fig. 12h). There are two cracks on the knob (Fig. 11a,d), which probably occurred during the production process. Regular parallel horizontal traces on the exterior show that the surface here was polished (e.g. with pumice) on the wheel.

The crest-knob has a vertical V-sectioned slot and, in the sides, a pair of horizontal perforations that conically narrow towards the interior of the knob without reaching the slot (Pl. 4). The knob



Fig. 10: River Ljubljana at Vrhnika (helmet Cat. No. 5), detail of the interior. Visible forging marks.

Sl. 10: Reka Ljubljana pri Vrhniki (čelada kat. št. 5), detajl notranjosti. Vidni so sledovi kovanja.

(Photo / Foto T. Lauko, NMS)

is filled with a hard grey substance (Figs. 10; 11f), which is most likely a lead-tin alloy.<sup>33</sup>

The rim of the bowl is thickened.

There are no traces to suggest that the helmet had a browguard.

At the sides and the back (Fig. 11b–d), a tin-lead alloy<sup>34</sup> was used to solder the two plume tubes of pure brass (around 22% and 14% zinc, respectively<sup>35</sup>) to the bowl.

Two hinges are attached to the sides on the rim interior (Fig. 11b,d) by way of pairs of copper<sup>36</sup> rivets; they were meant to hold the cheek-pieces

<sup>33</sup> The proton beams could not reach the dark grey substance in the knob and its elemental composition was estimated from the bits obtained by scraping some of the substance and wiping the scrapings with a piece of cotton wool. The results indicate an alloy of lead and tin, in which lead is probably predominant. For details see: Šmit, Istenič 2018, C2.

<sup>34</sup> The measurements show that the welding has a 1 : 1 ratio of tin and lead. For details see: Šmit, Istenič 2018, C2.

<sup>35</sup> One measurement was taken on each of the plume tubes. Left tube: Fe 1.3%, Ni 0.2%, Cu 75.0%, Zn 22.4%, As 0.08%, Se -, Pb 0.25%, Ag 0.25%, Sn 0.25%; right tube: Fe -, Ni 0.2%, Cu 76.1%, Zn 23.2%, As -, Se -, Pb 0.07%, Ag 0.11%, Sn 0.4%; elemental composition of the plume tube at the back: Fe -, Ni 0.1%, Cu 85.5%, Zn 14.0%, As 0.03%, Se 0.11%, Pb 0.11%, Ag 0.04%, Sn 0.2%. For details see: Šmit, Istenič 2018, C2.

<sup>36</sup> Results of the measurements of two rivets: Cu 99.2 and 99.4%. For details see: Šmit, Istenič 2018, C2.

<sup>31</sup> Istenič 2009i, 306, 307, Cat. No. 76.

<sup>32</sup> The elemental composition of the bowl was measured in one spot: Fe 1.7%, Ni 0.3%, Cu 87.2%, As 0.14%, Pb -, Sn 10.5%. For details see: Šmit, Istenič 2018, C2.





Fig. 12: River Ljubljanica at Vrhnika (helmet Cat. No. 5), detail. **g** – inscription on the neckguard underside; **h** – X-ray image (100 kV, 4 mA, 25 seconds) of part of the bowl and the inscribed neckguard.

Sl. 12: Reka Ljubljanica pri Vrhniki (čelada kat. št. 5), detajl. **g** – napis na spodnji strani vratnega ščitnika; **h** – rentgenski posnetek (100 kV, 4 mA, 25 sekund) dela kalote in vratnega ščitnika z napisom.

(Photo / Foto: [g] T. Lauko, NMS; [h] S. Perovšek, NMS, J. Vodišek, Inštitut za metalne konstrukcije, Ljubljana).



Fig. 11: River Ljubljanica at Vrhnika (helmet Cat. No. 5). **a** – front; **b** – left side; **c** – back; **d** – right side; **e** – view from above; **f** – interior.

Sl. 11: Reka Ljubljanica pri Vrhniki (čelada kat. št. 5). **a** – spredaj; **b** – leva stran; **c** – zadaj; **d** – desna stran; **e** – pogled od zgoraj; **f** – notranjost.

(Photo / Foto T. Lauko, NMS)

and were cut out of sheet bronze with roughly 5% tin.<sup>37</sup> There is iron rust in the right hasp of the hinge – probably the remains of the iron pivot bar. The cheek-pieces have not survived.

The underside of the neckguard bears a punched inscription P. OPPI > CRACCI (*Fig. 12g*).

The hole in the middle of the neckguard (*Fig. 11e*) marks the spot where the fitting with a ring for helmet suspension would have been riveted to the neckguard.

### 6. Hagenau helmet from Mušja jama near Škocjan (*Fig. 13*; site: *Fig. 18*: 6; *Pl. 5*)

The bronze helmet from the cave of Mušja jama near Škocjan<sup>38</sup> (*Fig. 13*; *Pl. 5*) was found on top of a conical pile of stones mixed with prehistoric votive offerings (11<sup>th</sup>–8<sup>th</sup> century BC).<sup>39</sup> It is 203 mm high and kept in the Civico Museo di Storia ed Arte Trieste (Inv. No. 40760).

The bowl has two distinct indentations, one at the back and the other on the right side. The surface bears an uneven dark green patina and in several spots a rough grey layer, presumably sinter.

The bowl has thin walls (th. approx. 1 mm) and a thickened rim (th. 3–4 mm). The interior shows clear traces of (uneven) forging. The exterior is markedly smooth in the places with a well-preserved patina, which indicates polishing.

The crest-knob was made integrally with the bowl, it is hollow (*Fig. 13f*) and has very thin walls (roughly as thin as the bowl). The heavy damage to the right side caused it to lose its original form here and to break at the neck. The knob has a roughly 26 mm deep V-sectioned vertical slot which has a barely discernible circular cut at the top. Left and right of the slot are roughly 12 mm deep horizontal perforations that cut through the

metal sheet (*Pl. 5*). On the front of the bowl, there are two roughly 4 mm wide holes above the rim (*Fig. 13a,d*), which were punched from the exterior and are not positioned completely symmetrically to the central axis of the bowl; they served to fasten the browguard (now missing).

Attached to the rim of the bowl on the left and the right sides are two probably bronze (the material does not visually differ from that of the helmet) rivets (*Fig. 13b,d*) that once held the hinges for fastening the cheek-pieces (now missing). The rivets have low D-sectioned heads and shanks measuring roughly 4 mm in diameter that reach some 5 mm to the interior of the helmet (*Fig. 13f*). On the interior, there are no traces of the hinges.

The surface above the rivets on the left side has a roughly 40 × 28 mm large and coarse grey patch (*Fig. 13b*) that presumably represents sinter.

The shallow-angled neckguard widens outwards. It holds two 4 and 6 mm wide holes that were punched from the underside and not completely symmetric with regards to the central axis of the helmet (*Fig. 13c*); their function is unclear.

The neckguard also has a heavily corroded surface approximately in the middle, both on the upper and undersides (*Figs. 13c,f,g*; approx. 18 × 20 mm on the upper side), which probably represents the remains of an iron rivet. It probably held the fitting (now missing) with a suspension ring attached to the underside.

Other holes on the neckguard most likely occurred during the decaying process.

The upper side of the neckguard bears two punched inscriptions (*Fig. 13g*; *Pl. 5*): .>.CAESIDIENI.C.TOMIVS (along the bowl rim) and .>.POSTVMI.M.VALERI.BACINI (along the exterior neckguard rim). The letters and dots of the inscription along the exterior rim are larger than those of the inscription at the bowl. The letters A and L (in Valeri) are partially covered by rust produced by the iron rivet in the middle of the neckguard. The helmet has not been X-rayed.

<sup>37</sup> Results of the measurements on two spots: Fe -, Ni 0.5%, Cu 93.5%, Zn -, As 0.19%, Se -, Pb 0.44%, Ag -, Sn 5.4% and Fe 1.9%, Ni 0.6%, Cu 92.2%, Zn -, As 0.18%, Se -, Pb 0.37%, Ag -, Sn 4.7%. For details see: Šmit, Istenič 2018, C2.

<sup>38</sup> Szombathy 1912, 168, 169, Figs. 180, 181; Kubitschek 1912; Degrassi 1929, 177–179 = Degrassi 1962, 742–745, four photographs on the figure between pp. 436 and 437; Marzatico, Gebhard, Gleirscher 2011, 371, 647, Cat. No. 7.27; Maggi 2005; Vidulli Torlo 2008; Borgna et al. 2016, 672, Pls. 68, 86. Kept in the Civico Museo di Storia ed Arte Trieste, Inv. No. 40760.

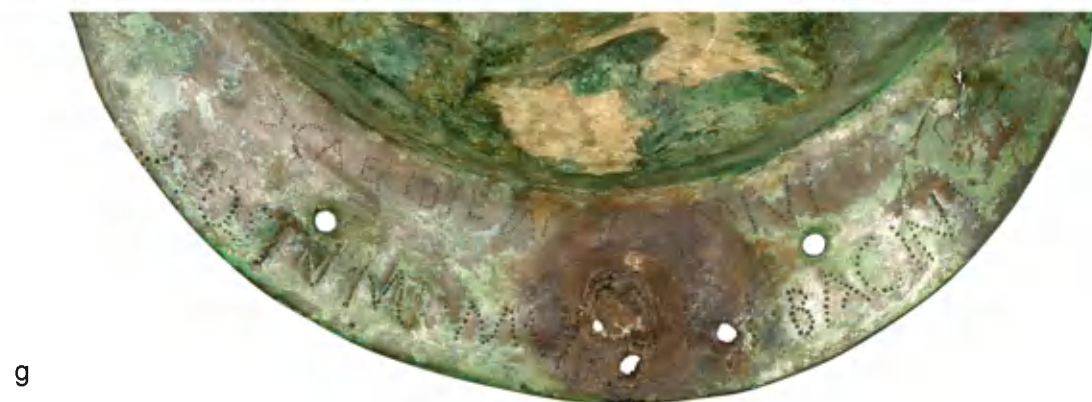
<sup>39</sup> Teržan 2016, 405, 406.

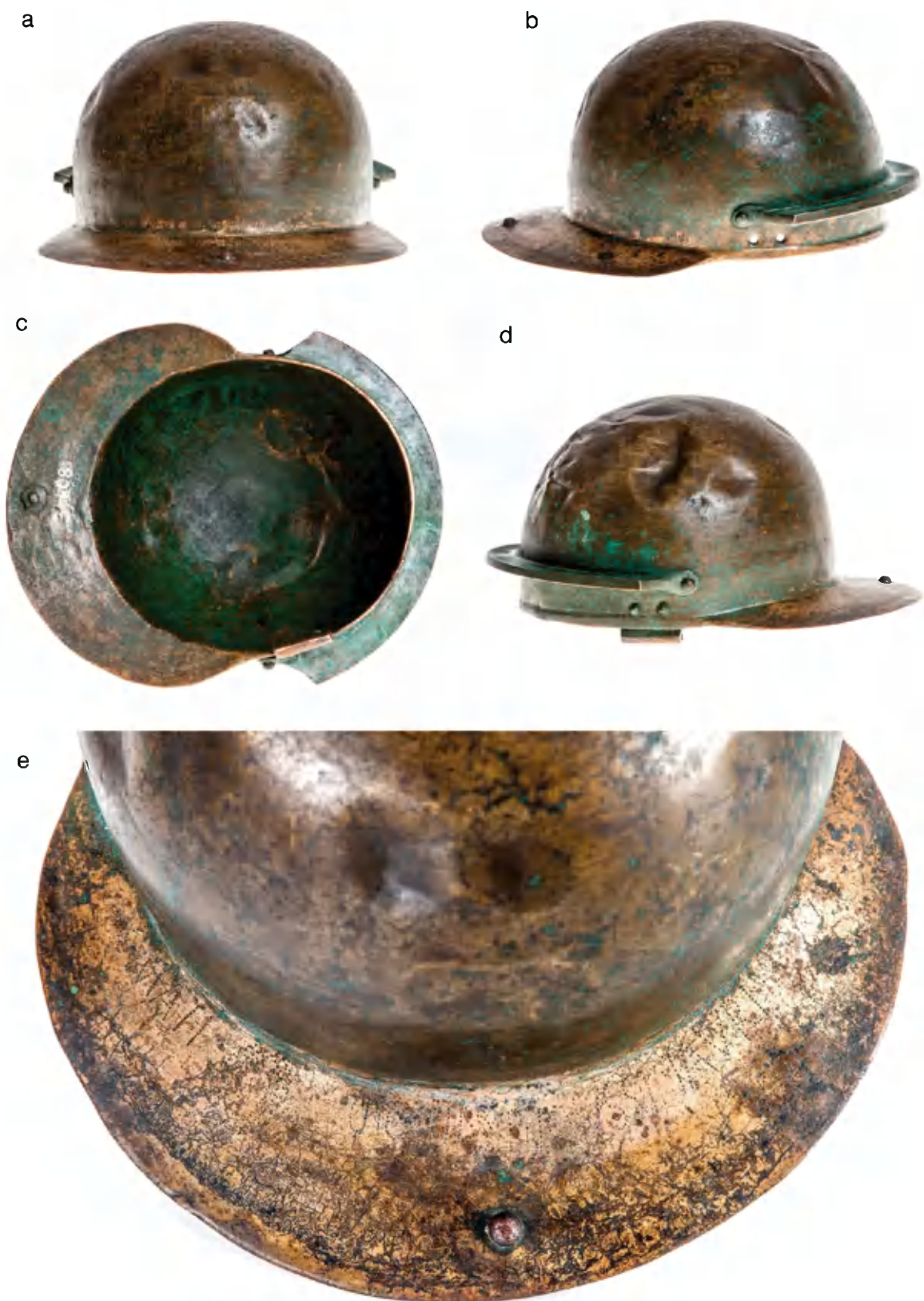
*Fig. 13*: Mušja jama near Škocjan (helmet Cat. No. 6). **a** – front; **b** – left side; **c** – back; **d** – right side; **e** – top; **f** – interior; **g** – punched inscriptions on the neckguard underside side of the neckguard.

*Sl. 13*: Mušja jama pri Škocjanu (čelada kat. št. 6). **a** – spredaj; **b** – leva stran; **c** – zadaj; **d** – desna stran; **e** – zgoraj; **f** – notranjost; **g** – puncirana napisa na spodnji strani vratnega ščitnika.

(Photo / Foto Civico Museo di Storia ed Arte Trieste)







*Fig. 14: River Sava at Mokrice (helmet Cat. No. 7). a – back; b – left side; c – interior; d – right side; e – inscription on the upper side of the neckguard, detail.*

*Sl. 14: Reka Sava pri Mokricah (čelada kat. št. 7). a – zadaj; b – leva stran; c – notranjost; d – desna stran; e – napis na zgornji strani vratnega ščitnika, detajl.*

(Photo / Foto Hrvatski povijesni muzej)

**7. Hagenau helmet from the Sava at Mokrice (?)***(Fig. 14; site: Fig. 18: 7; Pl. 6)*

This bronze helmet was found in the River Sava at Mokrice (*Fig. 14*) and is now kept in the Hrvatski povijesni muzej (Inv. No. 31408).<sup>40</sup> The relatively heavy (wgt. 1470 g) helmet is 150 mm high. Its bowl has unevenly thick walls (0.5–1.5 mm) and a thickened rim. The helmet is well-preserved, though the bowl is deformed in several places – most distinctly as an indentation on the right side. It has a markedly brown and green patina, underneath which are clear traces of forging on the interior.

The knob is missing. There are no traces of plume tubes or solder that fixed them at the sides and the back. On the right, there is a hinge loop for a cheek-piece. The loop was cast of a copper alloy. Its interior holds the remains of the axis bar (*Pl. 6*) – the thick patina prevents us from determining whether it was made of iron or copper alloy. The loop is fastened to the inside of the bowl with a pair of rivets with heads on the outside. The conical-headed rivets are either copper or copper alloy. On the left side, only roughly 5 mm wide holes survive of the two rivets.

The browguard was cast and fastened to the bowl with three copper or copper alloy rivets: two with clearly visible heads on the exterior at both ends of the browguard and one on the front, which is only discernible on the interior of the helmet.

The neckguard is made integrally with the bowl. It has a hole in the middle that holds a copper or copper alloy rivet with a hemispherical head on the upper side. It passes through the neckguard and a round copper or copper alloy washer on the underside. The upper side bears a punched inscription C.MATI. CHO.III. >.P.MVSSI.TAVRI.; there is a poorly discernible punched wreath between the first name and the cohort (*Pl. 6; Fig. 14e*).

<sup>40</sup> Hoffiler 1937, 31, 32, Fig. 4a,b. The helmet formed part of the private collection of Milan Praunsperger and came to the Hrvatski povijesni muzej after World War II. I was unable to verify the data on the findspot as reported by Hoffiler (l. c.).

**8–10. Crest-knobs of Buggenum and Hagenau helmets from the Ljubljana – Šumi site***(Fig. 15: 8–10; site: Fig. 18: 8–10; Pl. 7: 8–10)*

The Late Augustan–Tiberian layers at the Ljubljana – Šumi site (left bank of the Ljubljanica) yielded three upper parts of bronze helmets.<sup>41</sup> All the crest-knobs on these pieces have thin walls and were made integrally with the bowl, of bronze with approx. 12% of tin.

– **No. 8** (Buggenum):

Spherical crest-knob, with a roughly 3 mm wide and 1 mm deep hole, and upper part of the bowl (*Fig. 15: 8; Pl. 7: 8*) (wgt. 35.19 g; surv. h. 41 mm; bowl th. approx. 1 mm).<sup>42</sup> Kept in the Mestni muzej Ljubljana (Inv. No. 510:LJU;0056907).

– **No. 9** (Hagenau):

Conical crest-knob and small part of the bowl (*Fig. 15: 9; Pl. 7: 9*) (wgt. 16.70 g; surv. h. 32 mm; neck wall th. approx. 1.3 mm; bowl th. approx. 1 mm), bronze with around 13% tin.<sup>43</sup> Kept in the Mestni muzej Ljubljana (Inv. No. 510:LJU;0056908).

– **No. 10** (Hagenau):

Truncated conical crest-knob and upper part of the bowl (*Fig. 15: 10; Pl. 7: 10*) (wgt. 19.45 g; surv. fragment h. 42 mm; neck and bowl th. approx. 1 mm), bronze with around 13% tin.<sup>44</sup> Kept in the Mestni muzej Ljubljana (Inv. No. 510:LJU;0056909).

<sup>41</sup> Gaspari 2010, 90, 94, Pl. 28: Š 1181, Š 899, Š 1307. The publication states that they originate from 'Early Roman deposits'. The dating to the Late Augustan–Tiberian period is based on the wider context of the site.

<sup>42</sup> Elemental composition: Fe 0.26%, Cu 86.9%, As -, Se -, Br -, Ag -, Sn 12.7%, Au -, Pb 0.13%; patina on the exterior: Fe 4.12%, Cu 58.4%, As 0.10%, Se -, Br -, Ag -, Sn 37.1%, Au -, Pb 0.23%; patina on the interior: Fe 3.06%, Cu 60.2%, As 0.09%, Se -, Br -, Ag -, Sn 36.10%, Au -, Pb 0.22%.

<sup>43</sup> Elemental composition: Fe 0.22%, Cu 87.5%, As 0.11%, Se -, Br -, Ag -, Sn 12.2%, Au -, Pb -; patina on the exterior – Fe 1.31%, Cu 49.2%, As 0.46%, Se -, Br -, Ag -, Sn 48.9%, Au -, Pb 0.18%; patina on the interior – Fe 2.03%, Cu 58.5%, As 0.52%, Se -, Br -, Ag -, Sn 36.60%, Au -, Pb -, Cr 2.34%.

<sup>44</sup> Elemental composition: Fe 0.22%, Cu 87.0%, As 0.02%, Se -, Br -, Ag -, Sn 12.7%, Au -, Pb 0.04%; patina on the exterior – Fe 1.00%, Cu 73.6%, As 0.05%, Se 0.059%, Br -, Ag -, Sn 25.1%, Au -, Pb 0.21%; patina on the interior – Fe 2.65%, Cu 62.2%, Zn 0.34%, As 0.05%, Se 0.08%, Br -, Ag -, Sn 34.30%, Au -, Pb 0.30%. The high tin content measured in the patina on the exterior and interior are probably the consequence of corrosion processes (Meeks 1993; Šmit et al. 2005, 218–219).



Fig. 15: Ljubljana – Šumi (crest-knobs Cat. Nos. 8–10). Ljubljana – Tribuna (cheek-piece Cat. No. 12: **a** – exterior; **b** – interior. Strmca near Povirje (crest-knob Cat. No. 13).

Sl. 15: Ljubljana – Šumi (gumbi kat. št. 8–10). Ljubljana – Tribuna (lični ščitnik kat. št. 12: **a** – zunanja stran; **b** – notranja stran. Strmca pri Povirju (gumb kat. št. 13).

(Photo / Foto T. Lauko, NMS)

### 11–12. Crest-knob of a Hagenau helmet and a cheek-piece from the Ljubljana – Tribuna site

(Figs. 15: 12; 16; site: Fig. 18: 11,12; Pl. 7: 12)

The remains of two successive forts have been investigated at this site (right bank of the Ljubljanica) dating to the Middle and Late Augustan, possibly also the Early Tiberian periods. The finds associated with the early fort (after 10 BC–beginning of the Late Augustan period) include a crest-knob, while a cheek-piece is among the finds associated with the later fort (from around AD 5 to the end of the Late Augustan or beginning of the Tiberian period).<sup>45</sup>

#### – No. 11:

As discernible from the published photo, the crest-knob (Fig. 16) of a copper alloy was separately cast and soldered to the top of the bowl.<sup>46</sup>

#### – No. 12:

A right cheek-piece (Fig. 15: 12; h. 163 mm; sheet metal th. at rim approx. 0.5 mm; wgt. 137.45 g) is forged of sheet bronze with roughly 8.5% tin. The exterior, which was perhaps tinned, bears a fine dark green patina with a very smooth surface, while the inside has a similar patina, as well as a

storage at the ARHEJ d.o.o.

<sup>46</sup> The item was not available in August 2017 and could thus not be drawn, examined in detail, determined as to soldering traces on the underside and the elemental composition.

<sup>45</sup> Hvalec et al. 2009, 4; Gaspari et al. 2014, 138–143; Gaspari 2014, 131–133, Fig. 139. Both items in temporary



Fig. 16: Ljubljana – Tribuna. Crest-knob (Cat. No. 11).  
Sl. 16: Ljubljana – Tribuna. Gumb (kat. št. 11).  
(After / po: Gaspari 2014, Fig. / sl. 139)

patina with a slightly rough surface.<sup>47</sup> The front edge (incompletely preserved; Fig. 15: 12a; Pl. 7: 12a) has two semi-circular cusps with a roughly 12 mm wide raised border or flange. Other edges are sunken to form a roughly 7 mm wide and 3 to 5 mm high step. The upper edge has two hasps, 30 and 36 mm wide, respectively. The front loop, above the semi-circular cusps, is complete (l. 30 mm; diam. approx. 7 mm), while the back loop (l. 36 mm), with the sheet metal rolled towards the inside, is only partially preserved. The axis bar is missing.

The lower outside part of the piece holds the remains of the head of a copper<sup>48</sup> rivet (its centre located 17 mm from the lower edge), of which a large part of the copper<sup>49</sup> shank survives on the inside (l. 8 mm; Fig. 15: 12b; Pl. 7: 12b). The rivet probably fastened a loop of sheet bronze<sup>50</sup> to the inside of the cheek-piece, of which the lower (surv. l. 22 mm; max. w. 12 mm) and upper strips (surv. w. and l. 8 mm) survive, but the spot where the loop bent does not. The loop probably held the ring that in turn held the (leather) strap; i.e. was

<sup>47</sup> Elemental composition: Fe 0.11%, Ni 0.18%, Cu 91.1%, Zn -, As 0.08%, Ag -, Sn 8.54%, Sb -, Pb -, Mn -; green patina at the front – Fe 3.53%, Ni 0.17%, Cu 52.9%, Zn 0.37%, As 0.20%, Ag -, Sn 42.6%, Sb -, Pb 0.23%, Mn -; grey patina at the back – Fe 1.94%, Ni -, Cu 84.8%, Zn -, As 0.10%, Ag -, Sn 13.0%, Sb -, Pb 0.10%, Mn -. The high tin content measured in the patina at the front may be the consequence of corrosion processes (Meeks 1993; Šmit et al. 2005, 218, 219) or indicates surface tinning.

<sup>48</sup> Elemental composition: Fe 0.53%, Ni -, Cu 99.3%, Zn -, As -, Ag -, Sn 18%, Sb -, Pb 0.04%, Mn -.

<sup>49</sup> Elemental composition: Fe 0.47%, Ni -, Cu 99.5%, Zn -, As -, Ag -, Sn -, Sb -, Pb -, Mn -.

<sup>50</sup> Elemental composition: lower strip – Fe 0.68, Ni -, Cu 83.7%, Zn -, As 0.29%, Ag -, Sn 15.3%, Sb -, Pb 0.07%, Mn -; upper strip – Fe 0.53, Ni -, Cu 87.7%, Zn -, As 0.22%, Ag -, Sn 11.4%, Sb -, Pb 0.11%, Mn -. The difference in the tin content was probably caused by the remains of patina on the measured spot on the lower sheet.

a tie-loop. The straps of the left and right cheek-pieces were tied under the chin.<sup>51</sup>

The presence of other rivets is indicated by rivet holes, all of which were punched from the outside: two large holes in the upper corners (diam. 3.5 and 5 mm), nine small ones (diam. 2–3 mm) along the edges and one roughly in the centre. There is no evidence to suggest that any of the holes fastened decorative pieces,<sup>52</sup> which leads me to conclude that the holes served to fasten a (leather) lining to the inside of the cheek-piece.

### 13. Crest-knob of a Hagenau helmet from Strmca near Povirje

(Fig. 15: 13; site: Fig. 18: 13; Pl. 7: 13)

The solid crest-knob (h. 37 mm; wgt. 68.61 g), made of leaded bronze<sup>53</sup> (Fig. 15: 13), was found (by an unauthorised individual with a metal detector) on the interior slope of the west rampart at Strmca, which is the central peak of a prehistoric hillfort extending over three peaks southeast of Povirje.<sup>54</sup>

<sup>51</sup> Cf. Degen 1978, 171–175; von Detten, Schalles, Schreiter 1993, 185–187, Mil 7–9, Pls. 24, 25; Junkelmann, Thüry 2000, AG 331, -164, -165, Fig. 90.

<sup>52</sup> Cf. brass cheek-pieces with iron rivets on Weisenau helmets: Junkelmann, Thüry 2000, 165, 166, Cat. Nos. AG 546 and AG 547, Fig. 97.

<sup>53</sup> Elemental composition: Fe 0.015%, Ni 0.11%, Cu 64.4%, Zn 0.38%, As 0.95%, Ag 0.24%, Sn 6.96%, Sb 0.66%, Pb 26.3%, Mn -.

<sup>54</sup> The name of the peak (Strmca) is taken from geographic maps, while the archaeological literature thus far knows it under the name Štirnca (e.g. Slapšak 1974; Osmuk 2000–2004, 156–157; Osmuk 1976, 70–72). Immediately west of it lies the hill of Tabor (Hill 525.3 m). Strmca and Tabor each have a prehistoric rampart and are connected with a pair of walls running across the saddle between them. East of Strmca is another peak with a rampart that leans onto the rampart of the hillfort at Strmca (topographic description: Slapšak 1974). The pair of walls across the saddle are not discernible in the online lidar image.

Apart from the crest-knob, the amateur treasure hunter found the following items at Strmca: hobnail of Roman military footwear with a distinct pattern on the underside (Narodni muzej Slovenije, Inv. No. R 27127) suggesting a date from Caesar's Gallic War to around 20 BC (cf. Istenič 2015a, 57, 58), a Late Roman belt buckle with a mount (Narodni muzej Slovenije, Acc. No. 2013/4-3), as well as two Augustan coins and 17 coins from the 3<sup>rd</sup> and 4<sup>th</sup> centuries, three of those of Gordian (determined by the finder).

In literature, the name Tabor was used as a common name for all three peaks south of Povirje (Petru 1975; Osmuk 1974, 68–69; Osmuk 1976, 70–72). For this reason,

The remains of soldering<sup>55</sup> on the underside of the knob clearly show that the knob was soldered to the top of a bowl using a tin-lead alloy. The knob is kept in the Narodni muzej Slovenije (Inv. No. R 27126).

### TYPO-CHRONOLOGICAL ATTRIBUTION OF HELMETS

The helmets from the Ljubljana (*Fig. 1; 2; Pl. 1*), Kovačevše (*Fig. 3; Pl. 2*), the area of Sv. Anton (*Fig. 4; Pl. 3*) and Grad near Krn (*Figs. 5–9*) are Etrusco-Italic.

The helmets from the Ljubljana (*Fig. 1; 2; Pl. 1*) and Kovačevše (*Fig. 3; Pl. 2*) belong to the typologically early examples of the Etrusco-Italic helmets. Pernet dates these (without providing solid evidence, as there are no helmets from reliably dated contexts) to the 4<sup>th</sup> and 3<sup>rd</sup> centuries BC.<sup>56</sup> According to Quesada Sanz and Kavanagh de Prado, similar helmets in the Iberian Peninsula came to light at sites dated to the late 3<sup>rd</sup> and early 2<sup>nd</sup> centuries BC, but they too offered no arguments to support the dating.<sup>57</sup>

The latest context with an Etrusco-Italic helmet is the shipwreck (mentioned in the Introduction) from Madrague de Giens (France) dated to around 70 BC.<sup>58</sup>

Junkelmann names the Etrusco-Italic helmets Type Montefortino and divides them into five

and because of limited context data, we do not know as to which of the three interconnected hillforts yielded the finds marked as 'Tabor pri Povirju' (kept in the Narodni muzej Slovenije, Inv. Nos. P 19542–P 19551, P 27237, R 18608–R 18610, R 26244–R 26246, R 26394–R 26395). The objects date to the Late Hallstatt (one of them is a fragment of a Negova/Negau helmet), Early Roman (hobnail, cylindrical bell with a hexagonal handle) and Late Roman periods; the same is true of the two asses of Tiberius and Claudius, respectively (*FMRSI* I 51-2; *FMRSI* VI 35-1), and of the Late Roman coins (*FMRSI* VI 35-4,5,6).

Tabor also yielded four hobnails of Roman military footwear with a characteristic pattern on the underside (Narodni muzej Slovenije, Acc. No. 2018/17\_1) that date between the period of Caesar's Gallic Wars and 20 BC (cf. Istenič 2015a, 57, 58).

<sup>55</sup> Elemental composition of the soldering remains, measured on the patina: Fe 3.43%, Ni 0.17%, Cu 43.1%, Zn 0.63%, As 1.78%, Ag 0.64%, Sn 17.7%, Sb 1.10%, Pb 31.4%, Mn -; measured on a patina-free spot: Fe 0.12%, Ni 0.13%, Cu 72.4%, Zn 0.45%, As 0.66%, Ag 0.19%, Sn 5.05%, Sb 0.44%, Pb 20.6%, Mn -.

<sup>56</sup> Pernet 2010, 73, 74, Fig. 37.

<sup>57</sup> Quesada Sanz, Kavanagh de Prado 2006, 70–72, Fig. 2.

<sup>58</sup> Feugère 1994a, 39, 40.

subtypes.<sup>59</sup> The helmets from the Ljubljana and Kovačevše fall into his Montefortino/Cremona subtype,<sup>60</sup> which is named after a helmet with a Latin inscription from Pizzighettone near Cremona that probably dates – based on the inscription – to the second half of the 3<sup>rd</sup> century BC.<sup>61</sup> One of the helmets of this subtype has a bronze fitting with two loops, that hold a bronze ring each, fastened to the underside of the neckguard with a copper alloy rivet;<sup>62</sup> such a fitting also survived on a helmet of the Montefortino/Canosa subtype.<sup>63</sup> Junkelmann believes that two straps were inserted into the rings that ran through the loops in the lower part of the cheek-pieces and then under the chin, where they were tied together.<sup>64</sup> Later helmets of the Etrusco-Italic tradition (Haguenau type) have a fitting with a suspension ring attached at this spot on the neckguard underside.<sup>65</sup>

The above indicates that we should consider a broad span, from the 3<sup>rd</sup> to the first third of the 1<sup>st</sup> century BC, for dating the helmets from the Ljubljana and Kovačevše.

The punched wave pattern on the neckguards of the helmets originating in the area of Sv. Anton<sup>66</sup> (*Fig. 4*) and at Grad near Krn (*Figs. 5–8*) ranks them among the later Etrusco-Italic helmets dating to the 2<sup>nd</sup> and early 1<sup>st</sup> centuries BC. Such helmets were most numerous unearthed in Italy, southern France and Spain, while the findspots span from Spain to Greece and southern Russia, and include the burials of non-Romans. The helmets, primarily worn by the Late Republican Roman soldiers, thus found their way to the warriors of other peoples,<sup>67</sup> where they served to underline the high social standing of their owners.<sup>68</sup>

<sup>59</sup> Subtypes: Talamone, Canosa, Cremona, Rieti and Buggenum; he thus included the Buggenum helmets into the group of Etrusco-Italic helmets (Junkelmann 2000, 52–65).

<sup>60</sup> Junkelmann 2000, 59, 60; Junkelmann, Thüry 2000, 100, 107–110; Pl. 4; Figs. 30–34; Cat. Nos. AG 130; AG 290.

<sup>61</sup> Junkelmann 2000, 60, Figs. 10, 11.

<sup>62</sup> Junkelmann, Thüry 2000, 100, 109, 110; Pl. 4; Figs. 33, 34; Cat. No. AG 290.

<sup>63</sup> Junkelmann, Thüry 2000, 93, 94; Fig. 26; Cat. No. AG 441.

<sup>64</sup> Junkelmann 2000, 59; Junkelmann, Thüry 2000, 94, 96, 110.

<sup>65</sup> Cf. helmets from the Ljubljana (No. 5), Mušja jama (No. 6) and the Sava at Mokrice (No. 7), and Fn. 126.

<sup>66</sup> Reinecke 1942, 190, Fn. 132; Egg et al. 1988, Cat. No. 109.

<sup>67</sup> Schaaff 1988, 319–322, Fig. 3; Egg et al. 1988, Cat. No. 111; Pernet 2010, 74, Fig. 38.

<sup>68</sup> Feugère 1994a, 39, 40.

Junkelmann ranked the helmets with the wave pattern and other similar helmets with different decorative designs to the Montefortino/Rieti sub-type and, similarly as Schaaff, dated them to the 2<sup>nd</sup> and early 1<sup>st</sup> centuries BC.<sup>69</sup>

Closely resembling the example from Grad near Krn is the helmet from the area of Rieti (Italy), with excellently preserved decoration and the stamp Q. Cossius.<sup>70</sup> The two helmets share (as much as can be inferred from the published photos) the punched decoration of symmetrically positioned waves (composed of punched lines and dots) that are similar in production technique, design and location on the neckguard (Fig. 17), as well as the punched herringbone pattern above the rim of the bowl.

The distribution of the late Etrusco-Italic helmets indicates a close connection between these helmets and the Roman army or the armies of their Italic allies,<sup>71</sup> while the Roman production can be inferred from the stamp on the helmet from Rieti. The earliest helmet positively identified as Roman is the above-mentioned example from the Cremona area bearing a Latin inscription, on which the form of the letters and the name suggest a dating to the second half of the 3<sup>rd</sup> century BC.<sup>72</sup> The Roman army still used such helmets in the early 1<sup>st</sup> century BC.<sup>73</sup>

Other Roman bronze helmets from Slovenia, which trace their origins in the Republican helmets of the Etrusco-Italic tradition, are later and date to the Principate.

The helmet from the Ljubljana (Figs. 10–12; Pl. 4) is of a transitional form between the Buggenum and Hagenau types.<sup>74</sup> The absence of a browguard and the integral hollow knob tie it to the typologically earlier Buggenum helmets,<sup>75</sup> while the features that point to the later helmet type, named after the Hagenau site in Alsace (France; Hagenau in German) and characterised among other things by a separately made crest-knob, are the plume

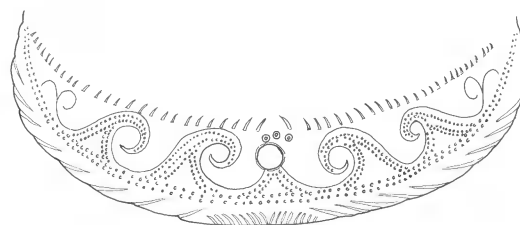


Fig. 17: Forum Novum near Rieti (Italy). Punched decoration on the helmet neckguard. Not to scale.

Sl. 17: Forum Novum pri Rietiju (Italija). Punciran okras na vratnem ščitniku čelade. Ni v merilu.

(After / Po: Schaaff 1988, 321, Fig. / sl. 5)

tubes at the sides and the back of the bowl.<sup>76</sup> Another such feature is the punched inscription on the neckguard that relates the owner of the helmet and the unit in which he served, as by far the greatest number of inscribed helmets belongs to the Hagenau,<sup>77</sup> and only rare examples to the Buggenum type.<sup>78</sup>

Similar helmets that are typologically between the Buggenum and Hagenau types have been found at Neuss<sup>79</sup> and at an unknown site.<sup>80</sup> Similarly as the helmet from the Ljubljana, they are made integrally with the crest-knob and are without the browguard, but correspond with the Hagenau type in every other feature. The helmet from an unknown site has a punched inscription on the underside.

The hole in the neckguard (Fig. 11e,f) indicates the spot where the fitting with a presumable suspension ring was riveted to the underside of the neckguard.<sup>81</sup>

The Buggenum helmets probably developed in the mid-1<sup>st</sup> century BC<sup>82</sup> and their concentration

<sup>69</sup> Junkelmann 2000, 53, 60–62; Junkelmann, Thüry 2000, 110–115; Figs. 35–41; Cat. Nos. AG 597, AG 266, AG 310.

<sup>70</sup> Junkelmann 2000, 61, Fig. 13; Schaaff 1988, 321, Fig. 5.

<sup>71</sup> Schaaff 1988, Fig. 3; Pernet 2010, 74, Fig. 38.

<sup>72</sup> Junkelmann 2000, 60; Figs. 10, 11.

<sup>73</sup> Feugère 1994a, 39, 40; Pernet 2010, 75.

<sup>74</sup> Schaaff 1988; Waurick 1988; Waurick 1990, 12, 13, 20–30, Fig. 22, Figs. 7, 12, 13, 16–19, 22, Pl. 1: 2; Ortisi 2015, 27, 28.

<sup>75</sup> Cf. Schaaff 1988, 325, 326.

<sup>76</sup> Ortisi 2015, 27; Waurick 1988, 327–333; Hagenau helmets with (partially) surviving plume tubes: von Detten, Schalles, Schreiter 1993, 178–181, Mil 1, 2, Pls. 20, 21; Klein 2003, 30–32, Figs. 3–5.

<sup>77</sup> Waurick 1988, 332, 333.

<sup>78</sup> Schaaff 1988, 325, 326.

<sup>79</sup> Waurick 1988, 328, 329; Fig. 1: 1.

<sup>80</sup> Junkelmann, Thüry 2000, 123; Cat. No. AG 538.

<sup>81</sup> Cf. von Detten, Schalles, Schreiter 1993, 180–185, Mil 2–4, Pls. 21–23; Klein 2003, 31, Fig. 4.

<sup>82</sup> The main element in dating their beginning is the helmet from the River Kupa near Sisak with the inscription SCIP IMP (Egg et al. 1988, 529, Cat. No. 113; Waurick 1990, 12, 13, 20–23, Figs. 12, 13), which suggests that the helmet owner served under the command of P. Cornelius

along the lower reaches of the Rhine speaks of their use in the Middle (and Late) Augustan periods, when the area witnessed increased activities of the Roman army. Soon afterwards, they were replaced by the Hagenau type.<sup>83</sup>

The earliest Hagenau helmet from a narrowly dated context comes from Haltern and has all the features of the type including the browguard.<sup>84</sup> From the Augustan to the (Early) Flavian period when the Hagenau helmets fell into disuse, the neckguards grew in length and width.<sup>85</sup>

The shallow-angled and short neckguard on the helmet from the Ljubljana (Fig. 11b–f) is only slightly wider than the bowl and similar to the neckguard on the helmet from Haltern.

The helmet from the Ljubljana can most likely be attributed to the final period of use of the Buggenum type and the beginning of use of the Hagenau type, i.e. to the Middle or Late Augustan period.

The inscription *P(ublīi) Oppi(i) >(centuria) Cracci* on the helmet (Fig. 12; Pl. 4) reveals that it belonged to a soldier named Publius Oppius, who served in a century commanded by a man with the cognomen Graccus or, less likely, Craccus.<sup>86</sup> The owner of the helmet is presented with its praenomen and nomen/gentilicium, which clearly shows him to be a Roman citizen, but also that the helmet can be dated prior to the end of the first half of the 1<sup>st</sup> century.<sup>87</sup> *Oppius* is a Latin name<sup>88</sup> most numerous represented in Italy,<sup>89</sup> which suggests that the owner came from Italy.

The identification of the helmet from Mušja jama near Škocjan (Figs. 13; Pl. 5) as the Hagenau type is determined by the two holes in the front side of the helmet, which show where the browguard would have been attached, but also by the form of the crest-knob with a vertical slot in the centre.<sup>90</sup>

Scipio Nasica who was given the title of *imperator* in 49 BC and died in 46 BC.

<sup>83</sup> Schaaff 1988, 325, 326; Feugère 1994a, 47–49, 79, 80; Schreiter 1993, 44; Ortisi 2015, 27.

<sup>84</sup> Müller 2002, 34, 35, 181, No. 430; Pls. 39, 40.

<sup>85</sup> Waurick 1988, 329, 356; Feugère 1994a, 84, 85; von Detten, Schalles, Schreiter 1993, 180.

<sup>86</sup> It seems even less likely that the inscription relates the gentilicium of the commander of the century, i.e. Craccius or Graccius.

<sup>87</sup> Bodel 2001, 83, 84.

<sup>88</sup> Solin, Salomies 1994, 132.

<sup>89</sup> *OPEL* III, 114; *EDCS* (the name appears in 268 inscriptions, almost half of which originate from Italy).

<sup>90</sup> Degrossi (1929) already determined it as the Hagenau type and dated it to the Early Imperial period. Vidulli Torlo

Thetypological characteristics (form and angle of the neckguard) and the integral crest-knob suggest an early date,<sup>91</sup> while the comparison with the helmet from Haltern shows a date after the Augustan period. The two holes on the neckguard are unusual and have not yet been explained as to their function.

The inscriptions *>(centuria) Caesidieni C(aius) Tomius* and *>(centuria) Postumi M(arci) Valeri Bacini*<sup>92</sup> (translation: of Caesidienus' century, (owner) Gaius Tomius<sup>93</sup> / of Postumus' century, (helmet of) Marcus Valerius Bacinus) on the neckguard (Fig. 13; Pl. 5) name the presumably successive owners of the helmet.<sup>94</sup> One was Marcus Valerius Bacinus from the century commanded by Postumus, the other was Gaius Tomius and served in the century commanded by Caesidienus. Both helmet owners were Roman citizens. Tomius, Caesidienus and Postumus are all Latin names.<sup>95</sup> Caesidienus only appears in this inscription, Tomius is rare,<sup>96</sup> while Postumus is a common name, most frequently recorded in Italy.<sup>97</sup> Except for the helmet from Mušja jama, the name Bacinus is only known on one other inscription from Hispania.<sup>98</sup> We may presume that one owner, Gaius Tomius, and both commanders came from Italy.

The helmet reportedly found in the River Sava at Mokrice (Fig. 14; Pl. 6) also belongs to the Hagenau type. The neckguard is relatively long and widened at the sides, which together with the absence of the crest-knob indicates a late example of the type and a dating to the second quarter of the 1<sup>st</sup> century AD.<sup>99</sup> The inscription *C(aii) Mati(i)*

(2008, Cat. No. 21) ascribed it to the Buggenum type, as did Maggi (Maggi 2005; 2016), who dated it to the end of the Republican period also on the basis of the inscriptions (in my opinion erroneously).

<sup>91</sup> Cf. Waurick 1988, 329, 332, 356, Fig. 2; von Detten, Schalles, Schreiter 1993, 178–185, Pls. 20–23; Feugère 1994a, 81–86; Junkelmann 2000, 67, 68.

<sup>92</sup> *CIL* I 3609 = *AE* 1930, 127 = *EDR*007414 = *EDCS*-26700425.

<sup>93</sup> The owner's name on Roman helmets only rarely occurs in the nominative (instead of the genitive case) (e.g. helmet from Schaan: Degen 1978, 172–174).

<sup>94</sup> Punched owner's inscriptions are common on Hagenau helmets (Waurick 1988, 332–333), which leads me to disagree with the hypothesis that one of the inscriptions on the helmet from Mušja jama is the name of a divinity (cf. Teržan 2016, 429, 430).

<sup>95</sup> Solin, Salomies 1994, 40, 143, 189.

<sup>96</sup> *EDCS* lists one inscription with this name (*EDCS*-33100117).

<sup>97</sup> *EDCS*: 278 inscriptions, half from Italy, *OPEL* III, 155.

<sup>98</sup> *OPEL* I, 107 (Baccinus).

<sup>99</sup> Cf. Fn. 85.



*c(o)ho(rtis) III >(centuria) P(ublil) Mussi(i) Tavri* (Fig. 14e; Pl. 6) relates that the helmet owner, Gaius Matius, was a Roman citizen and served in a legion, which corresponds with the mention of the third cohort.<sup>100</sup> The century of Gaius Matius was commanded by Publius Mussius Taurus.<sup>101</sup> Matius and Mussius are Latin names,<sup>102</sup> both most common in Italy,<sup>103</sup> which leads me to suggest that the helmet owner and his commanding officer both came from Italy. The fact that the owner is named with his praenomen and nomen/gentilicium without the cognomen indicates that the helmet does not postdate the late first half of the 1<sup>st</sup> century.<sup>104</sup>

The forms of the crest-knobs from Ljubljana – Šumi (Fig. 15: 8–10; Pl. 7: 8–10) have close parallels among the Buggenum and Hageunau helmets. They were made integrally with the bowl, which is characteristic of the Buggenum helmets, but can also be found on the early Hagenau helmets, with the latter type otherwise predominantly displaying separately made knobs subsequently fastened to the bowl.<sup>105</sup>

The (truncated) conical form of two of the crest-knobs suggests they more likely belonged to Hagenau helmets (Fig. 15: 9,10; Pl. 7: 9,10),<sup>106</sup> while the spherical form of one knob speaks in favour of a Buggenum helmet (Fig. 15: 8; Pl. 7: 8).<sup>107</sup> The conical crest-knobs from Ljubljana – Tribuna (Fig. 16) and Strmca near Povirje (Fig. 15: 13; Pl. 7: 13), which were separately made and soldered to the bowl, also belong to respective Hagenau helmets. The crest-knob from Ljubljana – Tribuna comes from a narrowly-dated context (earlier camp, dating: after 10 BC–beginning of the Late Augustan period),<sup>108</sup>

showing that already the earliest Hagenau helmets could have soldered crest-knobs.

The attribution of the cheek-piece (Fig. 15: 12; Pl. 7: 12) from the later fort (dating: from around AD 5 to the late Augustan or early Tiberian period) at Ljubljana – Tribuna is unclear. It has a close parallel in a tinned copper alloy cheek-piece from Gamla (Israel) that probably formed part of the helmet of a legionary and dates to AD 67; it has a similarly shaped edge lined with holes, of which the left hole at the top holds a large rivet head. In the publication, the cheek-piece is associated with a Hagenau helmet.<sup>109</sup>

Only two Hagenau helmets survive complete with cheek-pieces, both from Schaan (Liechtenstein).<sup>110</sup> These cheek-pieces are of the same basic form as the example from Ljubljana (without ear cusps), but simpler and flat, i.e. without raised and sunken edges.

Similar edge moulding as the cheek-piece from Ljubljana can be seen on the cheek-pieces of the Weisenau helmets, but these are rarely copper alloy (usually iron) and usually have an ear cusp; the exceptions in this respect are the cheek-pieces without an ear cusp of an early variant of Weisenau helmets (the Weisenau/Nijmegen subtype after Junkelmann) that are of copper alloy and tinned.<sup>111</sup> The cheek-pieces from Schaan have a rivet with a large head on the outside that most probably served to fasten the (leather) strap connecting the left and right cheek-pieces.<sup>112</sup> Probably serving the same function was the (partly surviving) loop on the inside of the cheek-piece from Ljubljana, which has close parallels (the rings in the loops survived) on the three copper alloy cheek-pieces, presumably of Hagenau helmets, from the River Rhine at Xanten, and also with the partly surviving loops on the cheek-pieces of the presumably Weisenau helmets from the same site.<sup>113</sup> We may suppose that the cheek-piece from Ljubljana formed part either of a Hagenau helmet or of an early variant of a Weisenau helmet.

<sup>100</sup> Cf. Waurick 1988, 332.

<sup>101</sup> Hoffiler 1937, 31, 32. The century of (P. Mussius) Taurus is mentioned on two other helmets: one from the River Sava at Zagreb and the other from Moesia Inferior (Mac Mullen 1960, 33, Nos. 6–8; erroneously associated with the 3<sup>rd</sup> cavalry cohort – cf. Waurick 1988, 332).

<sup>102</sup> Solin, Salomies 1994, 115, 124.

<sup>103</sup> Matius: the EDCS database lists 126 inscriptions (more than half from Italy); Mussius: 41 inscriptions (half from Italy).

<sup>104</sup> Bodel 2001, 83, 84.

<sup>105</sup> Cf. above in this chapter; Schaaff 1988, 325; Waurick 1988, 327.

<sup>106</sup> Waurick 1988, 327, 328, 331, 332; Figs. 1: 1,2,4; 1A; 1B; 2: 1,3.

<sup>107</sup> Schaaff 1988, 325.

<sup>108</sup> Cf. Fn. 45.

<sup>109</sup> Stiebel 2014, 58–62; Fig. 4.2: 1.

<sup>110</sup> Degen 1978, 171–176; Waurick 1988, Fig. 1: 3.

<sup>111</sup> Waurick 1988, 333–335, Fig. 3: 1; Junkelmann 2000, 78, Cat. No. AG 292; Junkelmann, Thüry 2000, 124, 125, 129, 164, 165, Cat. Nos. AG 292, AG 331. The two cheek-pieces on a helmet of a Weisenau/Guttman subtype also lack ear perforations (Junkelmann 2000, 79, 80; Junkelmann, Thüry 2000, 140, 141, Cat. No. AG 600).

<sup>112</sup> Degen 1978, 171–175.

<sup>113</sup> von Detten, Schalles, Schreiter 1993, 185–190; Pls. 24–27; Mil 7–12.

## MATERIALS AND PRODUCTION TECHNIQUES

All the Etrusco-Italic helmets from Slovenia were made in a single piece with the crest-knob. Traces of the production technique reveal that the helmets were forged, polished on the outside and decorated using the punching technique.

The analyses have revealed an approximate elemental composition of the helmets from the Ljubljana and from Grad near Krn. Both are made of bronze containing roughly 12% and 6% tin, respectively, while the lead content is too low for the material to be deliberately added. Such an alloy is suitable for casting and forging, the alloy with 12% of tin is also optimal in hardness and toughness.<sup>114</sup>

The results of the elemental analyses of the helmets from Slovenia correspond well with the results of eleven other Etrusco-Italic helmets (Montefortino/Talamone, Montefortino/Canosa and Montefortino/Cremona subtypes after Junkelmann).<sup>115</sup> This shows that the helmets were usually made of bronze with a medium amount of tin (6 to 11 or 12%) and no or very little lead and other elements. Such an alloy is suitable for casting, forging and other cold forming techniques.<sup>116</sup> Binary alloys of copper/tin with 5–7% to 10–12% tin content were used for Late Bronze Age helmets.<sup>117</sup>

Thus far, the most detailed interpretation of the production technique for the Etrusco-Italic helmets has been proposed by Born. He believed that they were made in one of two ways: casting the knob and the material later forged to obtain the bowl and casting the knob and the fully formed bowl. In both cases, the helmet was finished with forging or the outside polished on a slow wheel. As for the decoration, he proposed that the scale pattern on the crest-knobs was made either during the casting process or later by engraving, while the cable pattern on the rim was made by filing.<sup>118</sup>

The examination of the helmets from Slovenia revealed that there are no traces of the crest-knobs

being cast and that hollow crest-knobs could easily have been made by forging.<sup>119</sup>

Bronze with around 10% and 12% tin was used to make the helmet of the Buggenum/Haguenau type from the Ljubljana and three upper parts of either Buggenum or Haguenau helmets from the Ljubljana – Šumi site. Bronze with such tin content is hard and tough.<sup>120</sup> The crest-knobs of the helmets were made integrally with the bowl. It seems reasonable to assume that these helmets were made by forging and their exterior later polished on a wheel. I believe the same method was used to make the helmets from Mušja jama and the River Sava at Mokrice.

The crest-knob of the Haguenau helmet from Strmca near Povirje was separately cast of leaded bronze and soldered with a tin-lead alloy to the top of the bowl. A careful examination and identification of the alloys of other knobs of Haguenau helmets will show whether the separately made knobs were usually cast of leaded bronze. This would seem reasonable as the inclusion of lead in the alloy greatly improved the casting properties of bronze and also reduced its cost, making it suitable for products that did not require the mechanical properties such as hardness and toughness necessary for helmet bowls.

The cheek-piece from Ljubljana – Tribuna was forged of bronze with 8–9% tin, i.e. alloy suitable for cold working,<sup>121</sup> which is consistent with the established production technique.

The data on the alloys used to make the Haguenau helmets recovered in Slovenia are comparable with those on the helmet of the same type from Haltern, the crest-knob of which was made in a single piece with the bowl, while the browguard was made separately. Browguard is brass (92.16% copper and 7.63% zinc), while the helmet proper is of leaded bronze with very high tin content (major alloying metals are copper – 64.71%, tin – 26.04% and lead – 7.87%).<sup>122</sup> Such an alloy is appropriate for casting, but not for cold working.<sup>123</sup>

The elemental composition of other Buggenum or Haguenau helmets and their parts is not known to me.

<sup>114</sup> Born 1991, 73, 77.

<sup>115</sup> Born 1991.

<sup>116</sup> Born 1991, 77 (lead content is less than 0.25%, only in one case 1.7%).

<sup>117</sup> Trampuž Orel 2016, 333.

<sup>118</sup> X-ray images in the first case only show traces of forging, in the second case both of casting and forging (Born 1991, 75–77, Pls. 12–14). Junkelmann (2000, 54, 55) also presumes polishing on a slow wheel.

<sup>119</sup> I sincerely thank Christoph Steidl Porenta (cf. Fn. 30) and Tomaž Lazar (Narodni muzej Slovenije) for their opinions on the subject.

<sup>120</sup> Brown 1976, 25.

<sup>121</sup> Brown 1976, 25.

<sup>122</sup> Riederer 2002, 121; Table 19.

<sup>123</sup> Cf. above and Brown 1976, 25, 26.

The publications of Buggenum helmets do not state the production technique, while the Hagenau helmets are generally believed to have been made by forging (rarely cast first and then forged).<sup>124</sup> This calls for an in-depth analysis of the production manner of the Buggenum and Hagenau helmets that will include the characterisation of the alloys.

Filling the interior of the knob (probably with a lead-tin alloy) as seen on the Buggenum/Hagenau helmet from the Ljubljana, is mentioned in the publications of rare other Roman bronze helmets from the Republican period or the Principate.<sup>125</sup>

The hinges that fastened the cheek-pieces on the discussed helmets are made either of bronze (both helmets from the Ljubljana and probably also the one from the Sava at Mokrice) or of iron (helmet from Grad near Krn) and were either forged (both helmets from the Ljubljana and the helmet from Grad near Krn) or cast (helmet from the Sava at Mokrice). The hinges were fastened to the bowl with copper rivets (both helmets from the Ljubljana), bronze(?) (helmet from Mušja jama), copper/copper alloy (helmet from the Sava at Mokrice) or iron (helmet from Grad near Krn).

The remains of a rivet in the middle of the neckguard only survive on the helmet from Mušja jama and show that it was of iron. Comparing it with the helmets from other sites reveals that these rivets were usually made of copper or copper alloy and fastened the hinge loop to the underside of the neckguard.<sup>126</sup>

The hinges for fastening cheek-pieces to the bowl of the helmets from other sites are usually made of a copper alloy and forged, but they – possibly the helmets latest in date – can also be cast.<sup>127</sup> Their publications do not state whether the rivets were made of copper or bronze. Iron rivets are rarely used in the Etrusco-Italic<sup>128</sup> and

later Roman bronze helmets;<sup>129</sup> I noted no iron hinges (for attaching cheek-pieces) in literature. It would appear that copper rivets were standard in the Roman military equipment.<sup>130</sup> Copper was also used for the rivet on the cheek-piece from Ljubljana – Tribuna.

Because of its toughness and plasticity, copper is particularly suitable for connecting elements such as rivets, which had to withstand relatively great stresses. This is also true of wrought iron (or low-carbon steel), obtained from pig iron, which is very strong, ductile and of a low hardness so that it can withstand a high degree of plastic deformation.<sup>131</sup>

The earliest brass elements on the helmets from Slovenia are the plume tubes on the helmet from the Ljubljana, which is a transitional form between the Buggenum and Hagenau types. They also occur on the latest type of the Roman helmets of the Etrusco-Italic tradition, i.e. the Hagenau type.<sup>132</sup> Romans began producing and using brass around 60 BC and it became common in military equipment from the Augustan period onwards.<sup>133</sup> Brass was also used to make decorative elements and crest-holders of the iron Weisenau helmets.<sup>134</sup>

Also associated with the latest of the helmets of the Etrusco-Italic tradition is soldering. Tin-lead alloy was used to solder the plume tubes (helmet No. 5 from the Ljubljana) and crest-knobs, if the knobs were separately made (knob from Strmca near Povirje). The use of tin-lead alloy for soldering was common in the Roman military equipment.<sup>135</sup>

<sup>124</sup> Waurick 1988, 327, 328. Given the information in von Detten, Schalles, Schreiter 1993 (178–184, Mil 1–6), the six Hagenau helmets from the Rhine at Xanten that probably date to the first half/middle of the 1<sup>st</sup> century were only made by forging. Feugère (1994a, 84), to the contrary, believes that a combination of casting and cold working was employed.

<sup>125</sup> Junkelmann 2000, 55.

<sup>126</sup> Well-preserved hinge-loops can be found on the helmets from the Rhine at Xanten (von Detten, Schalles, Schreiter 1993, 180–184; Pl. 22: Mil 2–6).

<sup>127</sup> E.g. the typologically late Hagenau helmets from Xanten (Waurick 1988, 331; Fig. 1B, bottom right).

<sup>128</sup> E.g. on two Monterfortino/Canosa helmets (Junkelmann, Thüry 2000, 93, 96; Cat. Nos. AG 441, AG 542; Fig. 28; Pl. 1).

<sup>129</sup> An iron rivet is mentioned on the neckguard of a Hagenau helmet from Haltern (Müller 2002, 181, Cat. No. 430).

<sup>130</sup> Istenič 2016, 279–281.

<sup>131</sup> Pleiner 2006, 16–20.

<sup>132</sup> Also cf. von Detten, Schalles, Schreiter 1993, 178–181, Mil 1, 2, Pls. 20, 21; Klein 2003, 30–32, Figs. 3–5.

<sup>133</sup> Istenič 2005; Istenič, Šmit 2007; Istenič 2010; Istenič 2015b; Istenič 2016.

<sup>134</sup> E.g. Breščak 2015, Graves 1 and 41, Pls. 4–6, 14–16 (in my opinion, the piping published as being of bronze is actually made of brass. Junkelmann, Thüry 2000 (128–144; Cat. Nos. AG 503, AG 501, AG 502, AG 600, AG 800) mention brass decoration (without mentioning any natural scientific analyses) on the iron Weisenau helmets. Cf. the crest-holder from the Ljubljana – Tribuna site (Fig. 19).

<sup>135</sup> Istenič 2016, 279–281.

## CONCLUSIONS

Sites in Slovenia (*Fig. 18*) have thus far yielded several examples of Roman bronze helmets from the Late Republican and Early Imperial periods, more precisely six complete helmets, numerous fragments of another helmet, three fragments (with the crest-knob) of the upper parts of three helmets, two separately made knobs (of two helmets) and one cheek-piece. Four of the helmets are Etrusco-Italic, a form that ceased to be used in the opening decades of the 1<sup>st</sup> century BC. They are made in a single piece together with the knob and polished on the outside. Other helmets and their parts belong to the Buggenum (upper part with the knob of one helmet) and Haguenu types (two helmets, two knobs, two upper part fragments with the knob), as well as to the transitional form between the Buggenum and Haguenu types (one helmet); all these date to the Early Principate. The cheek-piece from Ljubljana belonged either to a Haguenu or Weisenau helmet.

Most of the bronze helmets from Slovenia come from undated contexts with the exception of the cheek-piece and the upper part of a helmet from Ljubljana – Tribuna, as well as the three upper parts of helmets from Ljubljana – Šumi, the contexts of which suggest a dating to the Middle and Late Augustan periods, and the Late Augustan–Tiberian periods, respectively. Dating most of these helmets is therefore based on their typological features. Because of the lack of comparable helmets from reliably dated contexts, such dating is least reliable for the two typologically earliest examples, i.e. the helmet from the Ljubljana (Cat. No. 1) and the helmet from Kovačevše, for which I suggest a broad dating from the 3<sup>rd</sup> to the first third of the 1<sup>st</sup> century BC. The helmets from the area of Sv. Anton and from Grad near Krn, which have the characteristic punched wave pattern on the neckguard, probably date to the 2<sup>nd</sup> or the first third of the 1<sup>st</sup> century BC.

The typological features of the helmet from the Ljubljana (Cat. No. 5) indicate a date to the Middle/Late Augustan period. A slightly later date is more likely for the helmet from Mušja jama (Tiberian period) and for the helmet reportedly found in the River Sava at Mokrice (Tiberian–Claudian period). The knob of a helmet from Strmca near Povirje belonged to a Haguenu helmet, which suggests a dating between the

(Late) Augustan period and the second third of the 1<sup>st</sup> century AD.<sup>136</sup>

Two of the four Etrusco-Italic helmets from Slovenia – from Kovačevše above the valley of the River Vipava and from Grad near Krn above the valley of the River Soča – were found together with other small finds.

At Kovačevše, other finds of weapons comprise two prehistoric spearheads or possibly two spikes<sup>137</sup> and part of a chainmail<sup>138</sup> that may be either Roman or Celtic.<sup>139</sup> The finds from Krn include two ritually deformed Late Hallstatt axes, upper parts of two LT D1 swords (one with parts of its scabbard), four Late La Tène axes and several spearheads.

The finds from both sites predominantly consist of items that are related to the material culture of the prehistoric inhabitants living in the area roughly between the 5<sup>th</sup> and the 1<sup>st</sup> century BC. The earliest among the few Roman items from Kovačevše are the brass Alesia<sup>140</sup> and Jezerine I<sup>141</sup> brooches dated roughly between 60 and 15 BC.<sup>142</sup> In addition to the helmet, the finds from Krn include two Roman products that are both bronze vessels: an Idrija type jug (second half/last third of the 2<sup>nd</sup> century–80/60 BC<sup>143</sup>) and a cylindrical vessel (1<sup>st</sup> century BC<sup>144</sup>), while the bronze bucket is earlier (4<sup>th</sup>–3<sup>rd</sup> century BC) and probably originates in the pre-Roman milieu of the eastern part of northern Italy.<sup>145</sup>

The Roman army would very likely have been present in the Vipava Valley after the foundation of the colony of Aquileia in 181 BC and occasionally immediately before that, as the valley lay en route to the eastern hinterland of Aquileia and to the crucial pass at Razdrto/*Ocra* that the Romans conquered in the 2<sup>nd</sup> century BC.<sup>146</sup> In spite of

<sup>136</sup> Cf. Fns. 84 and 85.

<sup>137</sup> Svoljšak 1983, 25, Nos. 143, 145–147; Pl. 4: 111–114.

<sup>138</sup> Svoljšak 1983, 20, No. 44; Pl. 3: 91.

<sup>139</sup> Cf. Beck, Chew 1991, 34, 35; Bishop, Coulston 2006, 63, 64.

<sup>140</sup> Svoljšak 1983, 14, 20, Nos. 1, 2, 4, 136, Pls. 1: 12, 17, 24, 25; Istenič 2005, 206–209, Pls. 1: 3, 9, 15, 16 (brooch No. 3 is made of copper-tin-zinc alloy).

<sup>141</sup> Svoljšak 1983, 19, No. 23, Pl. 1: 26; Istenič, Šmit 2007, 142, 144, 145, Fig. 3 (left brooch), Table 1: MNG Inv. No. 24.

<sup>142</sup> Istenič 2005, 189, 190; Istenič, Šmit 2007, 141, 142, 145.

<sup>143</sup> Boube 1991, 25–32; Bolla, Castoldi 2016, 134, 150, 151.

<sup>144</sup> Bolla, Boube, Guillaumet 1991, 7–11.

<sup>145</sup> Cf. Bolla, Castoldi 2016, 122–123; Turk et al. 2009c, 51, 54, 57–59.

<sup>146</sup> The hypothesis that the Romans assumed control of the pass is associated with the Roman destruction of the

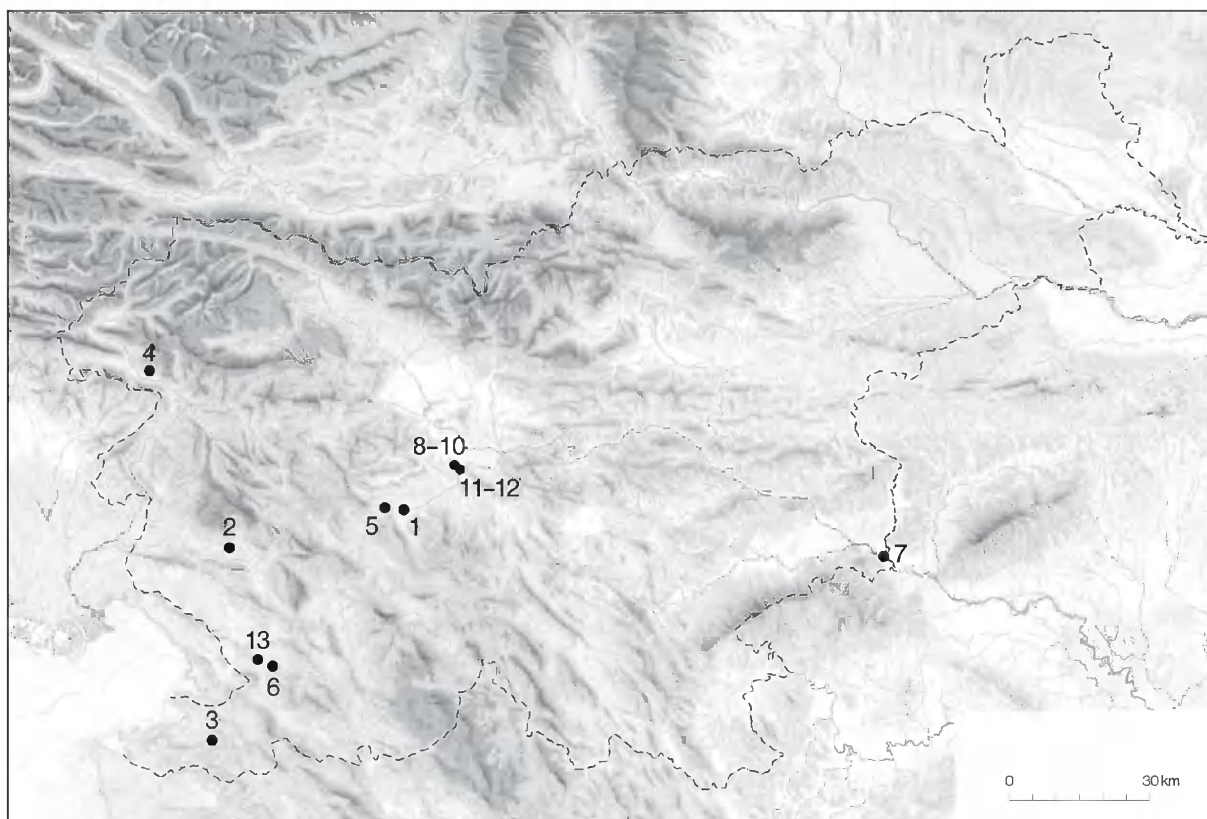


Fig. 18: Sites with Roman bronze helmets from the Republican period and the Early Principate in Slovenia.

Sl. 18: Najdišča bronastih rimskih čelad republikanske dobe in zgodnjega principata v Sloveniji.

(Source / Podlaga: Pregledna karta Slovenije, M. = 1:500.000, ©GURS 1968<sup>2</sup>.)

1. River Ljubljanica at Blatna Brezovica (Tri Lesnice site) / reka Ljubljanica pri Blatni Brezovici (najdišče Tri lesnice). Subtype / podtip: Montefortino/Cremona.
2. Lokavec – Kovačevše (presumed findspot / domnevno najdišče). Subtype / podtip: Montefortino/Cremona.
3. Area of Sv. Anton / okolica Sv. Antona. Subtype / podtip: Montefortino/Rieti subtype.
4. Grad near Krn / Grad pri Krnu. Subtype / podtip: Montefortino/Rieti.
5. River Ljubljanica at Vrhnika / reka Ljubljanica pri Vrhniki. Type / tip: Buggenum/Haguenau.
6. Mušja jama near Škocjan / Mušja jama pri Škocjanu. Type / tip: Haguenau.
7. River Sava at Mokrice / reka Sava pri Mokricah (presumed findspot / domnevno najdišče). Type / tip: Haguenau.
8. Ljubljana – Šumi. Type / tip: Buggenum.
- 9–10. Ljubljana – Šumi. Type / tip: Haguenau.
11. Ljubljana – Tribuna. Type / tip: Haguenau.
12. Ljubljana – Tribuna. Type / tip: Haguenau/Weisenau.
13. Strmca near Povirje / Strmca pri Povirju. Type / tip: Haguenau.

this, the helmet from Kovačevše dated between

prehistoric settlement on the hill of Grad near Šmihel that had previously controlled the Razdrto pass, which is based on the numerous pieces of Roman weaponry recovered at the site (Horvat 2002, 142; Figs. 154, 155); they provide compelling evidence of the end of this settlement in the 2<sup>nd</sup> century BC, probably in the middle (Horvat 2015, 276, 267; Laharnar 2015, 11–14; Laharnar, Lozić 2016, 60–65). At the end of the 2<sup>nd</sup> or in the early 1<sup>st</sup> century BC, the Romans established a trading post at Razdrto (Horvat, Bavdek 2009, 93–96).

the 3<sup>rd</sup> and the beginning of the 1<sup>st</sup> century BC, seems more probably to have been an early import (through trade or as a gift) of prestige within the prehistoric community rather than evidence of the actual presence of the Roman army.

A similar assumption can be made for the helmet from Krn, which is typologically later (2<sup>nd</sup>–first third of the 1<sup>st</sup> century BC). Occasional activities of the Roman army in the 2<sup>nd</sup> and 1<sup>st</sup> centuries BC in the upper valley of the Soča, which formed part of the wider hinterland of Aquileia and would



















































































