

Take it to the Grave. Traces of Production, Post-Casting Treatment and Use of Metal Objects from Urnfield Cemeteries in Lower Austria

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Abstract

Within the scope of a master's thesis, investigations of traces of use on selected knives, pins and razors from two Urnfield Culture cemeteries were conducted to gain insight into the Late Bronze Age *chaîne opératoire* concerning the production and processing of deposited artefacts. Selected finds from two sites, 3 km apart from each other in the Lower Traisen Valley, Lower Austria, were sampled for the study. Inzersdorf ob der Traisen is the slightly older site dating mainly to Ha A with activity in both preceding and subsequent periods (late 13th–11th century BC). The cemetery of Franzhausen-Kokoron is attributed to Ha A2 – Ha B3 (early 11th–8th century BC). Copper-based knives, pins and razors are some of the commonly deposited metal objects in the graves of both cemeteries. Taking into account the object biographies and the Late Bronze Age depositional customs, the production steps, traces of further processing and modes of use of the objects and their development in the course of the Late Bronze Age will be examined in more detail.

Keywords

Urnfield period, Lower Austria, bronze objects, metalwork wear analysis, Lower Traisen Valley

Zusammenfassung – *In das Grab gebracht. Herstellungs-, Bearbeitungs- und Gebrauchsspuren an Metallobjekten urnenfelderzeitlicher Gräberfelder in Niederösterreich*

Im Rahmen einer Masterarbeit wurden Untersuchungen zu Gebrauchsspuren an ausgewählten Messern, Nadeln und Rasiermessern aus zwei urnenfelderzeitlichen Gräberfeldern durchgeführt, um Einblicke in die spätbronzezeitliche *chaîne opératoire* deponierter Metallfunde zu gewinnen. Für die Untersuchungen wurden ausgewählte Artefakte aus zwei 3 km voneinander entfernt liegenden Fundstellen im unteren Traisental, Niederösterreich, herangezogen. Die Fundstelle Inzersdorf ob der Traisen, die etwas älter ist und hauptsächlich in Ha A datiert, zeigt Aktivitäten in vorangehenden und nachfolgenden Perioden (spätes 13.–11. Jahrhundert v. Chr.). Das Gräberfeld in Franzhausen-Kokoron wird in Ha A2 – Ha B3 (frühes 11.–8. Jahrhundert v. Chr.) eingeordnet. Messer, Nadeln und Rasiermesser gehören zu den am häufigsten deponierten Metallobjekten in den Grabbefunden beider

Friedhöfe. Unter Berücksichtigung der Objektbiographien und der spätbronzezeitlichen Deponierungssitten werden in diesem Beitrag Herstellungsschritte, Bearbeitungsspuren und Nachweise des Gebrauchs der Objekte sowie die Entwicklung der Arbeitsabläufe gesamtheitlich im Laufe der Spätbronzezeit betrachtet.

Schlüsselbegriffe

Urnfelderzeit, Niederösterreich, Bronzeobjekte, Gebrauchsspurenanalyse, Herstellungsspuren, Unteres Traisental

1. Introduction

This paper discusses the processes connected to the manufacture, working, manipulation and deposition of Late Bronze Age knives, pins and razors from the cemeteries of Inzersdorf ob der Traisen and Franzhausen-Kokoron in Lower Austria. The results of metalwork wear analysis presented here derive from a master's thesis. The goal of this paper is to extend metalwork wear analysis to knives, pins and razors found in funerary contexts in order to shed light on applied production and processing techniques. The aim of the analysis of knives, pins and razors was to ensure a range of detectable traces as well as identification of differences in the working steps applied. The choice of burial contexts was made because the burial rites in the Urnfield period cemeteries of the region follow a comparable pattern of deposition concerning metal artefacts. Furthermore, only minor chronological or individual deviations can be observed in the features.¹ This results in a sufficient number of artefacts as a data basis, which will improve detection of varying standardised working processes at different sites.

However, the preservation of objects varies significantly within each cemetery site due to the presence of certain

¹ LOCHNER 2021, 233–234 and Tab. 09_01.

objects during the pyre-burning process. Knives, pins and razors were selected as they are found in high numbers in both cemetery sites in order to answer questions about the potential of metalwork wear analysis on objects with traces of heat exposure. Moreover, all three find groups are sufficiently well embedded in the typological framework to also observe subtle chronological developments and changes in production and post-casting treatments. Ultimately, the question of their use prior to the deposition in the grave is of fundamental interest. Traces of use on artefacts result from regular application and thus depend not only on the function of the artefact but also on the individual object's biography. Such marks may also correlate with prehistoric burial practices, depending on their placement in the burial pit as grave goods or personal belongings, for example, and as such might be tied to the location within the burial pit as well.

The methodology of metalwork wear investigations of artefacts applied originally derives from use-wear analyses of lithic tools.² By now, this is a widely acknowledged field of research in archaeometallurgy, even if the potential is far from being fully utilised. Previous works clearly demonstrated that corrosion, use and subsequent manipulations of objects do not diminish the significance of such analyses.³ Through constant development of new methods and approaches, more and more causes of observed traces and reasons behind their formation on metal objects can be identified. So far, concerning research on the Bronze Age period, the focus has been directed mainly towards weapons and pieces of armour, especially in the context of their potential use in combat.⁴ Additionally, a significant body of work is on specific prehistoric tools and/or weapons like axes.⁵ During the development of metalwork wear analyses as a research discipline and also in subsequent years, copper-based objects classified as tools or jewellery received significantly less attention. Traces of production, processing and use are investigated on knives from different archaeological contexts in Poland and Switzerland,⁶ most of them found in wetland settlement features. By contrast, pins and razors remained mostly disregarded.⁷

² This term was chosen based on suggestions in a paper by Andrea Dolfini and Rachel Crellin as it includes traces of production, (re-) working and use, see DOLFINI, CRELLIN 2016, 79.

³ SEMENOV 1964. – ROBERTS, OTTAWAY 2003, 120.

⁴ BRANDHERM 2011. – DOLFINI 2011. – LI et al. 2011. – MÖDLINGER 2011. – MOLLOY 2011. – HORN 2013. – HERMANN et al. 2019.

⁵ KIENLIN, OTTAWAY 1998. – ROBERTS, OTTAWAY 2003. – KRIŠTUF, BOHÁČ 2017. – HORN, KARCK 2019. – BARON et al. 2020.

⁶ SCHÄPPI 2014. – JENNINGS 2014. – SYCH 2015.

⁷ A study by Michael Meier focused on one razor find and its production and use, see MEIER 1992.

2. Methodology

In total, 74 artefacts, including 26 knives, 40 pins and 8 razors, were selected for the master's thesis since these object groups vary in their function and location within the graves. In addition, they are represented in sufficient numbers in both cemeteries, allowing changes in chronological or typological respects to be monitored. The procedure of selection for more detailed investigations was based on a preliminary optical assessment, the quality of the find context of each object, as well as typo-chronological classifications. In a subsequent step, the selected finds were examined under a Wild Heerbrugg M400 macroscope, beginning with the smallest magnification, 5.8×, during which areas of interest on each object were established. Subsequently, magnification up to 35× was used to ensure identification of smaller marks. A detailed analysis with a Zeiss Axio binocular and a linked Canon EOS 750D camera application was followed directly by documentation of evidence of production, processing, alteration and use. In addition, any heat impact observed on the objects' surfaces was recorded in consistent photographic, written and tabular form.

2.1. Definition

Traces of production include marks connected to the casting, which consist of:

- casting seams
- cavities and pores
- casting flaws

Traces of processing present as marks from a subsequent work step. Their function was to increase the utility and performance of the artefact. These include:

- removal of the casting jet
- traces of cold working
- evidence of repairs or reworking

In most cases these marks are intended to cover up traces of production with the ideal goal of removing them completely. However, the two categories, traces of production and further processing, are not addressed separately in comparable studies.⁸ A differentiation of those marks nevertheless seems inevitable here, as their absence or presence is a strong indicator for human intentions to optimise the object in question. They directly affect future handling of the objects and connected processes, be this use, recycling or deposition. Moreover, certain work steps such as the whetting of an edge of a blade were applied repeatedly if weapons or tools had been used intensively. Post-casting addition of decorations as a way to individualise an object or adapt it to

⁸ SYCH 2015, 116–118.

aesthetic conceptions is a step that follows the production. Such practices do not improve the material properties of objects. Instead, the decoration and its placement on objects are closely intertwined with prehistoric individual and/or collective identity formation, mentality and inter-/intra-cultural communication through symbols and the need to be regarded as a distinct category.⁹

Traces of wear are evidence of the object's use and identifiable through:

- notches on the surface or edges
- loss of material due to intensive (re-)sharpening
- abrasion of decoration
- blunt tips or edges

Damage on copper-based objects like chipping at the edges of a blade or fissures, as well as observed bends, were not integrated into any of the mentioned categories, since they might be caused by placement on the pyre during the cremation and amplified by heat exposure. Furthermore, post-depositional processes can be responsible in such cases. Thus, those marks, as well as surface corrosion, were noted and documented separately.

2.2. Heat Impact, Corrosion and Conservation

Initial macroscopic observations and subsequent stereomicroscopic investigations showed areas affected by heat exposure, corrosion processes and conservation procedures, which all affect the conducted analyses of underlying traces.¹⁰ Nevertheless, the state of the surface was documented in such cases as well. Considering the object's biography, the degree of heat impact visible on the surface is of interest for comparisons to other grave goods within the burial and provides additional information about the pre-depositional funerary practices. Depending on the copper and tin composition, the melting range between solidus and liquidus of bronze artefacts varies. A copper-based artefact with up to 20 wt. % Sn has liquid phases according to the copper-tin phase diagram starting with temperatures around 799°C and more. The analysis of cremated bones and archaeological experiments shows that such temperatures are commonly reached during the cremation and remain constant enough to affect the surface of metal objects.¹¹ Thus, the observation of deformations and impacts of heat exposure enables an identification of patterns in pre-depositional funerary practices with regard to the deceased and the artefacts involved.

Their absence, however, might not necessarily mean that they were not incorporated in the pyre-burning process, since the location the object was placed in might not have reached the necessary temperature or it might have fallen off before impacts of heat could manifest on its surface.

Corrosion processes depend on the chemical composition of each artefact and surrounding soil as well as post-depositional conditions (moisture, pH values, presence of organisms).¹² Additionally, object areas influenced by stress, e.g. due to intensive cold working or ornamentation, but also heat exposure, may exhibit an even greater degree of corrosion. In cases of overlapping, higher magnification might help with observations of faint traces when investigations are conducted by macroscopic or stereomicroscopic means.

While modern conservation procedures mostly leave corrosion layers intact, former practices often included the removal of corroded surfaces. The application of (electro-) chemical and mechanical procedures removed most, if not all, corrosion. The investigated artefacts from Franzhausen-Kokoron and Inzersdorf underwent first conservation work in the early 1980s.¹³ In some instances this left marks on the objects (Fig. 1), most likely resulting from the corrosion removal process. Moreover, the artefacts were coated with a



Fig. 1. Traces of conservation. – a–b. Modern abrasions superimposing on blade and handle surface. – c. Acrylic resin residue in fluted pinhead encased in red. – d. Modern abrasions superimposing on pinhead surface (Photos: N. Mittermair).

⁹ WOBST 1977, 127, 320–321. – SØRENSEN 1997, 93. – SØRENSEN 2004, 167.

¹⁰ A thorough discussion of the impact of conservation on the object's surface is found in SYCH et al. 2020.

¹¹ WAHL 1981. – FÜLÖP 2018, 288–289. – FRITZL et al. 2019.

¹² SCOTT 2002. – OUDBASHI 2015. – OUDBASHI 2018.

¹³ NEUGEBAUER, GATTRINGER 1984, 52.

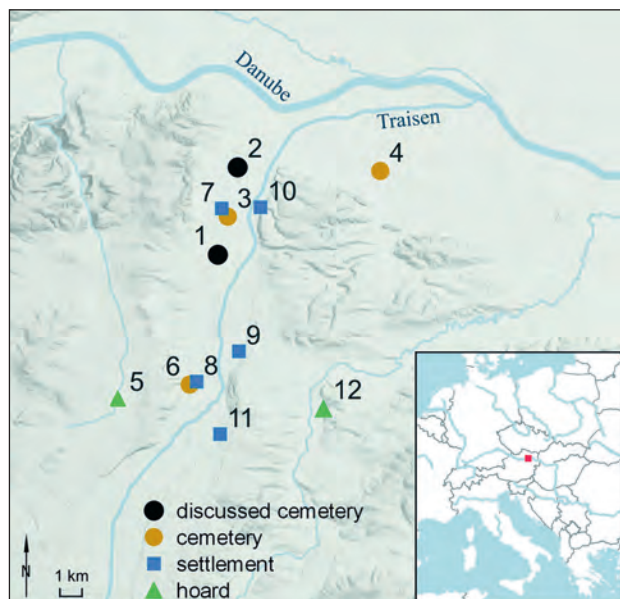


Fig. 2. Urnfield Culture sites in the Lower Traisen Valley. – 1. Inzersdorf ob der Traisen. – 2. Franzhausen-Kokoron. – 3, 7. Getzersdorf. – 4. Gemeinlebarn. – 5. Hafnerbach. – 6, 8. Unterradlberg. – 9. Ossarn. – 10. Oberndorf. – 11. Pottenbrunn. – 12. Rassing bei Kappeln (Credits: I. M. Petschko; digital elevation model: geoland.at; water: Land Niederösterreich and Natural Earth; administrative boundaries: EuroGeographics).

transparent resin-based liquid in order to prevent further chemical reactions. The coating was applied with a brush, as attested by visible traces on the surface of the artefacts and inclusions within the protective layer. This not only leads to an increased reflection of light on the artefacts' surface, it also further complicates identification and documentation of traces lying underneath.

3. Archaeological Landscape: The Lower Traisen Valley

The Lower Traisen Valley, stretching from north to south, is situated in the centre of the Austrian province of Lower Austria. The variety of preserved archaeological records and the intensive research conducted there makes the area one of the most important archaeological landscapes in Austria.¹⁴ During construction work for the S33 road, the Federal Monuments Authority Austria under Univ.-Prof. Dr. Johannes-Wolfgang Neugebauer conducted extensive archaeological investigations. In the early 1980s, numerous sites dating from the Neolithic to the Middle Ages were uncovered. Along the 20 km-long course of the Lower Traisen, glacial terraces are located up to the confluence with the Danube. A number of Late Bronze Age

settlements, cemeteries and hoards were found on both riverbanks, more concentrated along the low and high terraces (Fig. 2). Prominent sites in the vicinity with attested activity during the course of Late Bronze Age include Getzersdorf, Gemeinlebarn, Hafnerbach, Unterradlberg, Ossarn, Oberndorf and Pottenbrunn.¹⁵ The dense distribution of sites from prehistoric periods onwards underlines the importance of the region for communication between the foothills of the Eastern Alpine region in the south, the Bohemian Massif in the north and the east-west course of the Danube.¹⁶ Both of the cemeteries discussed are assigned to the Middle Danubian Urnfield Culture (1300–800/750 BC) and lie three km apart from each other.¹⁷

3.1. Inzersdorf ob der Traisen

The site encompasses 273 cremation burials and urn graves (Plan 1). They are generally attributed to the so-called *Baierdorf-Velatiče* group dating to the older Urnfield Period (Bz D – Ha A1). Based on the burial practices and deposited grave goods, a continuity up to the transition to Ha B1 can be assumed for a number of them. Within the site excavated in 1981–1983 and 1987, predominantly individual burials occur (250 features), but 21 group burials were also detected. The original spatial distribution of the cemetery cannot be reconstructed due to disturbances by modern gravel operations and intensive agricultural activities. Archaeological features consist of a few rectangular burial pits (1.5–2.4 m) considered the oldest burials within the site. The applied funerary practices are customary for the earlier activity span within the site. The features of this phase comprise cremated human remains arranged resembling physical bodies, while placements of grave goods roughly follow observable patterns in predated inhumation burial pits.¹⁸ Numerous, shallow oval to round pits with deposited urns ranging between 0.4 and 1.0 m in diameter are the most common grave form. The pottery finds of the cemetery represent the characteristic repertoire of the older Urnfield period containing vessels with a cylinder-shaped neck, biconical vessels and cups with an s-shaped profile. They often occur in concentrations around a central urn or cremated remains.¹⁹ Selected parts of animal bones, especially sheep/goat, were found within

¹⁵ For an overview of Lower Austria and the Traisen Valley during the Urnfield periods with most of the mentioned sites, see LOCHNER 2021.

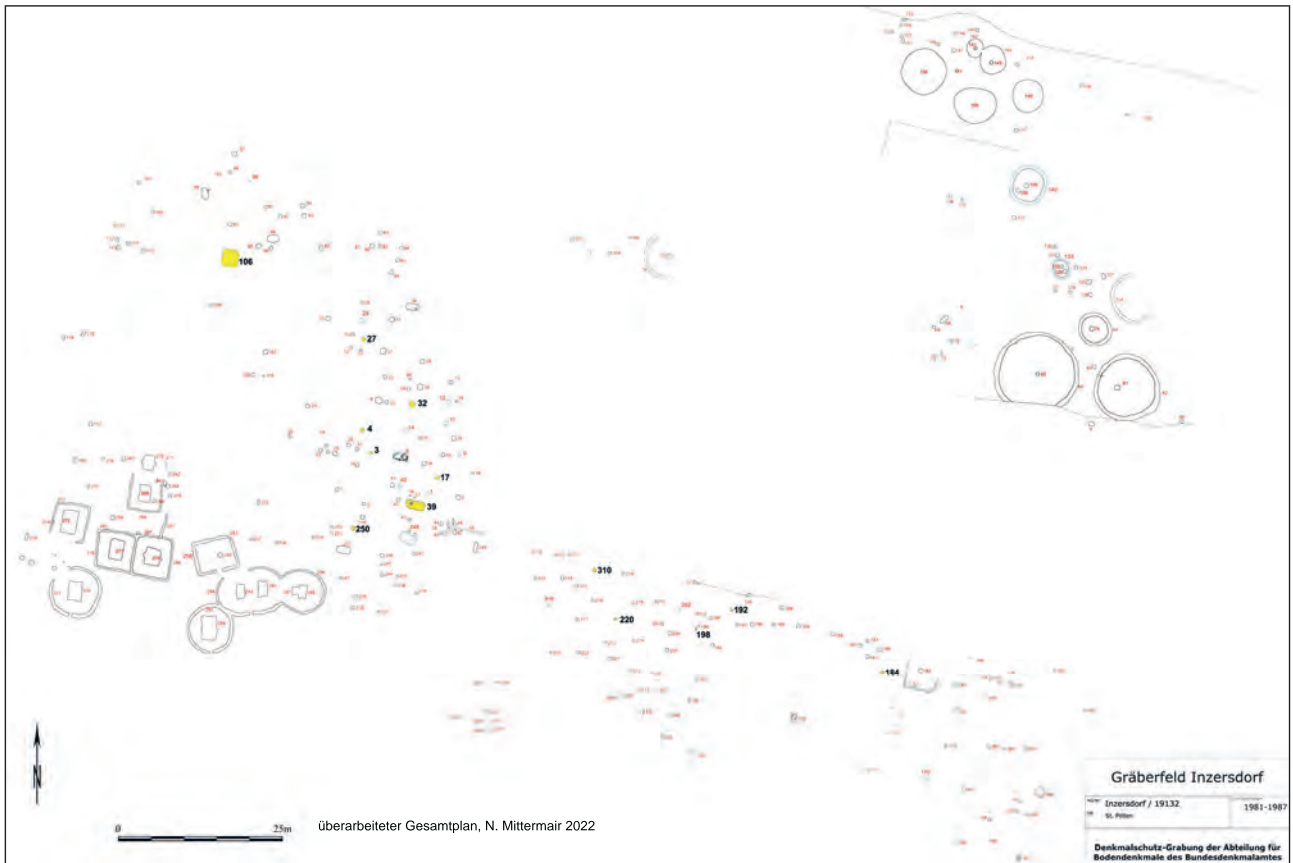
¹⁶ BLES 2012, 6–9.

¹⁷ PITTIONI 1954, 403–444. – LOCHNER 2021, 24.

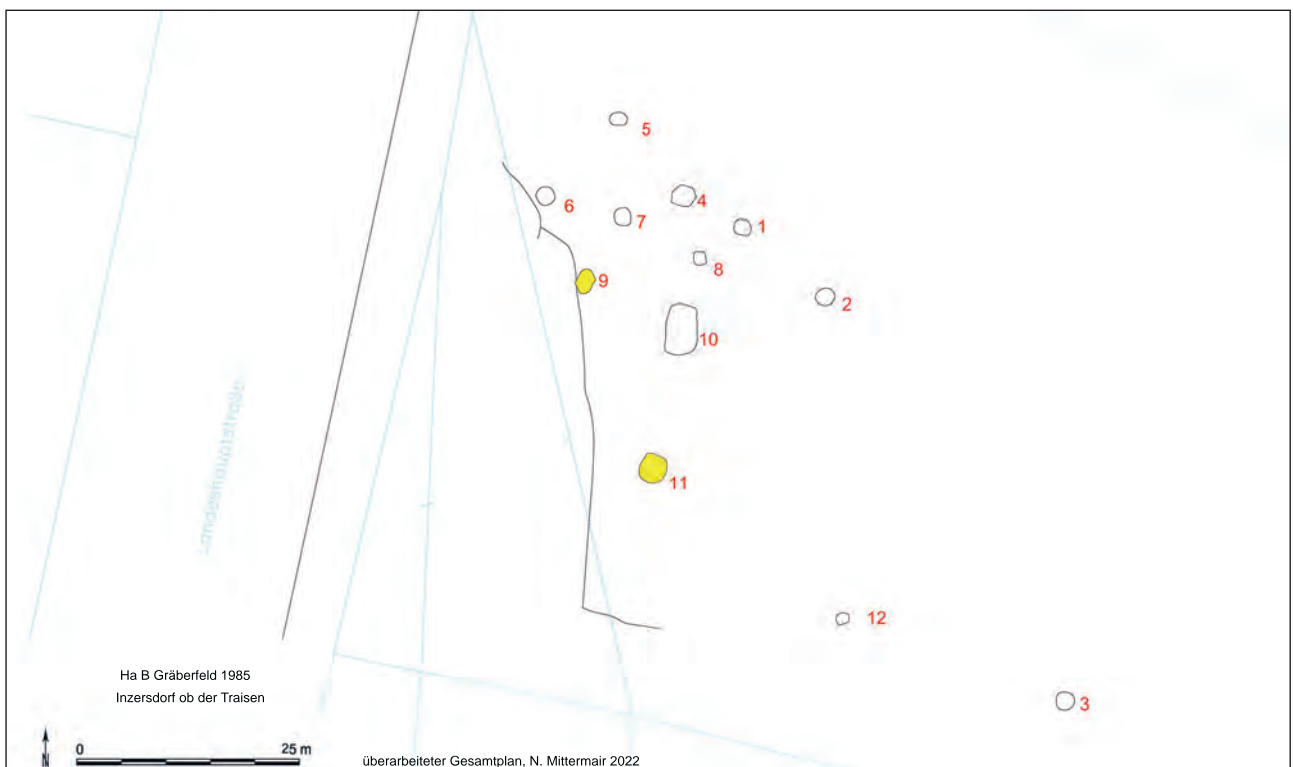
¹⁸ SØRENSEN, REBAY 2007, 120–121.

¹⁹ LOCHNER 2013, 18.

¹⁴ NEUGEBAUER, GATTRINGER 1981, 157–190.



Plan 1. Excavation plan of the cemetery at Inzersdorf ob der Traisen (Bz D – Ha B1) (Credits: Federal Monuments Authority Austria, adapted by N. Mittermair).



Plan 2. Excavation plan of the cemetery at Inzersdorf ob der Traisen (Ha B) (Credits: M. Lochner, adapted by N. Mittermair).

the burials.²⁰ In terms of metal finds, the quantity of 332 recovered copper-based objects and the absence of artefacts clearly categorised as weapons are remarkable. A bronze cup of type *Friedrichsrube* from grave 39 shows clear breaks and marks of repair that demonstrate its use over an extended period.²¹ Other metal grave goods include mostly dress items such as pins, fibulae, bracelets, necklaces and various clothing ornaments made of sheet metal. Average features included two to three metal objects each, significantly exceeding this in the case of burials of multiple individuals.

In 1985, further construction works approx. 500 m towards the south uncovered an urn cemetery (Plan 2) with 13 disturbed burials dated to the Ha B period.²²

3.2. Franzhausen-Kokoron

With an investigated area of 12,000 m² in 1981–1984, 1988 and 1991, in total 403 graves were excavated (Plan 3), of which 111 features were completely preserved. This cemetery dates to the younger Urnfield period (Ha A2 – Ha B3).²³ Spatial and chronological correlations can be observed in the form of a rather scattered, older group in the east and a younger, more densely organised concentration of graves in the west. Moreover, a cremation site situated in the centre of the western grave concentration was uncovered.²⁴ Since no prehistoric overlap of graves was recorded in either of the cemeteries, the existence of grave markers on the surface is assumed, although no archaeological evidence could be detected. 268 graves from Franzhausen-Kokoron were classified as urn burials. A significant number of burial pits show similarities with the features observed in the cemetery of Inzersdorf ob der Traisen, with round or oval shape and diameters between 0.4 and 1.0 m. In a few cases, pits displayed a rectangular shape with comparable dimensions. In contrast to Inzersdorf, at 24 features the number of co-buried individuals is significantly lower, with a variety in funerary practice ranging from all individuals within one urn, individuals placed in separate vessels and partly deposited individuals on the bottom of a pit outside an urn. Correlations between urn size and the age of deceased were argued.²⁵ The deposited pottery includes vessels with a conical or funnel-shaped neck and a flaring rim, beakers, cups with an s-shaped profile and bowls with an inverted rim.

In over 40 graves, bones from the shoulder parts of goats/sheep or pigs were excavated still in anatomical position, often in connection with shallow bowls and/or knives. The find composition in burial contexts is mainly interpreted as grave good food offerings for the deceased.²⁶ An alternative perspective may be a habit of sharing the food with the deceased. Sherds with and without traces of secondary heat exposure and scattered animal bones are regularly found in the burial contexts, suggesting the activity of participating members in close vicinity to the burials. In total, 529 copper-based objects were found, mainly pins, bracelets, fibulae, buttons and ringlets, on average one to two metal finds per grave. Graves with more than one individual contained significantly lower numbers of metal finds compared to Inzersdorf ob der Traisen.

4. Archaeological Context of the Analysed Finds

In total, in this paper objects from 31 graves are discussed. From Inzersdorf 14 graves dating to the older Urnfield periods (Bz D/Ha A1 – Ha A2) and two from the smaller Ha B cemetery, located slightly more to the south, were chosen. In addition, 15 graves from Franzhausen-Kokoron are addressed. The site of Inzersdorf is the subject of an ongoing dissertation by Michaela Fritzl.²⁷ The following short description of the archaeological records and results of anthropological investigations provides the context of the analysed metal objects. Lukas Waltenberger systematically revised the original anthropological analyses in Inzersdorf by Silvia Renhart, who conducted investigations of the material from both sites. Due to the large discrepancy between the two studies, the original results concerning the sex and age of individuals will only be taken into account with reservation. Nevertheless, determination of temperature ranges for the exposure to heat of human remains is significant with regard to the observation of traces of heat impact for the metal objects discussed.

Both Urnfield cemeteries, Inzersdorf and Franzhausen-Kokoron, provide a good overview of Urnfield burial practices adopted and adapted over the course of the Late Bronze Age.²⁸ Nevertheless, clear differences can be pointed out regarding the number and position of the metal objects within the graves. While approximately half of the discussed burials (8 out of 14 graves) from Inzersdorf contain more than two copper-based finds, the same is true only for a third

²⁰ LOCHNER 2021, 232. Herbert Böhm investigated the animal bones.

²¹ LOCHNER 2013, 16.

²² NEUGEBAUER, GATTRINGER 1988, 74–75.

²³ LOCHNER 2013, 24.

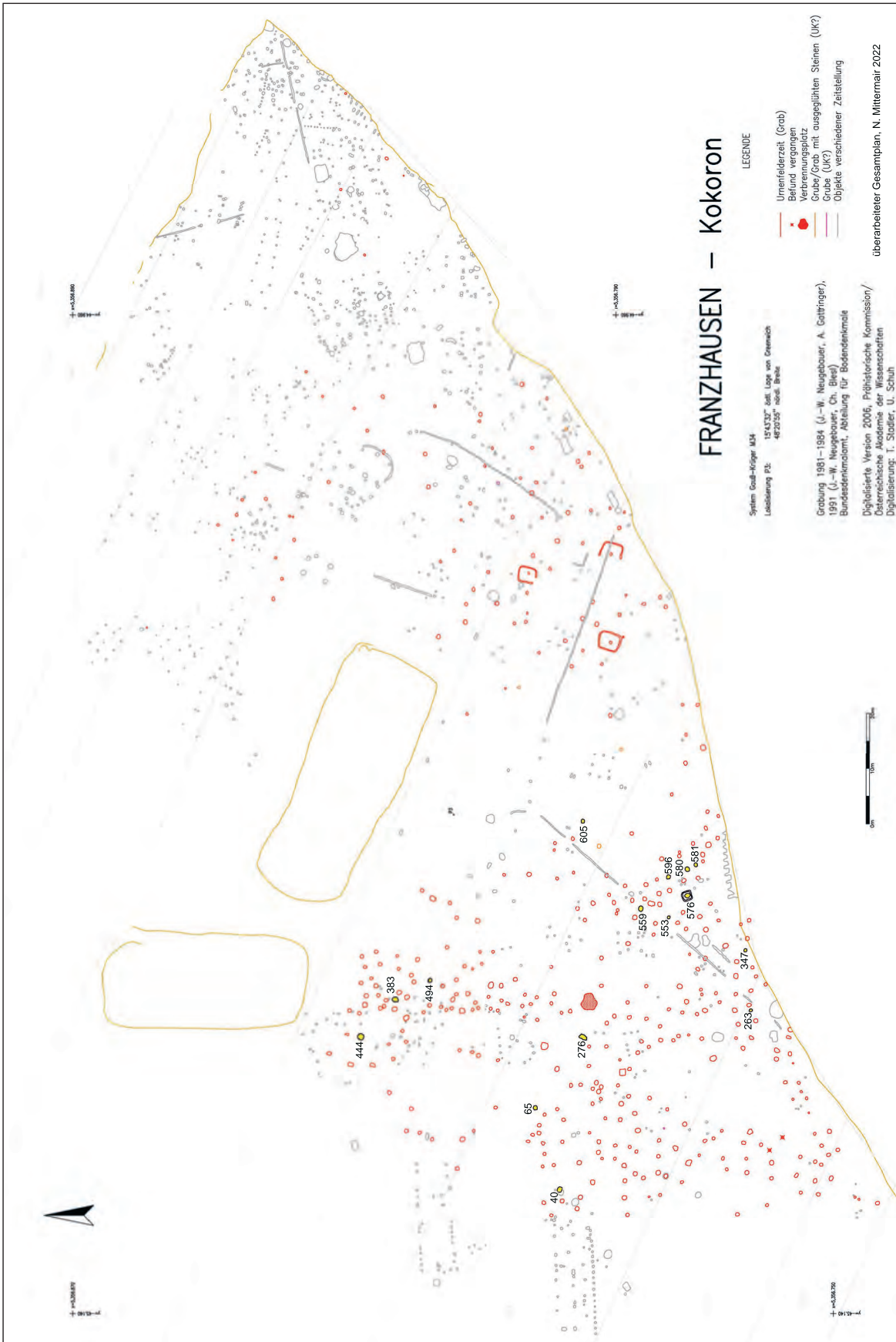
²⁴ LOCHNER, HELLERSCHMID 2016.

²⁵ LOCHNER, HELLERSCHMID 2009.

²⁶ LOCHNER 2021, 248.

²⁷ Burials with multiple individuals were investigated for a master's thesis at the University of Vienna in FRITZL 2017.

²⁸ LOCHNER, HELLERSCHMID 2016. – FRITZL 2017. – LOCHNER 2021, 247. – CAVAZZUTI et al. 2022, 64–65.



Plan 3. Excavation plan of the cemetery at Franzhausen-Kokoron (Ha A2 – Ha B3) (after LOCHNER, HELLERSCHMID 2016, modified by N. Mittermair).

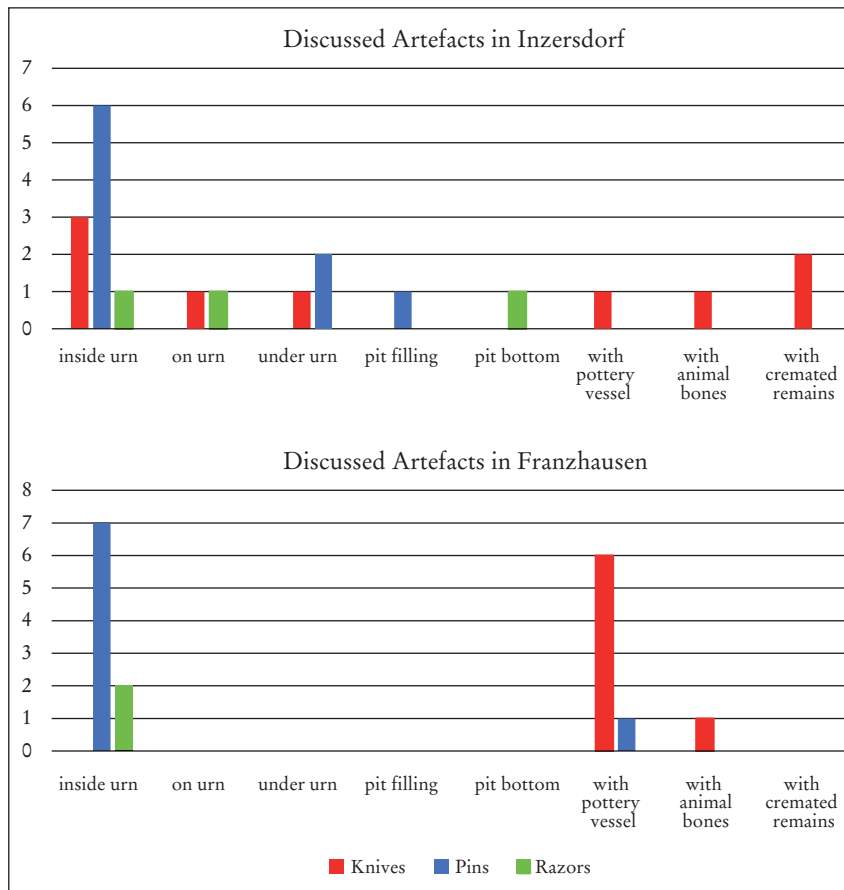


Fig. 3. Context of discussed knives, pins and razors within the burials of Inzersdorf ob der Traisen (n = 19) and Franzhausen-Kokoron (n = 17) (Graphics: N. Mittermair).

of those from Franzhausen-Kokoron (5 out of 15). Furthermore, the burials in Inzersdorf are not only richer in metal grave goods but they also display more depositional variety. In Inzersdorf, the investigated pins (9 in total) were mostly found inside an urn, below an urn or within the pit. The three analysed razors were excavated within the urn, on the urn shoulder and in the pit filling. Lastly, the knives under study (9 in total) are found in comparable frequency mixed with cremated human remains, inside an urn or together with vessels and/or animal bones. Less often, they are found deposited under an urn or on the pit bottom (Fig. 3).

Analysed pins from Franzhausen-Kokoron (8 in total) mostly derive from inside an urn; one was found inside an additional pottery vessel. Two razors were excavated inside an urn; the third's original location inside the burial pit unfortunately cannot be reconstructed. Notably, except for Grave 11 from Inzersdorf, anthropological analyses of burials with a razor inside suggest the cremated remains are attributable to adult male individuals. In Inzersdorf, the biological age was narrowed down to 40–69 and over 50 years.

All of the investigated knives (7 in total) were found accompanied by a shallow pottery vessel, mostly bowls, together with animal bones. In some cases, either pottery vessels or animal bones were accompanied by a knife. The shift in metal find deposition in the context of Late Bronze Age burial practices might very well accord with a change in metalwork wear traces on the investigated objects.

4.1. Knives

Changes in the morphology of knives are especially common due to practical reasons like increasing durability and the optimisation of shafts for a comfortable and simple handling of the artefact. The function of knives is still the subject of discussions based on their size, shape, decoration and occasional investigations of metalwork wear or metallography in recent years.²⁹ Late Bronze Age knives

²⁹ ŘÍHOVSKÝ 1972, 3. – SCHÄPPI 2014, 102. – SYCH 2015. – HOHLBEIN 2016, 11–22. – MÖDLINGER, TREBSCHKE 2021.

served as multifunctional tools, which gain influence in the burial context from the older Urnfield period onward, while the number of daggers simultaneously decreases.³⁰ Elaborate decoration on the back of the blade and upper parts of blades indicate that even if the objects were primarily of practical function, the wish to express and convey individual and/or collective aesthetic perceptions was frequently present and often fulfilled. This regularly leads to considerations of knives either being deposited as personal belongings of individual importance³¹ or within frameworks of cultural burial practices as part of food offerings and connected to the social role of the deceased individuals or conceptions about the afterlife.³²

4.2. Pins

Metal pins show a great morphological variety during the Late Bronze Age. The object category does not merely fulfil a functional role, but simultaneously – and maybe more importantly – transmits prehistoric ideas of aesthetics. Considering the widespread dispersal of certain types or regional similarities in ornamentation styles, pins also serve as a medium to communicate socio-cultural conceptions of form and decoration strongly connected to the self-identification of individuals and groups.

4.3. Razors

Evidence concerning Late Bronze Age hair and beard styles within central Europe is difficult to obtain, since depictions of human faces and archaeological evidence are scarce. Deposition in graves together with awls and tweezers from the Middle Bronze Age onwards lead to the attribution of razors to ‘toilet sets’ belonging to the deceased. As the artefacts often appear in burials of anthropologically classified male burials, various interpretations discuss razors with regard to male identity.³³ Transitions of individuals as regards age or family and social status also influence Late Bronze Age burials in terms of grave goods and the attire of prehistoric individuals. Moreover, the burial context of razors might well be linked to preparation of the body in funerary contexts or connected to mourning practices.³⁴

5. Production

The analysed finds, 16 knives, 17 pins and 6 razors are presented in Appendix B in their typological and chronological context, while the traces of metalwork wear are documented.³⁵

The observation of metalwork wear traces from the production steps of the three discussed object groups show significant differences.

5.1. Knives

As knives constitute a rather functional group of artefacts and are partly covered by a handle, the high number of documented production traces was not unexpected. The analysis of production traces on knives shows a clear variety in production techniques. Casting seams were found on hidden-tang knives INZ 9/6, FHK 40/5 and FHK 444/4, where the handle, made of organic material, would cover such marks (Fig. 4/a–d). Together with a noticeable mismatch in the area of the handle and tang in the latter two



Fig. 4. Evidence of production in two-part casting mould of knives. – a. Casting seam remains on INZ 9/6. – b. Casting seam remains and detail of mismatch in tang section in FHK 40/5. – c. Casting seam remains on tang tip of FHK 444/4. – d. Mismatch in intermediate section of FHK 444/4 (Photos: N. Mittermair).

³⁰ HANSEN 1994, 226.

³¹ SYCH 2015, 123.

³² LOCHNER 2021, 247–248.

³³ TREHERNE 1995. – KRISTIANSEN, LARSSON 2005, 228. – HARDING 2008. – KAUL 2013. – KINCADE 2014.

³⁴ FRIEMAN et al. 2017, 42.

³⁵ The finds were typologically classified by Michaela Lochner. Graphics for artefacts from Inzersdorf were drawn by Maria Imam, graphics for artefacts from Franzhausen-Kokoron were made by Franz Siegmeth. The objects are depicted in the figures in the order they are dealt with in the discussion.

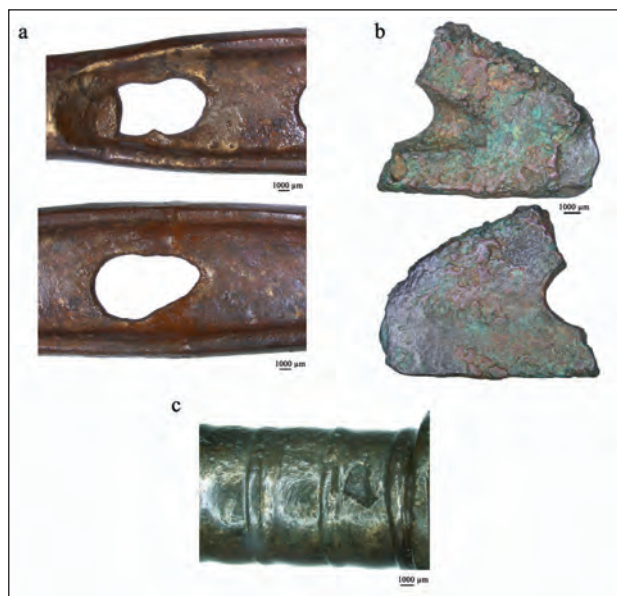


Fig. 5. Traces of production on knives. – a. Casting flaws close to rivet holes of INZ 39/7 prove a preparation in the casting model/mould. – b. One-sided rivet hole indentation in INZ 3/4 prepared in a casting model/mould. – c. The cavity in the intermediate section of FHK 383/6 originated in the casting process (Photos: N. Mittermair).

objects, clear evidence for casting in a two-part mould is displayed. Comparable types of hidden-tang knives show no traces from a two-part mould, resulting from either a thorough removal of production traces or a lost-wax casting process. In the case of INZ 3/4 both a single-part mould or lost-wax casting are feasible. The position of the casting jet, if observable in the investigated object range, was located on the tip of the tang. Examples for casting jets located at the tip of the blade are known in Urnfield Culture finds from pile dwellings in Switzerland.³⁶ However, evidence for such a production technique was not detected in the analysed material.

Rivet holes on artefacts were mostly already prepared in the casting mould/model (Fig. 5/a–b). The potential problems of preparation in moulds/models are displayed in occasional casting flaws (INZ 39/7).

Casting flaws like cavities and shrinkage defects are mostly noted in areas of the intermediate section between the blade and the tang or the tang itself. The lack of removal in latter instances is likely linked to the organic shaft that also covered the tang. Attestable flaws on the intermediate section relate only to the surface of objects and therefore do not influence the functionality in the investigated cases (Fig. 5/c).

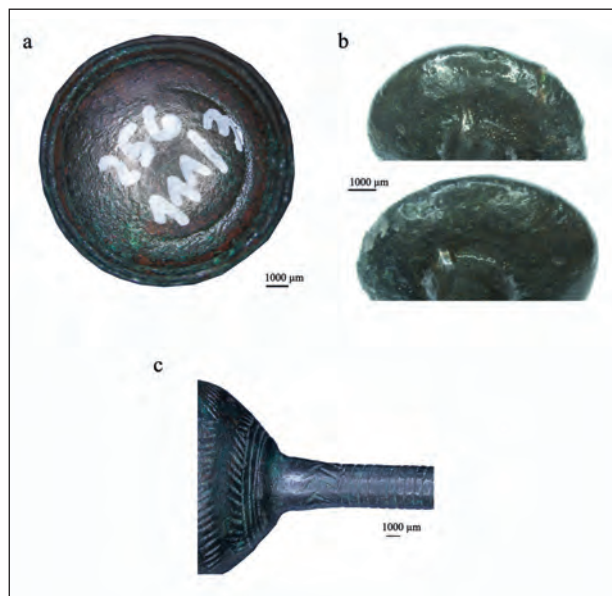


Fig. 6. Traces of production on pins. – a. Mismatch of cast decoration on pinhead INZ 111/3. – b. Casting seams on bottom of pinhead FHK 553/2. – c. The neck of pin INZ 310/5 (left) shows clear evidence for a 'cast-on' procedure (*Überfangguss*) (Photos: N. Mittermair).

5.2. Pins

Since the aesthetic function of pins is at least as important as that of fastening draped textiles and clothing, the general lack of production traces compared to knives is not surprising. Nevertheless, the analysis displayed remains of production traces on six of the pins discussed from Inzersdorf ob der Traisen and on four from Franzhausen-Kokoron attesting varying production processes.

Conclusions about the production technique of one pin (INZ 111/3) are drawn based on the casting flaw visible on the pinhead (Fig. 6/a). Due to its general asymmetric form and the first groove being interrupted exactly at the midpoint, production in a two-part mould is very likely. Remains of casting seams on the junction of the pinhead and pin neck in the case of two pins with vase-shaped heads (FHK 581/4, FHK 553/2) also suggest production in a two-part mould (Fig. 6/b).³⁷ The casting of pinheads in a 'cast-on' technique (*Überfangguss*) was identified on two pins with onion-shaped heads (INZ 192/9, INZ 310/5). The characteristic constriction followed by a distinct carination towards another segment of the object is a strong indicator for a two-phase production (Fig. 6/c). The lost-wax casting technique, if applied for production of the whole knife,

³⁶ SCHÄPPI 2014, 102.

³⁷ DRESCHER 1958, 5–15.

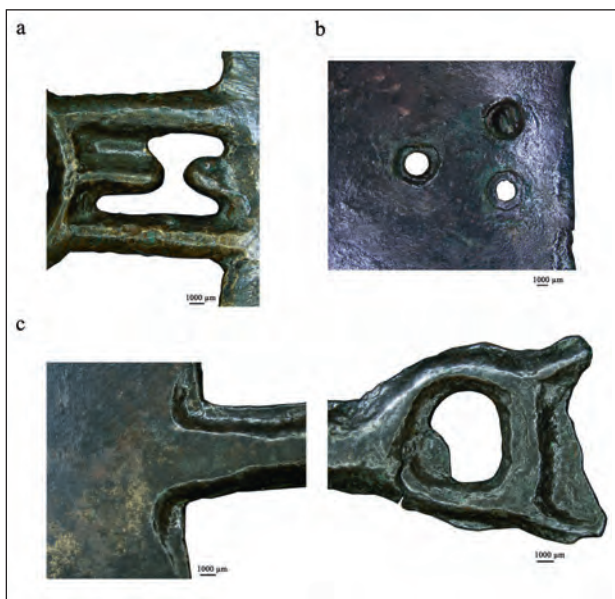


Fig. 7. Traces of production on razors. – a. Detailed view of a misrun in the handle area of FHK 605/7. – b. Rivet holes in INZ 192/8 prepared in the casting model/mould. – c. Details of the mismatch and resulting cold shut effect in the ring knob of FHK 494/8 (Photos: N. Mittermair).

razor or pin, is not easily determined by observations of the metal surface alone. The fluting of the *Mostkovice*-type pin (INZ 106/2), however, was likely formed in a wax model resulting in an irregular course.

In the case of pin INZ 192/9, an oval-shaped cavity inside the surface of the break resulted in a weak point as soon as it was exposed to stress like heat exposure (Fig. 37). The most common traces of production attestable on pins concern the surface of the objects. Shrinkage defects are the result of uneven solidification of the metal during the casting process and are visible on four objects (INZ 32/3, INZ 111/3, INZ 198/3, FHK 596/8). Such casting effects form cavities on the surface of an object and are characterised by an amorphous shape. Since the observed casting defect is located on the surface, usually no negative consequence follows.

5.3. Razors

The analysis of production procedures on razors showed most results in the areas of the handles, which is comparable to the general observations on knives. Unremoved casting seams or remains of the same were found on razors FHK 276/1, FHK 494/8 and FHK 605/7 inside the ring knobs or between the spiked handle ends. The position of the casting jet is not always determinable. In the case of INZ 184/3 and FHK 494/8 they were most likely located at the end of the handle.

Casting flaws of different sorts were also found in the area of the handles, resulting from either cold shuts (FHK 494/8) or misruns (FHK 605/7) that were not further worked on (Fig. 7/a, c). However, the cold-shut effect visible in razor FHK 494/8 may have been influenced by the observable mismatch in the area of the handle. The rivet holes observable on INZ 192/8 partly demonstrate preparation in the casting mould or model (Fig. 7/b).

6. Metalwork

Even though only a relatively small percentage of Late Bronze Age finds in general constitute metalworking tools, a large bandwidth of procedures connected to the working the cast products is attestable within the investigated finds. Recently a comprehensive study of Bronze Age tools and techniques involved in metalworking practices was published.³⁸ In general, the most commonly identified traces are linked to the removal of casting jets and seams as well as the polishing of surfaces and re-sharpening of blade edges.

6.1. Knives

An inevitable work step before an intended use of the objects is the removal of the casting jet. Traces of one of the first work steps can be found on four objects (INZ 184/6, FHK 40/5, FHK 65/10, FHK 383/6), either showing sharp-edged breaks or negative tool imprints (Fig. 8/a).

Cold working, annealing, quenching and hammering after treatment of the casting surface results in harder material properties. The resultant increasing crystalline irregularities in the microstructure lead to a more brittle copper alloy.³⁹ When the crystalline structure exceeds a certain level of deformation, fissures on the surface occur. These increase with repeated applied cold working, intense use or other manipulation of the object like the application of decoration or a high degree of heat exposure. Such fissures are visible on three knives (INZ 3/4, INZ 27/16, FHK 276/2). Another fissure was discovered below the handle of INZ 192/10, but cannot be attributed to this work step alone with certainty. Easily identifiable traces of cold working on one side together with a slight bend in the blade in some cases provides evidence for the last cold-worked side of an object.

Evidence for lack of quenching is provided in the form of dendritic surfaces. In two cases, FHK 65/10 and FHK 444/4, no traces of such intense metalworking steps can be attested in certain areas.

³⁸ NESSEL 2019.

³⁹ BORN, HANSEN 2001, 241–244.

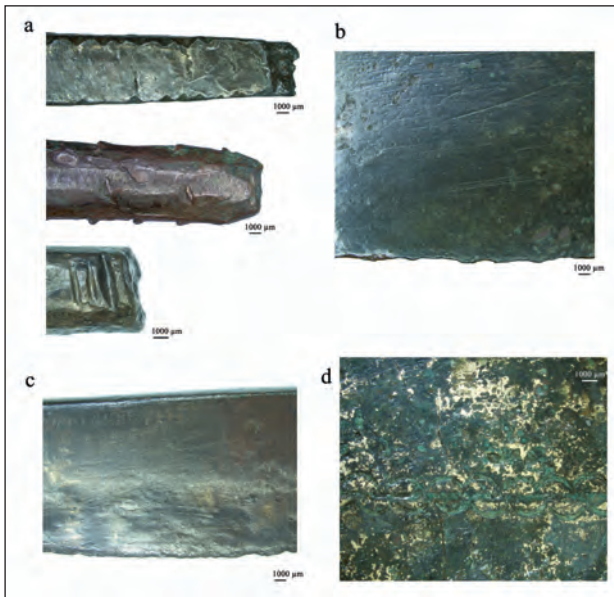


Fig. 8. Traces of metalworking on knives. – a. Negative tool marks on tangs deriving from removal of casting jets and forming the tang into the desired shape by hammering on FHK 65/10, INZ 184/6 and FHK 383/6. – b. Horizontal striation marks on FHK 65/10. – c. Horizontal striation marks and hammering marks along the edge on FHK 383/6. – d. Vertical fissures on the blade's surface attest to the work step of hammering in order to harden the blade on INZ 276/2 (Photos: N. Mittermair).

Horizontal striations are visible on a high number of artefacts, proof that the surface was regularly subjected to further treatment (Fig. 8/b). These traces may also be connected to reworking steps conducted sometime after the production of the knives. Such marks may be difficult to trace if an object was the subject of subsequent hammering, another annealing procedure or heat exposure in a later phase.

Hammering traces are attestable on a variety of objects (Fig. 8/c), especially close to the edge of a blade. Within the handle of INZ 4/14 evidence of hammering marks is also detectable. Occasionally linear grooves along the back of the blade attest that the whole blade was subjected to hammering (Fig. 8/d). The tangs of knives were frequently worked into desired shapes, observable by the round beginning of the tang and tool marks. In most cases, notches were punched into the tangs in a subsequent step in order to ensure better support of the shaft (Fig. 8/a). Attaching an organic handle with more than one rivet was achieved by punching through from the same side (INZ 27/16, INZ 39/7, INZ 106/29).

6.2. Pins

Metalwork wear investigations proved that the majority of pins show unequivocal evidence of surface treatment,

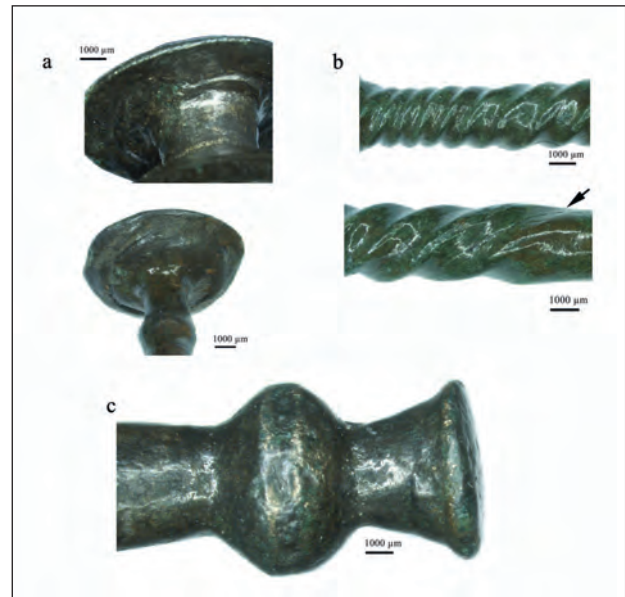


Fig. 9. Traces of metalwork on pins. – a. Bottom of pinheads processed post-casting on FHK 605/5. – b. Torsion in varying degrees led to a fissure in the pin shaft on FHK 576/6. – c. Excess material along the top of the pinhead due to hammering on FHK 559/3 (Photos: N. Mittermair).

often including signs of surface polishing. The pin INZ 32/3 lacks traces of polishing on the bottom surface of the pinhead, providing indications of time-efficient work procedures.

Much clearer traces of metalwork processes are visible on pins with a vase-shaped head (FHK 553/2, FHK 581/4, FHK 596/8, FHK 605/5). The pin shaft of FHK 576/6 was partially hammered into a rectangular shape, which resulted in linear grooves running through the middle of the sides parallel to the pin's course (Fig. 9/b). The subsequent torsion might have increased the effect slightly.

Negatives of the work process are visible at the transition from the node to the pin shaft. The bottom of the pinhead occasionally displays a gradual thinning towards the outer end of the pinhead plate, which was originally cast slightly thicker in shape (Fig. 9/a). This procedure was supported by hammering the surface on the outer edge, provided the work angle and the size of the pinhead allowed it (FHK 605/5). In the case of smaller pinhead plates (FHK 576/6, FHK 581/4, FHK 584/16, FHK 596/8), the treatment of such areas was probably rather carried out by grinding and polishing the surface. The pin with a small vase-shaped head (FHK 559/3) shows evidence of hammering at the top of its head, resulting in compression of excess material at the edge of the pinhead (Fig. 9/c). Also, in Franzhausen-Kokoron, the incomplete removal of

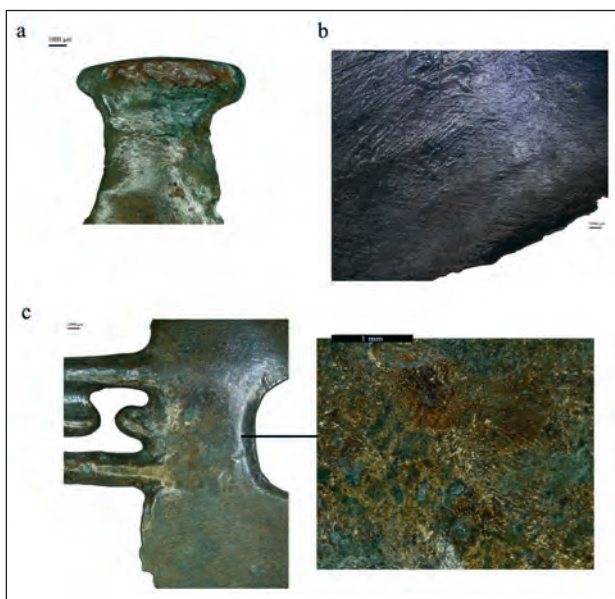


Fig. 10. Traces of metalwork on razors. – a. Horizontal fissure under the reworked casting jet of INZ 11/8. – b. Parallel-oriented peening marks along the edge on INZ 192/8. – c. Less worked area between the blades of FHK 605/7 with the dendritic surface in detail (Photos: N. Mittermair).

traces of production and processing suggest an inclination towards time-saving work procedures.

6.3. Razors

Post-casting procedures are visible on all discussed razors attesting a similar workflow. While no negative tool marks resulting from the removal of the casting jet are ascertainable, other procedures are comparable to the ones observed in knives. One object, INZ 11/8, even shows a fissure on the surface resulting from extensive cold working (Fig. 10/a). In this case, the casting jet was reworked into a node with roughly rhombic shape in cross-section, which additionally stressed the crystalline structure in the area. Evidence of hammering is detectable on all objects through either negative tool marks, material dispersion visible along the back and edges or one or more peening tracks parallel to the edges (Fig. 10/b). Dendritic surface was visible on razors FHK 276/1 and FHK 605/7 in the area between the two blades and the handle or at the base of the blade (Fig. 10/c).

7. Decoration

Variations in application techniques for decoration on the objects discussed were observed during the metalwork wear analysis, these being either cast with the object or applied after surface treatment.

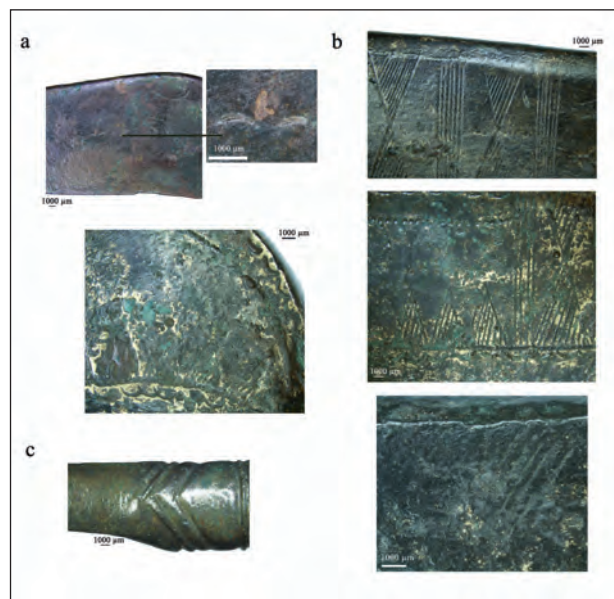


Fig. 11. Decorations on knives. – a. Arched indentations on INZ 184/6 and FHK 276/2 with partial overlap. – b. Various incised triangular designs on hidden-tang knives FHK 444/4 and FHK 276/2, and also on the reworked knife fragment FHK 494/1. – c. Decoration towards the back of blade FHK 65/10 cast with an error deriving from modelling (Photos: N. Mittermair).

7.1. Knives

The investigation of knife decorations revealed a strong preference for post-processing application of indentations and incisions. Only two discussed objects (FHK 65/10, FHK 383/6) show an intermediate piece between blade and tang adorned with decorations, both of which were prepared in the casting mould or model.⁴⁰ Additionally, an error in the adornment of the model was cast together with the object (Fig. 11/c). Six other artefacts, the majority belonging to hidden-tang knives, display decorations of mostly geometrical nature. In general, only a few instances with overlapping decorative motifs were identified, like the herringbone pattern on the back of the blade of INZ 220/6.

Two objects have a flat, rectangular tang and show incised triangular decorations. Neither decoration is well-preserved, since the artefacts were reworked. However, similarities can be detected in the design of triangles compared to other objects with hidden tangs (Fig. 11/b). The decoration of FHK 494/1 has an incised line running

⁴⁰ Experiments regarding the application of decoration with the lost-wax technique have been conducted since the late 19th century, see MÜLLER 1878, 38. Other studies on ornamentation practices include, e.g., FOLTZ 1980 and LOBISSER 2009.

through their middle filled with mirror-inverted hatchings. The difference can be found in FHK 580/3, which shows differently decorated triangles.

The concentric circle decorations of INZ 184/6 are not preserved well enough to determine whether they were incised or punched into the surface. For the row of arches, the latter application method can, however, be identified (Fig. 11/a). The same is true for the arches of FHK 276/2, while the rows of round indentations were chiselled into the surface. A slightly larger diameter was chosen for the solitary punctures on top of and between the incised triangle motifs. The hatchings of triangles and x-shaped decorations were created at a later stage. A comparable composition of decorative elements was used for FHK 444/4.

7.2. Pins

Regarding the previously mentioned shrinkage cavities on the surface, which would have been removed with further post-casting processing, these were on occasion apparently rather covered by superimposing decorations over them. Seven pins from the Inzersdorf cemetery show clear signs of decoration being applied after surface treatment (INZ 17/18, INZ 111/3, INZ 192/9, INZ 220/8, INZ 310/5, INZ 198/3, INZ 250/4). As for Franzhausen-Kokoron, this is the case for six objects (FHK 347/6, FHK 263/6, FHK 553/2, FHK 559/3, FHK 576/6, FHK 605/5).

In case of the *Kugelkopfnadel* with horizontal ribs (INZ 111/3), evidence for the casting of the ribs is provided by the shrinkage defect seen in the last rib on the pinhead bottom (Fig. 12/a). Moreover, a casting flaw on the first rib on the top of the pinhead can be detected. In a subsequent step, shallow indentations were applied on specific ribs, cast slightly broader.

Incised decorations in particular allowed observation of application techniques and their order of creation. First of all, due to slight overlaps in the decorative motifs in some cases, a sequence of application was determined. The indentation decoration on the pin with a biconical head, INZ 17/18, filling the segments of the pin shaft, was applied after the linear incisions were formed, while in the case of *Zwiebelkopfnadel* INZ 192/9, the incision line running through the middle of the pin head is drawn over the circular motif. The diagonal indentations on the carination of the *Spindelkopf* of INZ 220/8 were applied after the lines were incised. *Kolbenkopfnadel* INZ 250/4 shows that the irregular course of the herringbone motif was intersected by the linear incisions, which is also the case for *Zwiebelkopfnadel* INZ 310/5 and *Vasenkopfnadeln* FHK 263/6 and FHK 584/16.

Also remarkable are the attestable starting or end points during post-processing work steps (Fig. 12/b), when incised

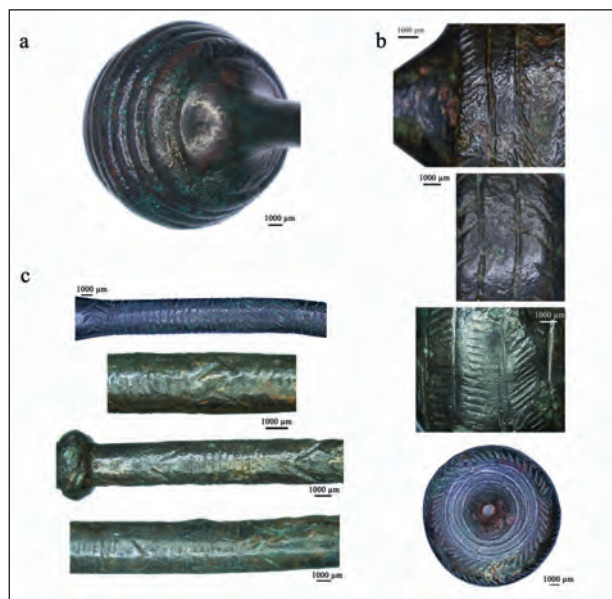


Fig. 12. Decorations on pins. – a. Detailed view of cast ribs of pin-head INZ 111/3. – b. Various imprecise applications of decorations on INZ 220/8, INZ 198/3, FHK 596/8 and FHK 310/5 (downwards). – c. Decorated pin shafts of FHK 310/8, FHK 605/5 with overlapping decor, FHK 584/16 and FHK 263/6 (downwards) (Photos: N. Mittermair).

circumferential lines do not fully merge (INZ 198/3) or overlap (INZ 220/8, INZ 310/5, FHK 596/8). In addition, errors and corrections are regularly attestable. On the top of the preserved pinhead INZ 192/9, within the motif of three concentric circles, the middle incision overlaps with the inner incision at one point. Significant overlap is also visible in INZ 250/4, while the groove along the node of FHK 559/3 runs in a highly irregular course. Decorations on pin shafts also show irregularities in some instances (FHK 605/5).

Overall, the applied motifs mostly fit into the general repertoire of the Late Bronze Age (Fig. 12/c). One exception is INZ 17/18, as no parallels for such a decoration style were found, although the application techniques are comparable and the particular motifs are attestable during the period. A possible explanation may be that the composition of pin INZ 17/18 reflects more of an individual taste. The deliberate choice of covering casting flaws with decorative elements and the irregular or even flawed application of such elements seems to fit the general impression of time-efficient work strategies being applied in both cemeteries.

7.3. Razors

Only one of the discussed razors shows decorative features that were incised after most of the processing steps (INZ 11/8). Downward-facing triangles on the blades are filled with diagonal hatching. Repeated grinding procedures

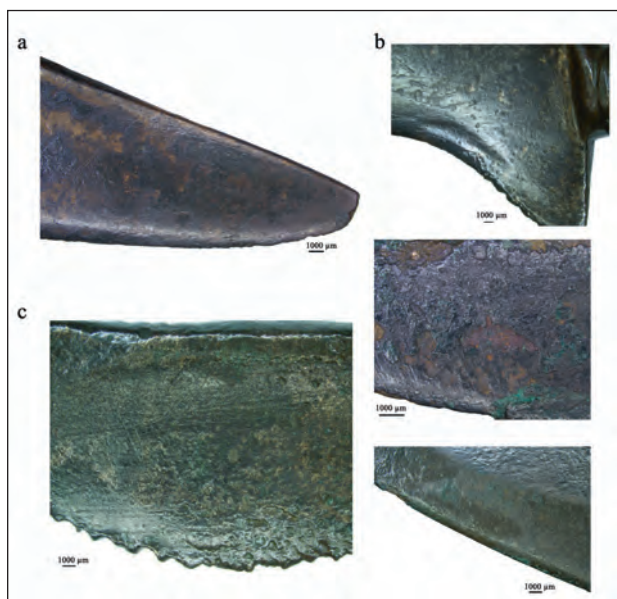


Fig. 13. Use of knives. – a. Notches and sharpened edge of blade tip INZ 27/16. – b. Transition of blunt base to sharpened edge of FHK 65/10, and sharpened edges of INZ 184/6 and INZ 4/14 (downwards). – c. Evidence of reuse on FHK 580/3: transition of blade edge to notches for handle (Photos: N. Mittermair).

and traces linked to conservation work led to the progressive fading of the patterns. The motif is comparable to observed decorative features on knife blades in terms of the application technique, placement on the object and size.

8. Use

For the discussed objects, differing conclusions concerning their use were obtained, as suspected beforehand.

8.1. Knives

The conducted analysis proves that the majority of knives were indeed used before their deposition within the burials. Characteristic traces include the sharpening of the edge, notches along the edge and varying degrees of blade wear. Investigations revealed differing patterns of use. The knife of *Binningen* type (INZ 4/14) shows signs of wear, especially from the middle of the blade towards the tip. *Dašice*-type knives (INZ 27/16, INZ 39/7), the riveted knife (INZ 3/4) and the flange-hilted knife (INZ 106/29) display more intense wear in the middle and rear edge of the blade. However, the reason for or cause of such diverging traces of use remains unclear for now. It might be linked to practical efficiency, to typological or morphological features or to a more individual preference in terms of use. Systematic investigations of knives together with an

experimental approach may prove useful in order to gain more insights.

In hidden-tang knives, the degree of use is equally heterogeneous. Some objects (INZ 184/6, FHK 65/10) show slender blades and diverging courses of the edges compared to the orientation of the backs of the blades in addition to a pronounced recess close to the blade base. Together with scratches and notches, these are strong indicators of constant resharpening and an intense pre-depositional use (Fig. 13/a–b). Two other artefacts (INZ 9/6, FHK 40/5) are striking due to the broad blades and blunt edges, which suggest a distinctly lower degree of use.

Identifiable reuse of blade fragments is visible in Franzhausen-Kokoron (FHK 494/1, FHK 580/3). The rear end is worked into a flat, rectangular tang in order to ensure a secondary phase of use (Fig. 13/c). In the case of FHK 580/3, notches were punched into the upper and bottom side of the tang. An organic handle would have mostly covered the original decoration. The comparable placement within the burial pit indicates no diverging function compared to other knife types.

8.2. Pins

Clear evidence for the use of pins based on metalwork wear analysis was not detected during the course of the analysis, which was to be expected. Slight, regular bends along the total length of pin shafts as observed in some cases (INZ 106/2, FHK 347/6, FHK 553/2, FHK 576/6) might suggest an additional work step for a more practical use, especially if heat exposure as one causal factor can be excluded. Nevertheless, such indications are not conclusive, since such bends may be connected to the deposition itself and/or disturbances of burial features. In some cases, hammering traces show that a manipulation of the shaft axis is linked to the processing. Bends of over 90° possibly hint towards deliberate manipulations before depositing the artefact in the burial, although combined with evidence of heat impact, movement during the pyre-burning process may have an impact as well.

8.3. Razors

The results of use-wear analysis on razors proved to be slightly problematic, since in nearly every case the original surface of the edge was badly or hardly preserved. Due to the circumstances, the work steps for intended use could not be observed in detail. Occasionally, some objects (FHK 494/8) show some traces of edge preparation on the base of the blade. In consequence, the only definite indicator for intensive use is attestable blade wear, best visible

in INZ 11/8, attesting to the highest degree of use in the discussed objects in the middle of the blade.

9. Heat Impact

Although traces of heat impact hinder the determination of metalwork wear on artefacts, interesting insights may be gained about funerary processes and the biography of individual objects by correlating observations with available data on the heat exposure of cremated bones.

9.1. Knives

Investigations of the surfaces of knives show distinct traces of heat impact on five of the knives discussed, all deriving from the Inzersdorf site (INZ 3/4, INZ 4/14, INZ 39/7, INZ 106/29, INZ 192/10). Analysis of the cremated bones show that they were exposed to temperatures of at least 500°C, mostly between 650°C and 700°C. The objects were usually discovered either with cremated human remains or inside the urn in the case of features with an earlier dating (Fig. 14). By contrast, knives found accompanied by pottery vessels or bones show no signs of heat exposure at all. The lack of attestable heat impact in knives from Franzhausen-Kokoron is connected to a shift in the find location within the burials, resulting from the change in burial practices.

9.2. Pins

Eight of the discussed pins show clear marks connected to heat exposure (INZ 17/18, INZ 111/3, INZ 192/9, INZ 220/8, INZ 310/5, FHK 347/6, FHK 553/2, FHK 559/3). The varying degree of heat exposure traces is notable. The evidence ranges from small heat-affected areas (INZ 111/3) to a vesicular surface on the entire object (INZ 192/9). Objects with clear indicators of heat exposure, provided data on temperatures is available (4 burials), were predominantly found within urns. Only in the case of *Spindelkopfnadel* INZ 220/8 was the pin found below the urn. The human remains found in the graves prove heat exposure in the ranges of 550–700°C, 650/700°C being the most common (Fig. 14). The similarities in visible heat impacts attest to the consistent role pins assume in the funerary practices of the Late Bronze Age in the Lower Traisen Valley.

9.3. Razors

The artefacts, although occasionally found within the urn, did not show significant heat impact. In the case of INZ 192/8, deformations and heat exposure indicate the presence and involvement of the object during the pyre-burning process. Interestingly, the razor was discovered placed on the shoulder of the urn rather than within the vessel, suggesting a deliberate selection of material after the heat impact. The



Fig. 14. Varying degrees of heat impact. – a. The discussed metal finds from Inzersdorf burial 192 show a similar vesicular surface (from top to bottom: INZ 192/10, INZ 192/8, INZ 192/9). – b. Pin shafts show partial heat impact concentrated on specific locations (INZ 17/18, FHK 310/5) (Photos: N. Mittermair).

cremated remains of the burials suggest exposure to maximum values of 650°C and 700°C within the pyres. Taking the particularly thin razor blades into account, as well as other analysed objects, such temperatures would have left detectable traces of heat exposure on the metal surface.

10. Discussion

Investigations of metalwork wear conducted on the discussed finds show a variety of production techniques ranging from casting in one- or two-part moulds to lost-wax casting. As far as it was possible to reconstruct the positions of casting jets, these were located at the end of knife tangs or at the tip of razor blades towards the handle or its end. Late Bronze Age knives from Switzerland showed casting jets positioned at the tip of the blades.⁴¹ No equivalent to this was found in the analysed material, and it could suggest variations in production processes connected to different regional workshop clusters. The processing of knives from both cemeteries followed a comparable work sequence, ranging from casting jet removal to surface treatment, annealing and cold working. Interestingly, a few artefacts show differences in the orientation of the blades and the handles, which must have been already designed prior to processing in either the casting mould or model. The modifications and diverging determinable wear of some knife blades attest to varying use patterns that might be tied to the object's form, individual preferences or differing functions.

Tangs were frequently hammered into desired shapes and notches added to optimise their support of organic

⁴¹ SCHÄPPI 2014, 102.

handles. Compared to studies of Late Bronze Age knives from southwestern Poland, the number of identifiable manufacturing marks is significantly higher.⁴² Possibly, the differences in detectable traces are linked to regional variations in applied work procedures. Moreover, marks of wear are visible to a much higher degree and in greater variation than in the case of contemporaneous knives from the hoards of Karmin, Poland.⁴³ It is not clear, however, whether production for an intended depositional context could have influenced the patterns of object use and thus be responsible for diverging observations on wear. Otherwise, regional preferences in metalcraft processes could also be responsible in this case. Since metalwork wear analyses of copper-based artefacts in Austria are not yet common practice, customary practices, parallels and particularities in production, cold working and use are not yet established on a regional level. It may prove sensible to investigate more sites of different archaeological contexts first. Nevertheless, such large-scale observations are interesting and tempting, as numerous Late Bronze Age artefact types show a widespread distribution.

Razors show comparable traces of production and processing to knives. Use of two-part moulds is attested. The area of the handle in particular was often only slightly worked on and this seems to have saved time and effort. The same is true for the often only roughly worked knife tangs, which would have been covered by the handles. Parallels like horizontal striation patterns, sharpening of edges and cold-working procedures attest to a similar preparation of the objects prior to their use. However, the bad preservation of razor blade edges does not provide conclusive results from use-wear analysis of the investigated objects. Only the decorated razor from Inzersdorf shows intensive wear in the central area of the blade. What remains unknown is whether such evidence reflects a more individual use pattern. Another possibility would be a longer period of use, for example due to the individual's age or the object being passed on as gift or inheritance.

In the case of pins, the comprehensive investigation shows comparable production quality within both cemeteries. Here too, different casting techniques are attestable, lost-wax as well as two-part mould casting, through characteristic casting seams or constrictions under the pinhead. However, the frequency of attestable production procedures is significantly lower than in knives. The surfaces are in almost all cases carefully polished, so that hints of casting seams, or cast surface or tool imprints from cold working are

only detectable in a few instances. If identifiable, such marks are detectable under the pinhead, where visibility is limited. In my opinion, the predominantly aesthetic function of the object favours the lack of identifiable traces of production, although the practical choice of improving utility, too, had an influence on the application of work processes. In any case, an increased work effort is visible, when compared to post-casting treatment of knives and razors.

Nevertheless, a considerable number of pins allow conclusions to be drawn about production and processing. In general, the observable production processes seem to follow practical considerations and correlate to morphological traits of the objects rather than being based on the chronological sequence of the two sites or the abilities of the producers. The high number of visible traces deriving from production and processing might be linked to time-efficient work procedures, which coincides with the sometimes imprecise decoration patterns. This is also supported by errors in application, easily identifiable under closer inspection. It remains unclear if the act of timesaving during production, processing and decoration of the pins was consciously perceived to be of greater value than the effort invested in the aesthetic quality of objects. Reasons for such a perspective may be found in a production solely for deposition within the burial. Considering most other investigated artefacts seem to at least suggest an intended use by the attestable cold working, this seems unlikely in my opinion. Another reason for different qualities in processing might be the varying levels of experience of the different craftspeople making them, since the investigated pins vary significantly in identifiable metalwork traces. The number of identified imprecisions created during the application of decoration to knives was significantly lower than in the case of pins.

In general, the application techniques of incised geometrical shapes and lines as well as chased or chiselled motifs is of similar fashion in both cemeteries on knives, razors and pins alike. Overall, the style fits well into the embellishment repertoire of the Late Bronze Age. The geometric decorations on the broadside of blades and blade backs were mostly applied in a post-processing step by incisions. Intensive use and resharpening results in partially faded embellishments. Also, in the case of pins, decorations were mostly applied after processing the objects and only occasionally cast together with the artefacts. A closer inspection of tool imprints in combination with experimental studies might shed more light on the tools used and whether motifs on knives, razors and pins were indeed produced with identical or similar means and equipment. Most common errors in application include irregular or broken lines and overlapping of the ornamentation.

⁴² SYCH 2015, 120.

⁴³ BARON et al. 2019, 69–70.

Although no definite evidence for the use of pins was provided through the metalwork wear analysis, studies of traces of heat exposure, combined with the archaeological information, proved useful. The regular context of pins within the cremation burials together with clear evidence of heat exposure, show a firm cultural integration of the object category in the burial practices attestable in Inzersdorf ob der Traisen and Franzhausen-Kokoron, either in the form of the deceased individual's attire or in the form of additional textile funerary goods. With regard to knives, burial practices during the younger and late Urnfield periods change to a common deposition on top of additional pottery vessels, mostly bowls, together with animal bones. This circumstance apparently led to an exclusion of knives from cremation processes. Since animal bones found within the highly probable context of food offerings were obviously portioned, the discussed knives may very well have been used during such food preparation steps prior to deposition as well. Blade wear, traces of resharpening the edges and notches along the edge were observed in varying stages and intensities on every knife analysed, which attests to functionality and use prior to their deposition, regardless of the exact location within a grave. Such observations make a production solely for deposition in a funerary context in Inzersdorf and Franzhausen-Kokoron rather unlikely. Reworking of blade fragments to rectangular-tanged knives, suggests a mainly practically motivated, deliberate choice instead of producing a new object attested by the covering of typical decoration with organic handles for further use. Such a practice was not encountered in metalwork wear investigations of Late Bronze Age knives from settlement contexts of Switzerland nor in analysed finds from hoards in Poland. Moreover, their deposition within burials at Franzhausen-Kokoron attests that the role of knives within the burial context was not directly linked to a certain type or shape. However, the beginning of rather standardised food offering compositions in Franzhausen-Kokoron might be linked to the hidden-tang knives, so called *Griffdornmesser*.

11. Conclusion

Metalwork wear analyses prove useful even if objects were found in the context of cremation burials. An attestable vesicular surface often does not affect the whole copper-based object, which for such effects to occur must have been exposed to stable temperatures of at least 500–650°C or higher. Frequently, however, objects found within the urns show few to no traces of heat exposure. Even though knives, pins and razors were evidently further worked on post casting, conclusions regarding production techniques and work

steps are still possible. Use of one- and two-part casting moulds as well as the application of the lost-wax casting method are attestable. Occasionally, the 'cast-on' technique was identified for the application of pinheads. Grinding and polishing of surfaces has been identified on most objects, however the degree of effort invested and thoroughness varies, especially depending on the visibility and utility of certain areas. Evidence of use was hardly detected on pins. Knives and razors, on the other hand, have yielded traces of varying degrees of use, provided that objects were sufficiently well preserved. Sharpened blade edges on knives and striation traces on razors also suggest a clear intention for use. Due to the preserved state of edges, observations of notches were not possible for razors, but were attested in considerable number on the analysed knives. In such cases, either intensive use or usage over longer periods seems more likely. Decorations were applied post-processing in most cases, generally more often on pins than on knives and only on one razor.

The analysis of investigated knives, pins and razors from Inzersdorf ob der Traisen and Franzhausen-Kokoron revealed occasional cases of imprecise execution in production, processing and decoration. Nevertheless, the amount of observed metalwork and use patterns on knives and razors seems to suggest, that production of the frequently decorated pins, knives and razors exclusively for deposition in the burial features as grave goods or funerary attire is unlikely.

Acknowledgements

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Appendix A

Grave Features

1. Inzersdorf ob der Traisen (Bz D – Ha B1)

Grave 3

Location: east within western area
 Burial type: urn burial
 Pit shape: burial pit of square shape (0.5 × 0.42 m)
 Preservation: disturbed in modern times
 Pottery: vessel fragments
 Metal finds: riveted tanged knife (INZ 3/4), pin, bracelet, two *Noppenringe*⁴⁴
 Position of discussed finds: inside the urn
 Individuals: 2
 Anthropology: 19–40-year-old possibly female adult (individual I), 0–6-year-old child (individual II)
 Heat exposure: approx. 500°C

Grave 4

Location: east within western area
 Burial type: urn burial with pottery cover
 Pit shape: irregularly round burial pit (0.5 m)
 Preservation: disturbed
 Pottery: bowls, cups and vessels with cylindrical neck east and south of the urn
 Metal finds: knife with a shell handle (INZ 4/14), pendant, fibula fragments, four bracelets, *Noppenringe*, sheet fragments, melted objects⁴⁵
 Position of discussed find: inside the urn
 Individuals: 2
 Anthropology: female adult (individual I), 1–3-year-old child (individual II), both inside urn
 Heat exposure: approx. 650–700°C

Grave 17

Location: east within western area
 Burial type: urn burial with stone cover
 Pit shape: almost oval burial pit (0.75 m)
 Preservation: undisturbed
 Pottery: cups, bowls and vessel with cylindrical neck surrounding urn⁴⁶
 Metal finds: a pin with biconical head (INZ 17/18), four bracelets, *Noppenringe*, fibula fragments, buckled sheet metal pieces, metal fragments
 Position of discussed find: inside the urn
 Individuals: 2
 Anthropology: 35–50-year-old female adult (individual I), 3–9-month-old child (individual II)
 Heat exposure: approx. 650–700°C

Grave 27

Location: northeast within western area
 Burial type: urn burial with stone cover
 Pit shape: almost round burial pit (0.7 m)

Preservation: undisturbed
 Pottery: bowls, cups and vessel with cylindrical neck on top of urn south/southwest⁴⁷
 Metal finds: knife with shell handle and rivets (INZ 27/16), bracelet
 Position of discussed find: inside the urn
 Individuals: 2
 Anthropology: 1–3-year-old child (individual I), adult of unknown sex (individual II)
 Animal bones: burnt bones of sheep/goat inside the urn
 Heat exposure: individual I approx. 500°C, individual II approx. 300°C

Grave 32

Location: east within western area
 Burial type: urn burial, cremation burial
 Pit shape: round burial pit (1.01 m)
 Preservation: undisturbed
 Pottery: various concentrations within the pit, mostly bowls, cups and biconical vessels⁴⁸
 Metal finds: pin (INZ 32/3), bracelet fragments, tubular bronze spirals, bow fibula, fibula fragments, bronze spiral fragments, melted fragments
 Position of discussed find: inside the urn
 Individuals: 2
 Anthropology: 30–50-year-old male adult (individual I) mixed with approx. 24-week-old foetal remains, 20–50-year-old possibly female adult (individual II)
 Heat exposure: approx. 500°C

Grave 39

Location: east within western area
 Burial type: cremation burial possibly with wooden panelling
 Pit shape: rectangular burial pit (2.7 × 1.4 m)
 Orientation: east-west axis
 Preservation: undisturbed
 Pottery: cups characteristic for the older Urnfield period aligned in east-west orientation, vessel with cylindrical neck, knobs and channelling in the west with smaller cups⁴⁹
 Metal finds: fragments of a shell handle knife with rivets (INZ 39/7), pin, bronze vessel of type *Friedrichsrube*
 Position of discussed find: in the southwestern corner mingled with cremated remains together with burnt pottery fragments
 Individuals: 1
 Anthropology: young adult of unknown sex, cremated remains deposited centrally in oval-shaped area

Grave 106

Location: north within western area
 Burial type: cremation burials with wooden panelling
 Pit shape: burial pit of square shape (2.7 × 2.6 m)
 Orientation: east-west axis
 Preservation: disturbed in ancient times
 Pottery: two pottery concentrations in the east and in the west in burial of individual I including a *Baierdorf-Velatiče* cup and other

⁴⁴ FRITZL 2017, 288–291.

⁴⁵ FRITZL 2017, 292–302.

⁴⁶ FRITZL 2017, 312–364.

⁴⁷ FRITZL 2017, 364–372.

⁴⁸ FRITZL 2017, 380–395.

⁴⁹ LOCHNER 2021, 243.

cups, a vessel with cylindrical neck, a supposed drum,⁵⁰ fragmented pottery concentration in the south with bowls
 Metal finds: pin (INZ 106/2), flange-hilted knife (INZ 106/29), hooked belt plate, belt hook, chisel fragment, sickle fragment, decorated metal sheet casing, wire rings, metal rings
 Position of discussed find: mingled with cremated remains in the north (INZ 106/29), in the pit filling (INZ 106/2)
 Individuals: 3
 Anthropology: 16–19-year-old possibly female adult in the north (individual I), 1–6-year-old child in pit filling and mixed with individual I (individual III), 7–12-year-old child (individual II)
 Heat exposure: approx. 650–700°C⁵¹
 Animal bones: burnt bones of sheep/goat in the centre of southern burial

Grave 111

Location: northwest within western area
 Burial type: urn burial
 Pit shape: roughly round burial pit (approx. 0.45 m)
 Preservation: disturbed
 Metal finds: pin with round, ribbed head (INZ 111/3)
 Position of discussed find: inside the urn
 Individuals: 1
 Anthropology: adult of unknown sex

Grave 184

Location: north within the southern area
 Burial type: urn burial
 Pit shape: round burial pit (0.55 m)
 Preservation: disturbed
 Pottery: pottery fragments and a cup in the west
 Metal finds: hidden-tang knife (INZ 184/6), single-edged razor (INZ 184/3)
 Position of discussed find: inside the urn (INZ 184/3), together with animal bones in the east (INZ 184/6)
 Individuals: 1
 Anthropology: < 50-year-old male mature
 Animal bones: left front leg of sheep/goat in anatomical position in the east

Grave 192

Location: north within the southern area
 Burial type: urn burial
 Pit shape: round burial pit (0.5 m)
 Preservation: slightly disturbed
 Pottery: vessel fragments in the north, bowl on top of urn, cup inside urn and fragments in the pit filling
 Metal finds: riveted razor (INZ 192/8), pin fragment (INZ 192/9), riveted tanged knife (INZ 192/10)
 Position of discussed find: on the urn's shoulder (INZ 192/8, INZ 192/10), inside the urn (INZ 192/9)
 Individuals: 1
 Anthropology: 40–69-year-old mature male

Grave 198

Location: northwest within the southern area

Burial type: urn burial
 Pit shape: round burial pit (0.45 m)
 Preservation: disturbed in modern times
 Pottery: dislocated fragments in burial pit, vessel with cylindrical neck inside the urn
 Metal finds: pin (INZ 198/3), copper-based metal ringlets
 Position of discussed find: inside the urn
 Individuals: 1
 Anthropology: adult of unknown sex

Grave 220

Location: east within the southern area
 Burial type: urn burial
 Pit shape: round burial pit (0.45 m)
 Preservation: disturbed in modern times
 Pottery: dislocated pottery fragments partly burnt, a bowl inside the urn
 Other finds: bone beads inside the urn
 Metal finds: belt hook, a knife blade (INZ 220/6), pin (INZ 220/8, INZ 220/9), melted metal droplet
 Position of discussed find: below the urn
 Individuals: 1
 Anthropology: possibly female adult

Grave 250

Location: east within western area
 Burial type: urn burial
 Pit shape: roughly round burial pit (0.5 m)
 Preservation: disturbed in modern times
 Pottery: bowl, small pot and cup within pit filling, cup with horizontal channelling inside urn
 Other finds: bone beads inside the urn
 Metal finds: pin (INZ 250/4)
 Position of discussed finds: inside the urn
 Individuals: 1
 Anthropology: possibly female adult

Grave 310

Location: northeast within the southern area
 Burial type: urn burial
 Pit shape: round burial pit (0.5 m)
 Preservation: undisturbed
 Pottery: vessel fragments in pit filling, bowl inside the urn
 Metal finds: pin (INZ 310/5)
 Position of discussed find: below the urn
 Individuals: 1
 Anthropology: 30–50-year-old possibly male adult

2. Inzersdorf ob der Traisen (Ha B)

Grave 9

Location: southwest within the grave concentration
 Burial type: urn burial
 Pit shape: oval burial pit (0.8 m in diameter)
 Preservation: disturbed in modern times
 Pottery: various bowls in the south
 Metal finds: hidden-tang knife (INZ 9/6)
 Position of discussed find: with the pottery concentration in the south
 Individuals: unknown

⁵⁰ POMBERGER 2011, 34. – LOCHNER 2015, 346.

⁵¹ FRITZL 2017, 402.

Grave 11

Location: south of the grave concentration
 Burial type: urn burial (possibly with cover)
 Pit shape: round burial pit (approx. 0.7 m)
 Preservation: disturbed in modern times
 Pottery: base fragments of a bowl on top of urn, cup and two bowls northwest of the urn
 Metal finds: single-edged razor (INZ 11/8)
 Position of discussed find: in the north of the pit
 Individuals: unknown

3. Franzhausen-Kokoron (Ha A2/B1 – Ha B3)**Grave 40**

Location: northwest within the western grave concentration
 Burial type: urn burial
 Pit shape: roughly oval pit (approx. 0.89 m)
 Preservation: undisturbed
 Remarks: intersecting another pit dated to the Early Bronze Age⁵²
 Pottery: assemblage of pottery vessels, including pots, bowls and cups in the south, conical bowl in the east
 Metal finds: hidden-tang knife (FHK 40/5), melted pin shaft
 Position of discussed finds: together with the biconical bowl in the east
 Individuals: 1
 Anthropology: probably male adult
 Heat exposure: approx. 550°C

Grave 65

Location: northwest within the western grave concentration
 Burial type: urn burial
 Pit shape: roughly oval burial pit (0.75 m)
 Preservation: undisturbed
 Pottery: mainly cups, bowls and vessels with cylindrical neck placed from east to west at the bottom of the pit surrounding urn, two graphited bowls, one of which has a funnel-shaped neck⁵³
 Metal finds: hidden-tang knife (FHK 65/10), pin fragments
 Position of discussed find: on top of bowl
 Individuals: 1
 Anthropology: male adult (89 g human remains outside of urn)
 Heat exposure: approx. 650–700°C
 Animal bones: pig and sheep/goat were found scattered within the bowl, other vessels and on the bottom of the burial pit

Grab 263

Location: south within the western grave concentration
 Burial type: urn burial
 Pit shape: oval burial pit (0.55 m)
 Preservation: undisturbed
 Pottery: bowl and beaker with funnel-shaped neck south of urn
 Metal finds: pin with a small vase-shaped head (FHK 263/6), decorated pin fragment (FHK 263/9)
 Position of discussed find: inside the urn
 Individuals: 1

Anthropology: female adult
 Heat exposure: approx. 550°C
 Animal bones: possibly belonging to sheep/goat mixed with human remains, finding of a shell of a common central European river mussel (*Unio crassus*) below one of the bowls

Grave 276

Location: west of the centrally situated cremation place
 Burial type: urn burial
 Pit shape: amorphous burial pit (1.45 × 0.87 m)
 Preservation: slightly disturbed in modern times
 Pottery: concentration east and southeast of the urn⁵⁴
 Metal finds: crescent-shaped razor with ring handle (FHK 276/1), hidden-tang knife (FHK 276/2)
 Position of discussed find: together with bowl and animal bones (FHK 276/2), unknown (FHK 276/1)
 Individuals: 1
 Anthropology: uncertainly classified as male adult
 Heat exposure: approx. 650–700°C
 Animal bones: left foreleg of sheep/goat in the southwest of the burial pit (green discolouration)

Grave 347

Location: south within the western grave concentration
 Burial type: urn burial
 Pit shape: burial pit of roughly round shape (0.6 m)
 Preservation: slightly disturbed in modern times
 Pottery: decorated vessel with cone-shaped neck, a bowl with inverted rim, and fragments of a pot visibly impacted by heat situated in the south of the pit⁵⁵
 Metal finds: pin with small vase-shaped head (FHK 347/6), iron knife, bracelet, perforated pin, fishing hook, belt buckle, ring, copper-based metal buttons
 Position of discussed find: inside the urn
 Individuals: 2
 Anthropology: possibly female adult (individual I), 1–6-year-old child (individual II)
 Heat exposure: approx. 650–700°C
 Animal bones: undetermined animal bones in the filling of the pit mixed with cremated human remains

Grave 383

Location: north within the western grave concentration
 Burial type: urn burial
 Pit shape: roughly rectangular in shape (0.86 × 0.82 m)
 Preservation: slightly disturbed in modern times
 Pottery: several cups, beakers and bowls east and south of urn⁵⁶
 Metal finds: hidden-tang knife (FHK 383/6), single-edged razor, belt buckle
 Position of discussed find: on top of a bowl in the south (FHK 383/6)
 Individuals: 1
 Anthropology: possibly female adult

⁵² LOCHNER, HELLETSCHMID 2016, http://hw.oeaw.ac.at/franzhausen-kokoron2/output/Grab_40.xml.

⁵³ LOCHNER, HELLETSCHMID 2016, http://hw.oeaw.ac.at/franzhausen-kokoron2/output/Grab_65.xml.

⁵⁴ LOCHNER, HELLETSCHMID 2016, http://hw.oeaw.ac.at/franzhausen-kokoron2/output/Grab_276.xml.

⁵⁵ LOCHNER, HELLETSCHMID 2016, http://hw.oeaw.ac.at/franzhausen-kokoron2/output/Grab_347.xml.

⁵⁶ LOCHNER, HELLETSCHMID 2016, http://hw.oeaw.ac.at/franzhausen-kokoron2/output/Grab_383.xml.

Heat exposure: approx. 300–550°C

Grave 444

Location: north within the western grave concentration

Burial type: urn burial

Pit shape: round burial pit (0.97 m)

Preservation: poorly preserved

Pottery: pottery fragments, bowl with inverted rim and a decorated beaker with cone-shaped neck in the east⁵⁷

Metal finds: decorated hidden-tang knife (FHK 444/4)

Position of discussed find: together with animal bones on pit bottom

Individuals: 1?

Anthropology: undetermined

Heat exposure: approx. 650–700°C

Animal bones: right foreleg, left hind leg as well as rib parts of a sheep (green discolouration), single rib of a pig

Grave 494

Location: northeast within the western grave concentration

Burial type: urn burial

Pit shape: round burial pit (0.7 m)

Preservation: slight disturbance in modern times

Pottery: bowl with inverted rim, a cup with cone-shaped neck⁵⁸

Metal finds: knife with partial rectangular tang (FHK 494/1), crescent-shaped razor (FHK 494/8)

Position of discussed find: inside a cup (FHK 494/1), inside urn (FHK 494/8)

Individuals: 1

Anthropology: male adult

Heat exposure: approx. 650–700°C

Grave 553

Location: southeast within the western grave concentration

Burial type: urn burial

Pit shape: round burial pit (0.55 m)

Preservation: disturbed in modern times

Pottery: miniature vessels including a bowl, beaker and perforated lid⁵⁹

Metal finds: pin with a big vase-shaped head (FHK 553/2), ring

Position of discussed find: inside the urn

Individuals: 1

Anthropology: 25–35-year-old possibly male adult

Heat exposure: approx. 550°C

Grave 559

Location: southeast within the western grave concentration

Burial type: urn burial

Pit shape: roughly rectangular burial pit (0.55 × 0.49 m)

Preservation: disturbed in modern times

Pottery: graphited, conical bowl and vessel with cone-shaped neck in the northwest⁶⁰

Metal finds: pin with small vase-shaped head (FHK 559/3)

Position of discussed find: inside the urn

Individuals: 1

Anthropology: female adult

Heat exposure: approx. 650–700°C

Grave 576

Location: southeast within the western grave concentration

Burial type: urn burial, cremation burial

Pit shape: rectangular trench surrounding the oval burial pit (0.9 m)

Preservation: disturbed in modern times

Pottery: bowls and cups concentrated in the southwest⁶¹

Metal finds: pin with small vase-shaped head (FHK 576/6)

Position of discussed find: inside the urn

Individuals: 2

Anthropology: possibly male adult in the urn (individual I), uncertainly classified as female adult spatially concentrated in pit filling (individual II)

Heat exposure: approx. 550°C

Grave 580

Location: south within the western grave concentration

Burial type: urn burial

Pit shape: oval burial pit (0.9 m)

Preservation: slightly disturbed in modern times

Pottery: graphited cup in the north, a bowl with inverted rim and a vessel with cone-shaped neck in the southwest⁶²

Metal finds: small knife with partial, rectangular tang (FHK 580/3), pin fragment

Position of discussed find: in a bowl

Individuals: 1

Anthropology: undetermined

Heat exposure: approx. 650–700°C

Grave 581

Location: south within the western grave concentration

Burial type: urn burial

Pit shape: oval shape (0.6 m)

Preservation: disturbed in modern times

Pottery: a bowl with inverted rim and a graphited cup in the south with a graphited bowl inside⁶³

Metal finds: pin with small vase-shaped head (FHK 581/4)

Position of discussed find: inside the urn

Individuals: 1

Anthropology: female adult

Heat exposure: approx. 650–700°C

⁵⁷ LOCHNER, HELLETSCHMID 2016, http://hw.oeaw.ac.at/franzhausen-kokoron2/output/Grab_444.xml.

⁵⁸ LOCHNER, HELLETSCHMID 2016, http://hw.oeaw.ac.at/franzhausen-kokoron2/output/Grab_494.xml.

⁵⁹ LOCHNER, HELLETSCHMID 2016, http://hw.oeaw.ac.at/franzhausen-kokoron2/output/Grab_553.xml.

⁶⁰ LOCHNER, HELLETSCHMID 2016, http://hw.oeaw.ac.at/franzhausen-kokoron2/output/Grab_559.xml.

⁶¹ LOCHNER, HELLETSCHMID 2016, http://hw.oeaw.ac.at/franzhausen-kokoron2/output/Grab_576.xml.

⁶² LOCHNER, HELLETSCHMID 2016, http://hw.oeaw.ac.at/franzhausen-kokoron2/output/Grab_580.xml.

⁶³ LOCHNER, HELLETSCHMID 2016, http://hw.oeaw.ac.at/franzhausen-kokoron2/output/Grab_581.xml.

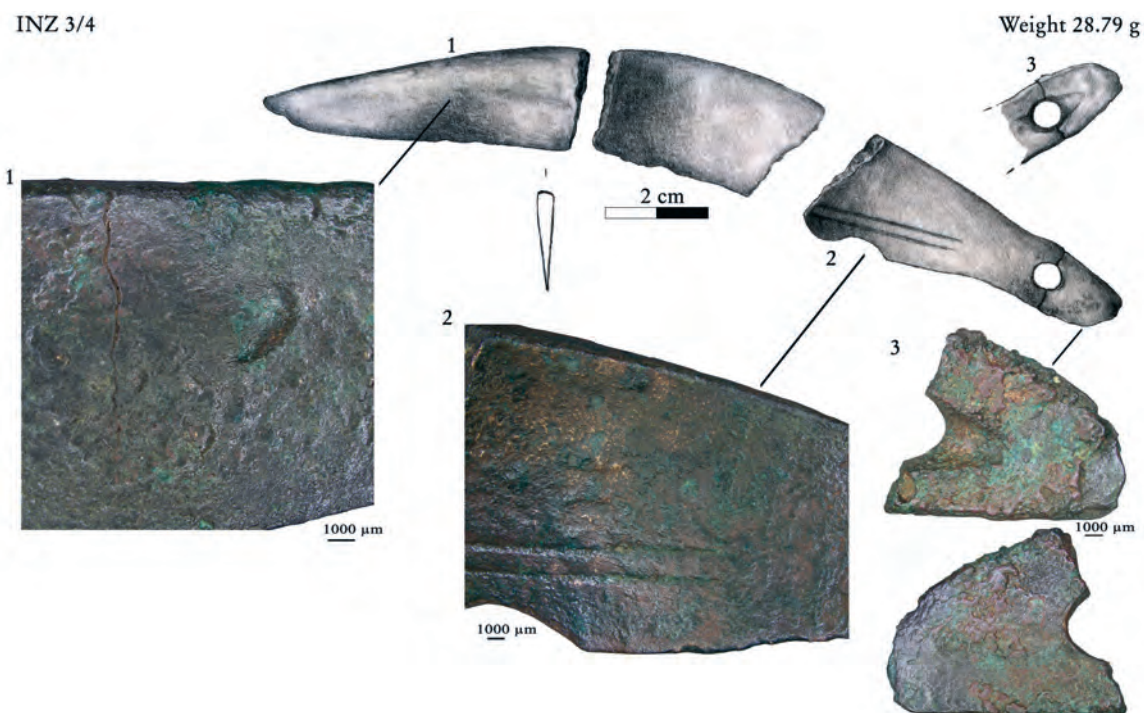


Fig. 15. Riveted knife INZ 3/4. – 1. Fissure from cold working and surface affected by heat exposure. – 2. Parallel incisions and hammered edge with small-sized notches towards the hilt. – 3. The rivet prepared in the casting mould/model suggests a single-part mould or lost-wax casting (Drawing: M. Imam. – Photos: N. Mittermair).

Grave 596

Location: southeast within the western grave concentration
 Burial type: urn burial
 Pit shape: oval burial pit (0.65 m)
 Preservation: undisturbed
 Pottery: two vessels in the east, a bowl from inside the urn⁶⁴
 Metal finds: pin with small vase-shaped head (FHK 596/8), pin fragments (FHK 596/12, FHK 596/13), bracelet, ring
 Position of discussed finds: from a vessel in the east (FHK 596/8, FHK 596/12), inside the urn (FHK 596/13)
 Individuals: 1
 Anthropology: female adult
 Heat exposure: approx. 650–700°C

Grave 605

Location: east within the western grave concentration
 Burial type: urn burial, cremation burial
 Pit shape: round burial pit (0.75 m)
 Preservation: undisturbed
 Pottery: bowl with inverted rim, a cup with cylindrical neck and a bowl with cylindrical neck with another cup inside in the southeast, a bowl with cylindrical neck on top, bottom of a vessel in the pit filling⁶⁵

Metal finds: pin with small vase-shaped head (FHK 605/5), an awl and a double-crescent-shaped razor (FHK 605/7)
 Position of discussed finds: inside the urn
 Individuals: 2
 Anthropology: 25–35-year-old male adult (individual I) in the urn, female adult (individual II) in pit filling
 Heat exposure: approx. 550°C

Appendix B

Object Descriptions

1. Knives

INZ 3/4 (Fig. 15)

Typology: *Riegsee* type
 Dating: beginning of older Urnfield period (Bz D – early Ha A1)
 Distribution: southeastern Germany, eastern Alpine region, north-eastern Austria, Moravia
 Length: 12.7 cm
 Width: 0.3 cm
 Height: 1.9 cm
 Preservation: fragmented; 99 %; modern damage on edge at tip and towards hilt
 Production: due to even reverse, production in single-part mould likely; rivet hole already prepared in casting mould
 Processing: vertical fissures in surface starting from the back of blade prove hardening procedure even though possibly increased due to heat exposure; blade close to edge shows marks of hammering

⁶⁴ LOCHNER, HELLENSCHMID 2016, http://hw.oew.ac.at/franzhausen-kokoron2/output/Grab_596.xml.

⁶⁵ LOCHNER, HELLENSCHMID 2016, http://hw.oew.ac.at/franzhausen-kokoron2/output/Grab_605.xml.

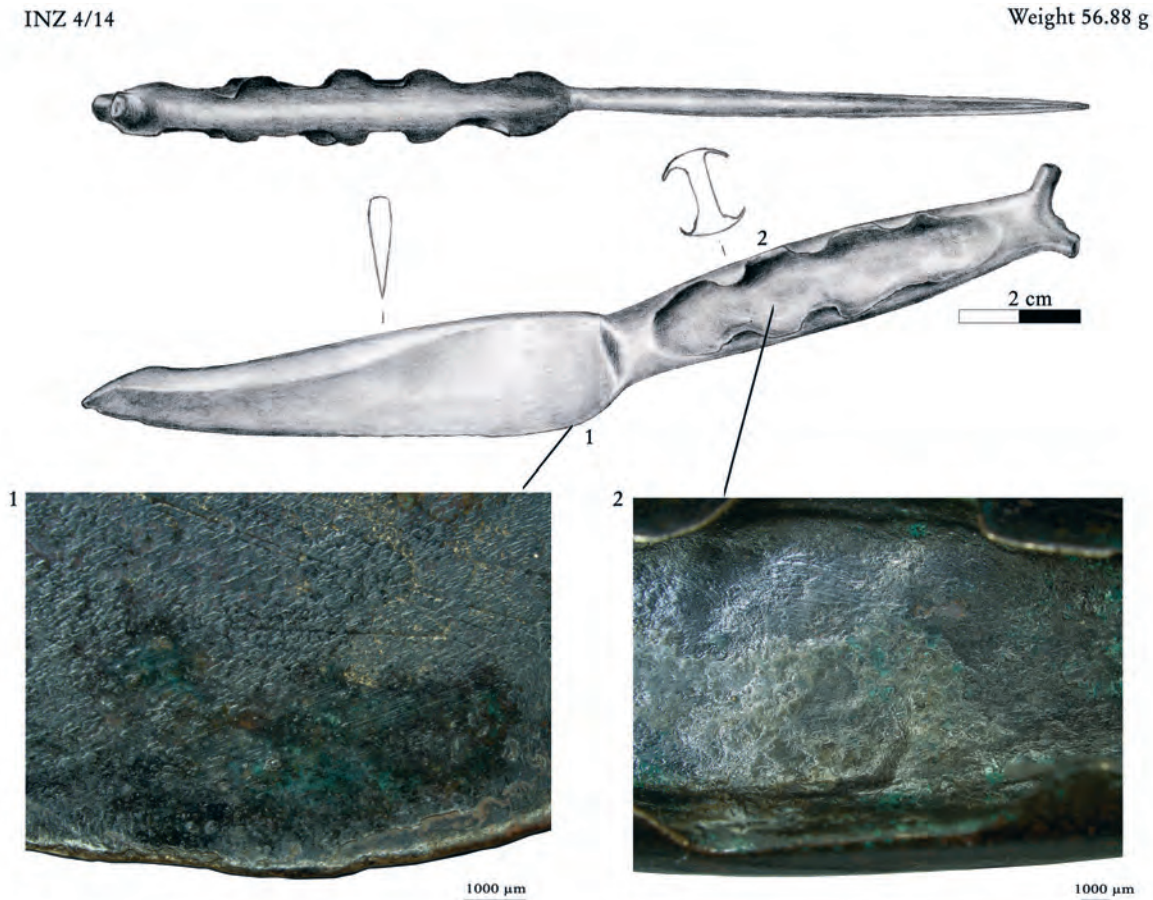


Fig. 16. Knife with shell handle INZ 4/14. – 1. Rather blunt edge at the end towards the hilt. Visible irregular striations along the blade derive from use rather than polishing or sharpening. – 2. Negative hammer marks within the shell handle (Drawing: M. Imam. – Photos: N. Mittermair).

Decoration: post-processing application of 2 parallel incisions

Use: small-sized notches in blade edge; blade wear visible in unpronounced blade base running from tang

Deformation: nearly 180° bend in object; surfaces of break show fewer signs of heat exposure; post-funerary manipulation of object possible

Heat exposure: vesicular surface on most of the fragments; side not depicted in drawing more exposed to heat

Corrosion: high rate of surface corrosion

INZ 4/14 (Fig. 16)

Typology: *Bimningen/Courtavant* type B

Dating: beginning of older Urnfield period (Bz D – Ha A1)⁶⁶

Distribution: Switzerland, western Alpine region⁶⁷

Length: 16.3 cm

Width: 1.1 cm

⁶⁶ WILLVONSEDER 1939, 271.

⁶⁷ ŘÍHOVSKÝ 1972, 37. Southwest Germany was mentioned as the main distribution area; however, equivalent objects were not found in HOHLBEIN 2016. Unless stated otherwise, information about the dating and distribution of knives derives from ŘÍHOVSKÝ 1972.

Height: 2.0 cm

Remarks: blade faceted and blade back showing protrusion close to tip rather typical for *Baierdorf* knives

Preservation: 97 %; modern damage on tip of blade and edges

Production: seam on inside of incomplete ring knob; asymmetrically worked transition from blade to handle and end of handle shell; averted axis of blade to horizontal axis of handle prepared in mould/model;

6 arched fixings for handle inlay already prepared in casting mould

Processing: casting surface removed; post-casting treatment of surface including polishing except in handle shell; hammering marks within handle shell; faceted blade part and blade close to edge show marks of hammering; post-casting revision of 6 arched fixings for inserted handle inlay; drawing of object shows last processed side of object

Use: sharpened edge from tip to half of blade; low number of notches; abrasions on blade edge visible, especially towards the tip

Heat exposure: a few areas with a vesicular surface beginning to form on knife blade

Corrosion: slight surface corrosion within handle shell

Conservation: corrosion removal traces on back of blade

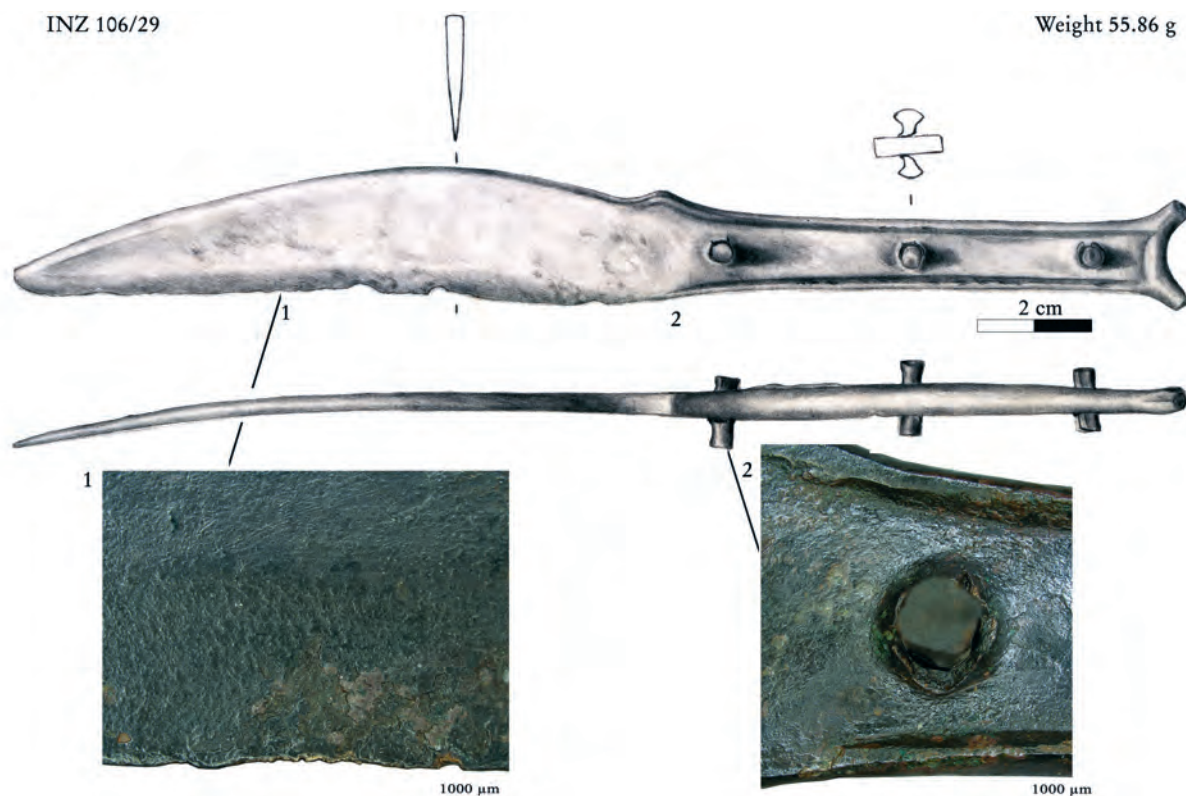


Fig. 17. Flange-hilted knife INZ 106/29. – 1. Notches along the edge and irregular striations along the blade suggest use. – 2. Three rivet holes punched through the same side, while rivets are made of similar-looking multi-edged fragments. Ends of flanges hammered flat towards the blade (Drawing: M. Imam. – Photos: N. Mittermair).

INZ 106/29 (Fig. 17)

Typology: *Baierdorf* type

Variant: A

Dating: beginning of older Urnfield period (Bz D – Ha A1)

Distribution: Alpine region, southwest Germany, southern Bohemia, northern Austria

Length: 20.4 cm

Width: 1.2 cm (with rivets)

Height: 2.3 cm

Preservation: 97 %; modern damage along edge

Processing: post-casting treatment of surface including polishing; flat hammered flanges at beginning of blade; 3 rivets pierced through the handle from the same side; hammering of lower blade part; faceted blade tip

Use: sharpened edge; medium- and small-sized notches in the edge; blade wear visible in midsection and unpronounced blade base; occasional scratches on blade surface

Deformation: slight bend in the blade area

Heat exposure: visible heat exposure on surface at blade tip on drawn side

Corrosion: visible surface corrosion in some areas

Conservation: traces of corrosion removal visible at the end of the flange on the reverse

INZ 27/16 (Fig. 18)

Typology: *Dašice* type

Dating: older Urnfield period (Ha A1)

Distribution: eastern central Europe

Length: 18.4 cm

Width: 1.4 cm (with rivets)

Height: 1.9 cm

Preservation: 100 %; slight modern damage along edge

Production: excess material of casting process inside the ring knob; visible casting features at transition from knob to handle; averted blade axis to horizontal axis of handle prepared in mould/model; 3 rivet holes prepared in mould/model

Processing: post-casting treatment of surface including polishing except in handle shell; hammering marks at handle; rivets pierced through the shell from the same side; hammering traces on lower part of blade; blade facet

Use: sharpened edge; small-sized notches close to blade base and tip; blade wear in midsection; scratches with various orientations (parallel, diagonal to edge) and lengths (approx. 1–3 cm)

Corrosion: slight surface corrosion within handle shell

Conservation: corrosion removal traces on blade part

INZ 39/7 (Fig. 19)

Typology: *Dašice* type

Dating: older Urnfield period (Ha A1)⁶⁸

Distribution: eastern central Europe

Length: 18.5 cm

⁶⁸ LOCHNER 2013, 16.

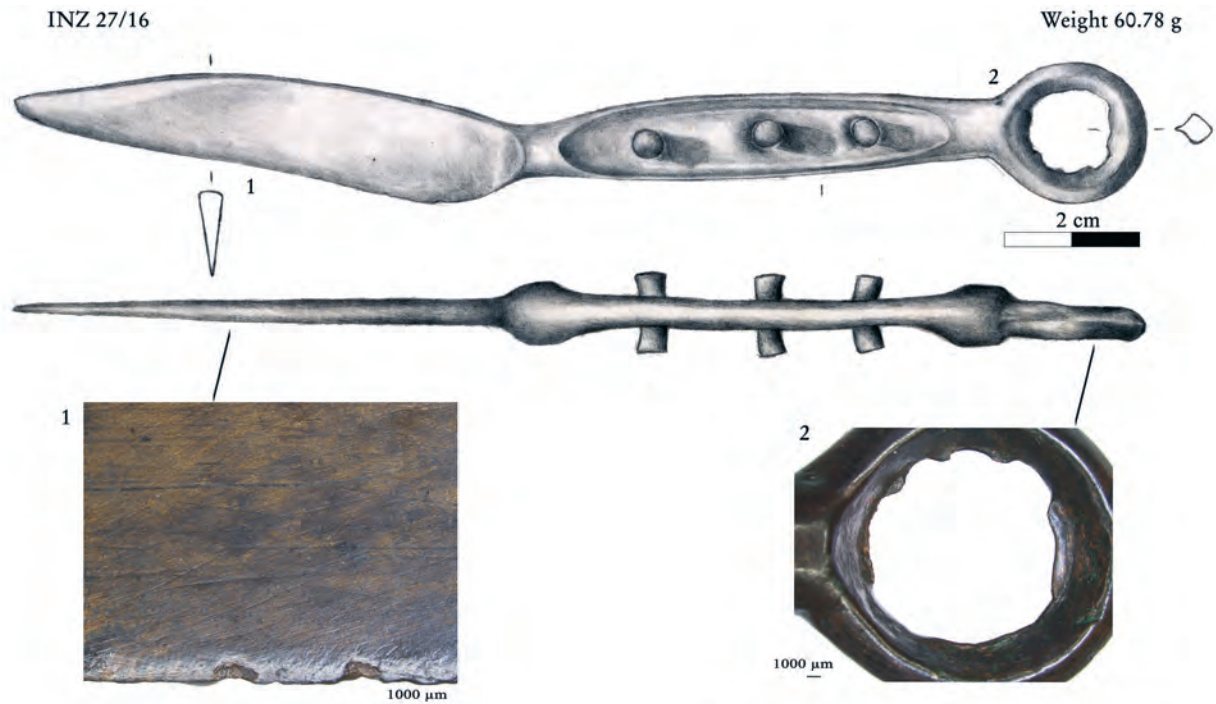


Fig. 18. Knife with riveted shell handle INZ 27/16. – 1. Fine, diagonal striations along the edge are proof of (re-)sharpening of the blade. Irregular striations likely derive from use. Similar notches in close proximity may suggest patterns in use or derive from post-casting treatment like hardening. – 2. Roughly removed excess material from casting inside the ring (Drawing: M. Imam. – Photos: N. Mittermair).

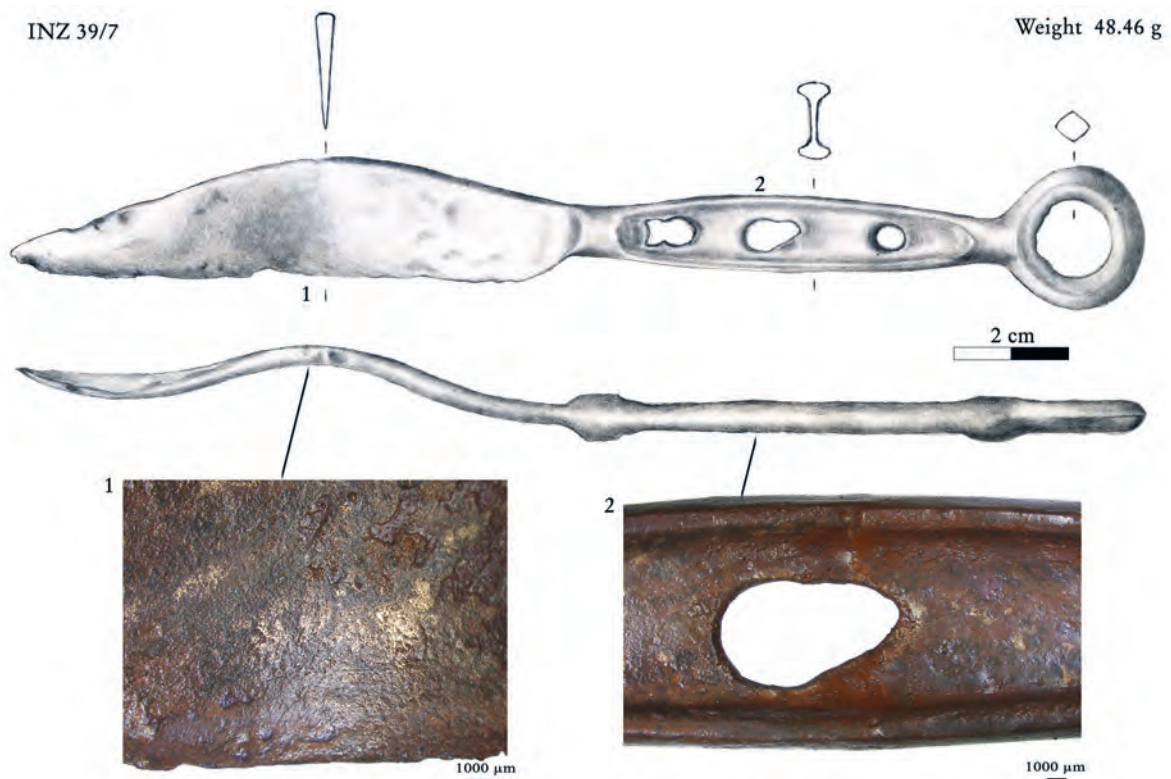


Fig. 19. Knife with riveted shell handle INZ 39/7. – 1. Vesicular surface on blade superimposes the barely visible horizontal striations either deriving from (re-)sharpening the blade or use. – 2. The casting defect visible at the second rivet resulted in a wider rivet hole than planned (Drawing: M. Imam. – Photos: N. Mittermair).

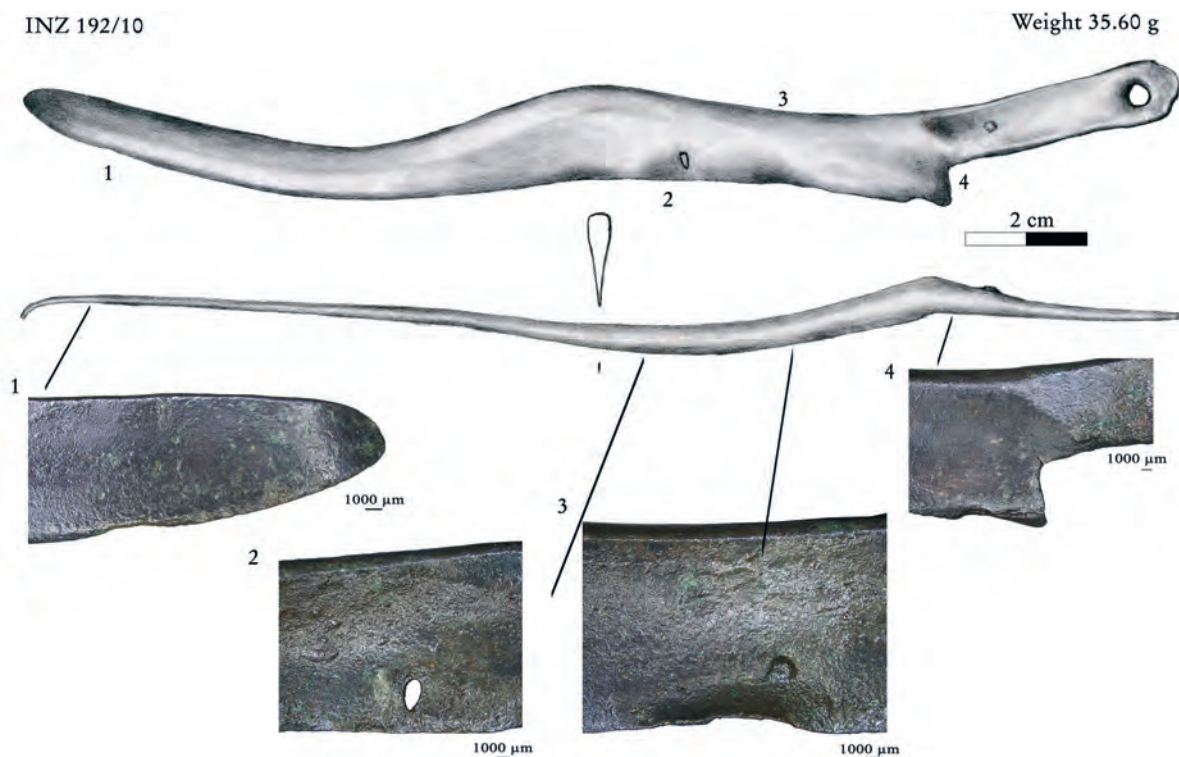


Fig. 20. Knife with riveted tang INZ 192/10. – 1. The bent blade tip may derive from the pyre-burning process. – 2. The cavity in the blade is a result of a cold-shut casting defect, the size may have increased during the pyre-burning process. – 3. The bent edges, as in 4, are a result of the heat impact affecting the microstructure in thinner sections. – 4. Blade area exposed to hammering visible. The fissure between the handle and the hilt is a result of the cold-working process, possibly increased by the impact of heat (Drawing: M. Imam. – Photos: N. Mittermair).

Width: 0.7 cm

Height: 1.7 cm

Preservation: 100 %

Production: excess material of casting process inside the ring knob;

3 rivet holes prepared in mould/model; casting flaws at 2 rivet holes

Processing: inner and outer rivet pierced through handle from same side; evidence of hammering at blade base

Use: sharpened edge; small-sized notches in areas with less heat impact; low degree of blade wear

Deformation: bend in blade

Heat exposure: vesicular surface and high degree of heat exposure

Corrosion: high degree of surface corrosion

Conservation: corrosion removal traces on whole object

INZ 192/10 (Fig. 20)

Typology: *Dašice* type

Dating: older Urnfield period (Ha A)

Distribution: eastern central Europe, equivalent find from Rýděč⁶⁹

Length: 18.9 cm

Width: 0.6 cm

Height: 1.5 cm

Preservation: 100 %

Production: rivet hole in tang prepared in mould/model; curved course of blade in part prepared in mould/model

Processing: post-casting surface treatment including polishing of blade; high number of hammering marks on tang; traces of hammering on whole blade including faceted blade, especially intense on lower part of blade; curved course of blade further expanded during hardening of blade; fissure at junction of handle and blade due to hardening procedures possibly expanded by use and/or heat impact

Use: blade sharpened close to tip; low number of small-sized notches; blade wear visible towards the tip

Deformation: slight bend in object

Heat exposure: vesicular surface on tang and blade on both sides; hole within blade

Corrosion: surface corrosion visible in some areas around the tang

Conservation: corrosion removal traces on whole object; acrylic resin residue

INZ 184/6 (Fig. 21)

Typology: *Hadersdorf* type

Dating: beginning of younger Urnfield period (Ha A2/B1)⁷⁰

Distribution: Alpine region, Silesia, Bohemia, Moravia, Hungary, Slovakia

Length: 15.7 cm

⁶⁹ JIRAŇ 2002, 35.

⁷⁰ According to ŘÍHOVSKÝ 1972, 63–64, decorated *Hadersdorf*-type knives date to later phases in general (Ha B1 – Ha B3). However, the number of uncovered finds of this type within the discussed region in general is quite low.

INZ 184/6

Weight 39.30 g

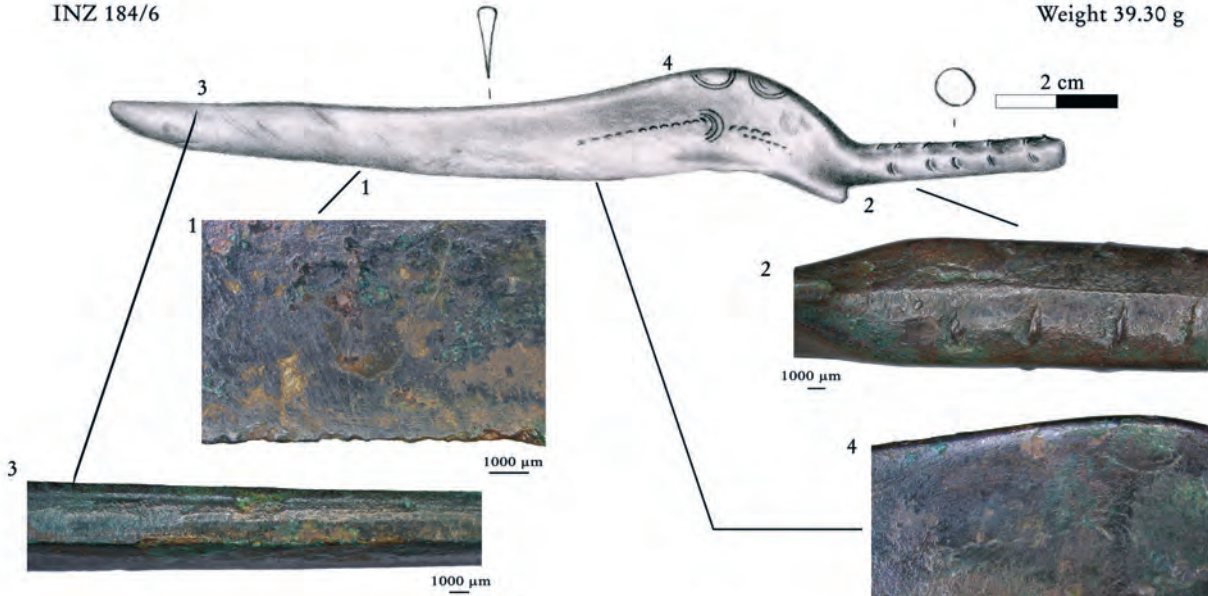


Fig. 21. Hidden-tang knife INZ 184/6. – 1. Detectable traces of conservation treatment, surface corrosion on blade and a high number of notches along the edge are visible. Striations along the edge attest to the (re-)sharpening of the blade. – 2. Casting seam on the tang roughly removed towards the blade, possibly by hammering. – 3. The channel-like indentation on the back of the blade derives from repeated hammering along the upper parts of the blade. – 4. Decoration lines and concentric circle motifs punched into the back of the blade (Drawing: M. Imam. – Photos: N. Mittermair).

FHK 65/10

Weight 73.07 g

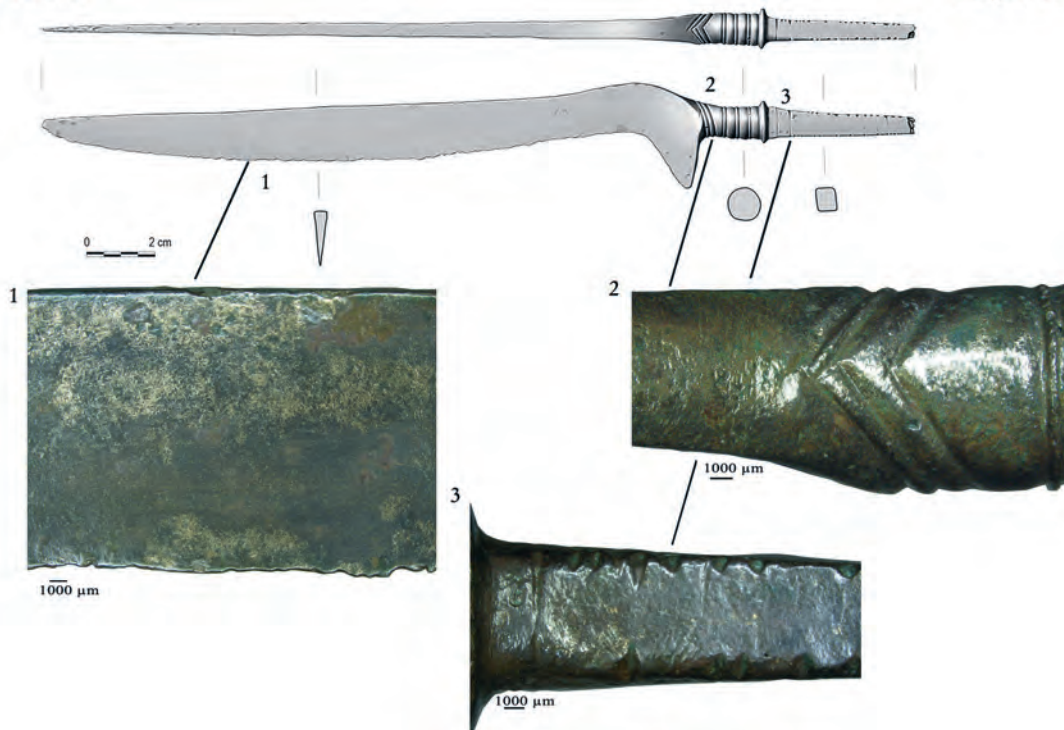


Fig. 22. Hidden-tang knife FHK 65/10. – 1. Damage includes small-sized notches along the edge and on the transition to the back of the blade, possibly from cold working and use. – 2. The irregularity in decoration of the transition to the hilt is one example of the inaccurate application of decoration on either the casting model or the artefact. – 3. Rectangular tang hammered into shape, indentations along the corners to improve the grip on the handle (Drawing: F. Siegmeth. – Photos: N. Mittermair).

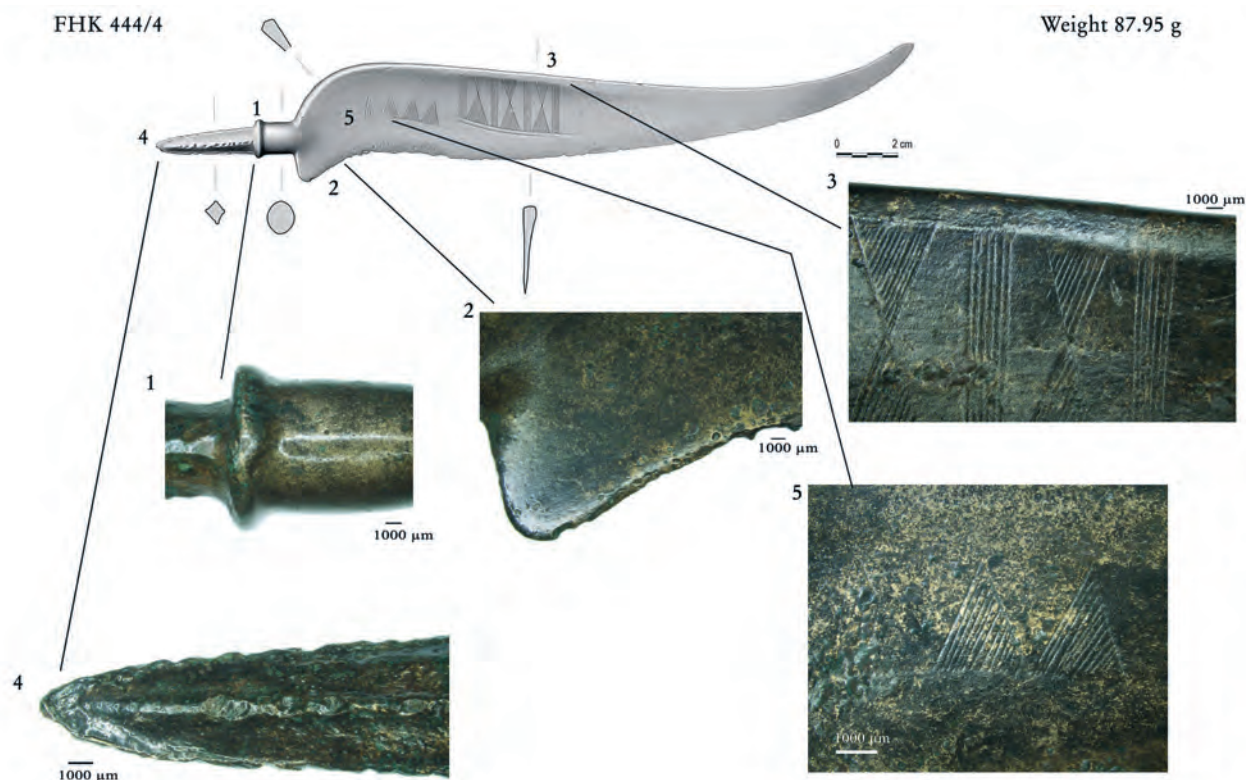


Fig. 23. Hidden-tang knife FHK 444/4. – 1. Asymmetry at the hilt results from not fully aligned casting mould parts. – 2. Clearly visible transition from striations at sharpened edge to the blunt end of the blade. – 3. Carefully incised decorations superimposed by horizontal striations, possibly from (re-)sharpening the blade or use. Transition to the back of the blade in the area hammered flat in a subsequent step. – 4. The casting seam of the tang was left in order to punch in notches to improve the grip on the handle. – 5. The varying degrees of accuracy between 3 and the hatchings in the standing triangle motif may indicate application by different craftspeople (Drawing: F. Siegmeth. – Photos: N. Mittermair).

Width: 0.7 cm

Height: 1.7 cm

Preservation: 100 %

Production: casting jet originally at end of round tang; shrinkage defects at surface of tang

Processing: removal of casting jet and hammering of tang end; post-casting treatment of surface including polishing; rows of indentations for ideal support of shaft; evidence of hammering of blade part towards tip; hammering marks along lower part of blade; drawn side is last worked edge side; reorientation of blade tip course through hammering

Use: sharpened edge; diagonal scratches at tip of blade; blade wear visible at end of blade and towards tip

Decoration: post-processing application of incised decoration; decoration identical on both sides; concentric half circles close to back of blade; concentric half circle and row of small arched incisions running parallel to back of blade⁷¹

Corrosion: visible surface corrosion

Conservation: corrosion removal traces visible on back of blade

⁷¹ Parallels in decoration choice are interestingly found in a *Hadersdorf*-type knife from Kostelec nad Orlicí, see JIRAŇ 2002, 53 and Pl. 16/176.

FHK 65/10 (Fig. 22)

Typology: *Wien-Leopoldsberg* type

Dating: younger Urnfield period (Ha B1 – Ha B2)

Distribution: central Europe

Length: 25.4 cm

Width: 0.7 cm

Height: 2.5 cm

Preservation: 100 %

Production: casting jet originally located at end of tang; possibly produced in lost-wax casting; small round cavities around decoration and below handle

Processing: removal of casting jet; post-casting treatment of surface including polishing; horizontal resharpener striations; originally round tang hammered into rectangular shape (vertical fissures in surface); indentations punched into corners to support shaft; last hammering of edge on side not drawn

Use: nearly no original edge left; high number of medium- and small-sized notches attestable along edge; intensive blade wear visible at back of blade near base

Decoration: decoration of intermediate piece between blade and handle cast; error attestable

Heat exposure: initial stages of vesicular surface on blade base

Corrosion: surface corrosion visible on tip

Conservation: corrosion removal traces visible on back of blade

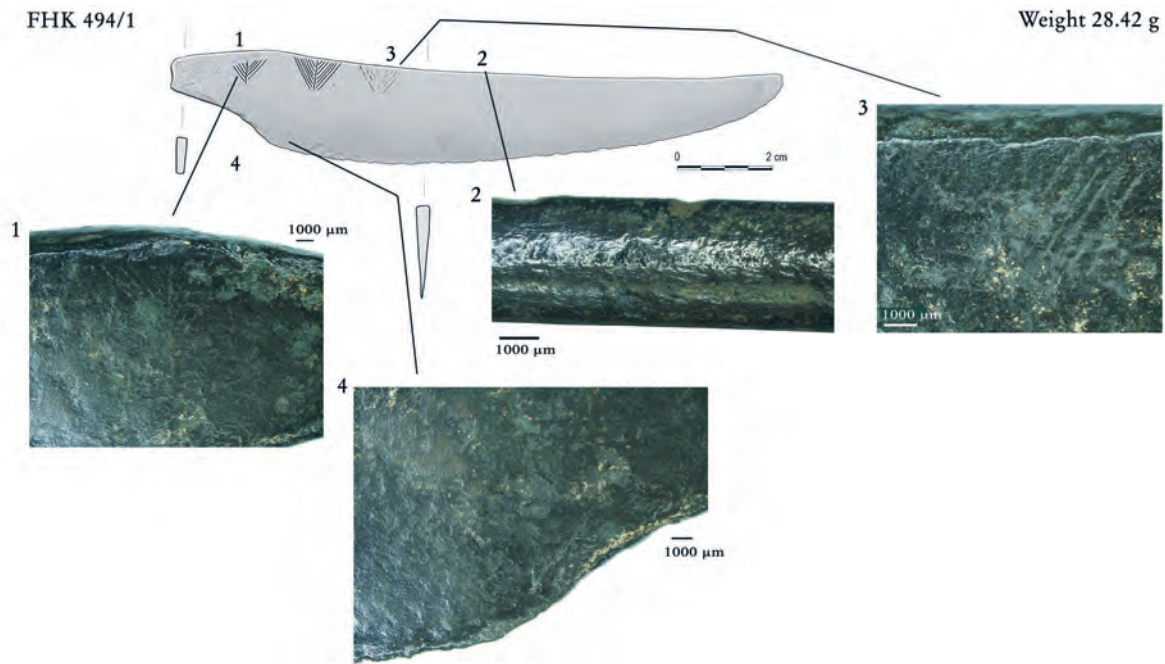


Fig. 24. Knife with rectangular tang FHK 494/1. – 1. Transition to rehammered angle of back of blade. Abraded hatched triangle motifs may be an indication of repeated cold working and sharpening. – 2. Evidence of hammering during cold-working procedure on the upper blade parts. – 3. Detail of abraded decorations. – 4. Evidence of hammering at the transition towards the blade during reworking of the blade fragment into the tang section (Drawing: F. Siegmeth. – Photos: N. Mittermair).

FHK 444/4 (Fig. 23)

Typology: *Wien-Leopoldsborg* type

Dating: younger Urnfield period (Ha B1 – Ha B2)

Distribution: central Europe

Length: 25.3 cm

Width: 0.9 cm

Height: 2.8 cm

Preservation: 100 %

Production: not completely overlapping two-part casting mould resulted in mismatch of end of intermediate piece; casting seam remains visible at beginning of tang

Processing: post-casting treatment of surface including polishing; indentation punched into casting seam remains and carination at tang to support shaft better; course of blade amplified by hammering; traces of hammering on blade especially along lower part of blade; last worked edge on drawn side

Use: sharpened edge; high number of medium- and small-sized notches

Decoration: post-processing application of incised decoration; 5 standing triangles with hatchings parallel to blade edge; alternating 5 parallel lines and x-shaped decoration with diagonal hatching; both motifs are positioned above 1 or 2 parallel arched grooves

Deformation: slight bend in blade tip corrected

Corrosion: surface corrosion

FHK 494/1 (Fig. 24)

Typology: knife with partial rectangular tang

Dating: younger Urnfield period (Ha A2/B1 – Ha B3)

Distribution: central Europe

Remark: originally likely a *Stillfried*-type knife

Length: 13.0 cm

Width: 0.4 cm

Height: 1.9 cm

Preservation: 100 %

Processing: post-casting treatment of surface including polishing; parallel running groove due to hammering visible on back of blade; reworking of blade fragment; hammering marks on tang and back of tang show; last processed side lies plane on even surface (side not drawn); hammering of lower part of blade

Use: high number of medium- and small-sized notches; blade wear visible towards the tip

Decoration: post-processing 3 incised triangular motifs starting from the back of blade with line running through the middle and mirrored hatching; decorations run beneath the shaft handle (derive from original object)

Corrosion: slight surface corrosion

Conservation: patina removed from a few areas

FHK 580/3 (Fig. 25)

Typology: small knife with partial rectangular tang

Dating: younger Urnfield period (Ha A2/B1 – Ha B3)

Length: 7.1 cm

Width: 0.2 cm

Height: 1.3 cm

Preservation: 100 %

Processing: post-casting treatment of surface including polishing; reworking of blade fragment; hammering marks on tip of blade, end of blade, tang; indentations punched into tang for ideal support of handle

Use: high number of small-sized notches in blade; intense blade wear visible towards the tip; a few scratches oriented parallel or diagonally to blade course (approx. 0.5–1.5 cm)

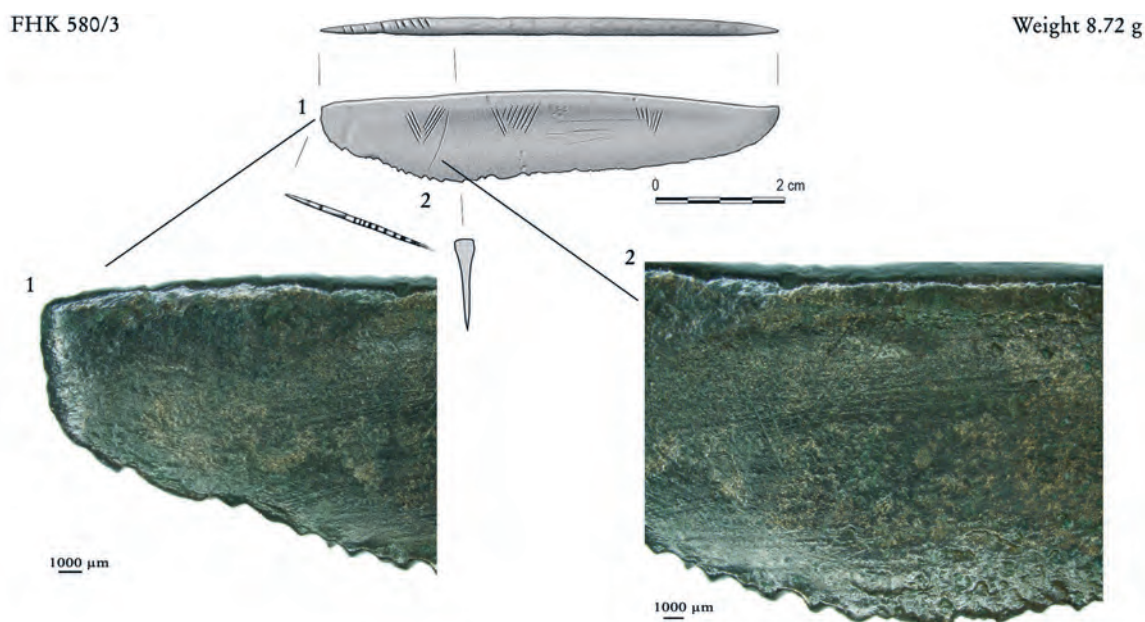


Fig. 25. Knife with rectangular tang FHK 580/3. – 1. Reworked blade fragment into tang through hammering indirectly visible through lack of striations. – 2. Intense wear of blade visible due to intense horizontal striations and abraded decorations deriving from repeated sharpening. Indented notches for the organic hilt (Drawing: F. Siegmeth. – Photos: N. Mittermair).

Decoration: post-processing application of incised triangular motifs starting from back of blade; varying decoration within triangles (chevrons, hatching)

INZ 9/6 (Fig. 26)

Typology: *Baumgarten* type

Dating: younger and late Urnfield period (Ha B1 – Ha B3)

Distribution: central Europe

Length: 21.9 cm

Width: 1.0 cm

Height: 2.9 cm

Preservation: 100 %

Production: casting seams at beginning of tang suggest two-part casting mould; end of both halves casting mould not symmetrical; casting feature at blade base; open cavity on tang

Processing: post-processing treatment of surface including polishing; horizontal striation pattern at upper blade part; traces of hammering on blade; negative marks of tool traces on bottom and top side of junction of intermediate part and tang to remove excess casting material; hammering traces on tang; indentations punched on corners of rhombic tang

Use: blunt edge; distinctly low number of small-sized notches

Corrosion: some areas with visible surface corrosion

Conservation: traces of corrosion removal

FHK 40/5 (Fig. 27)

Typology: *Baumgarten* type

Dating: younger and late Urnfield period (Ha B1 – Ha B3)

Distribution: central Europe

Length: 30.3 cm

Width: 1.4 cm

Height: 3.8 cm

Preservation: fragmented; modern break; 99 %

Production: cast in two-part mould due to visible remains of casting seams at beginning of tang; casting moulds lacking overlap visible in cross-section of tang; shrinkage defects visible on blade; intermediate piece between blade and tang and tang itself

Processing: negative marks of tool traces on bottom side of junction of intermediate part and tang to remove excess casting material; notches punched into corners of rhombic tang; post-casting treatment of surface including polishing; horizontal resharpening striations along blade; hammering of tang resulted in deformation of shrinkage defects; evidence of hammering on blade

Use: slightly sharpened edge towards blade tip; high number of medium- and small-sized notches

Deformation: slight bend in blade tip close to break

Corrosion: slight surface corrosion visible

Conservation: a few areas with visible corrosion removal on back of blade; acrylic resin residue

FHK 276/2 (Fig. 28)

Typology: *Baumgarten* type

Dating: younger and late Urnfield period (Ha B1 – Ha B3)

Distribution: central Europe

Length: 28.4 cm

Width: 1.2 cm

Height: 3.2 cm

Preservation: 100 %

Production: traces of casting jet removal on tang end; cavity in tang

Processing: post-casting surface treatment including polishing; tang hammered into rhombic form; notches punched into corners; high number of fissures from high degree of hardening of the blade

Use: high number of large and medium-sized notches along edge

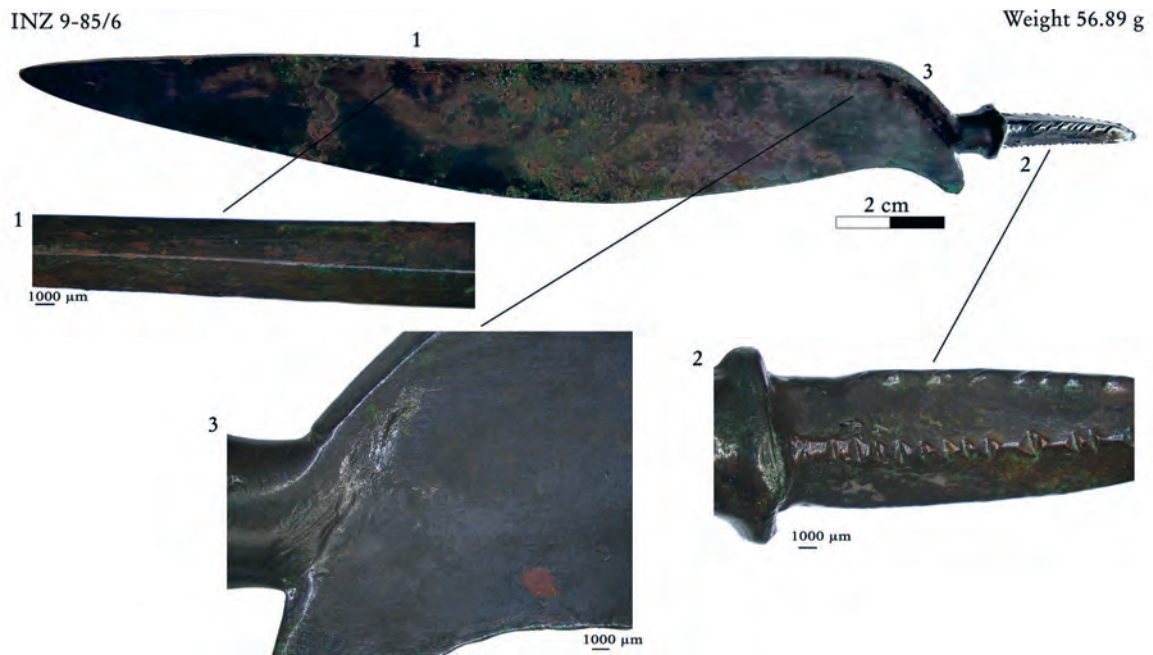


Fig. 26. Hidden-tang knife INZ 9/6 from the Ha B cemetery of Inzersdorf. – 1. Faceted back of blade likely prepared in casting model/mould. – 2. Casting seams used for application of notches for the hilt. – 3. Negative tool marks of hammer from cold working. Along the blade, regular horizontal striations from polishing the surface (Photos: N. Mittermair).

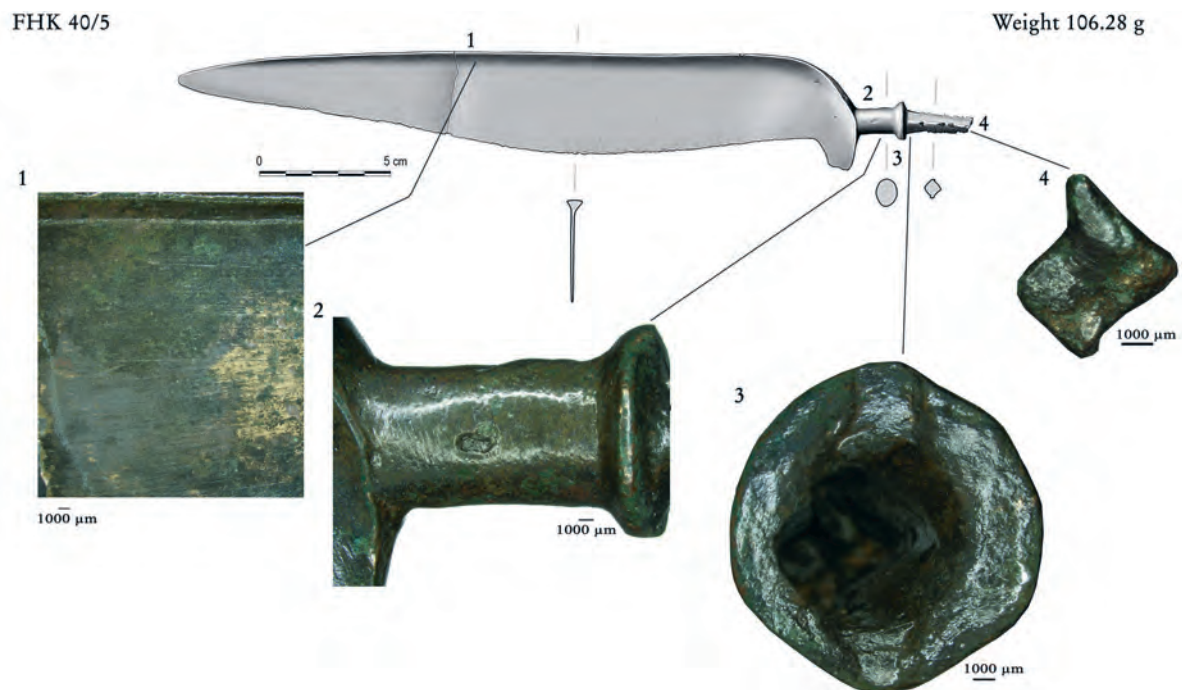


Fig. 27. Hidden-tang knife FHK 40/5. – 1. Regular horizontal striations attest to polishing of the surface. Irregular, deeper striations are likely linked to object use. – 2. The visible cavity between the tang and the blade is a result of the casting process and was not fully removed. – 3. Roughly removed casting seams are visible at the end of the tang and attest to casting in a two-part mould. – 4. The asymmetric tang end also indicates production in a two-part mould (Drawing: F. Siegmeth. – Photos: N. Mittermair).

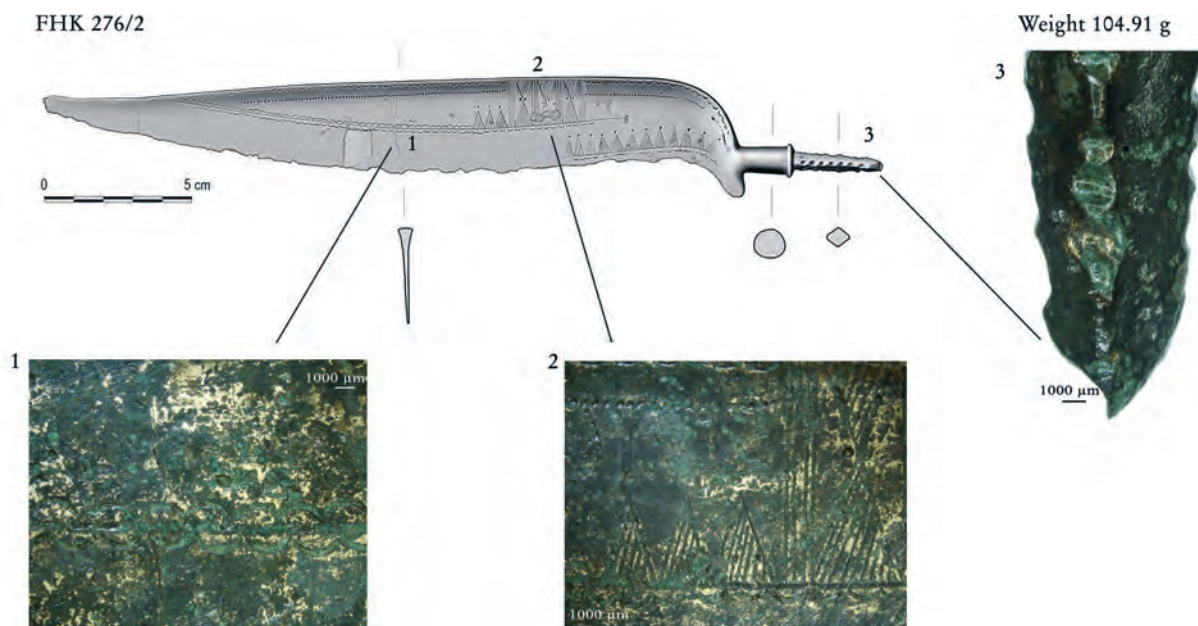


Fig. 28. Hidden-tang knife FHK 276/2. – 1. The high number of vertical fissures is evidence for intensive cold working. – 2. Detail of incised and indented geometrical decorations. Slight overlaps in the right part of the picture within the incised line shows the production sequence: first the horizontal line was incised, then the half-circles were indented in a row. Afterwards the hatchings of the triangles followed (Drawing: F. Siegmeth. – Photos: N. Mittermair).

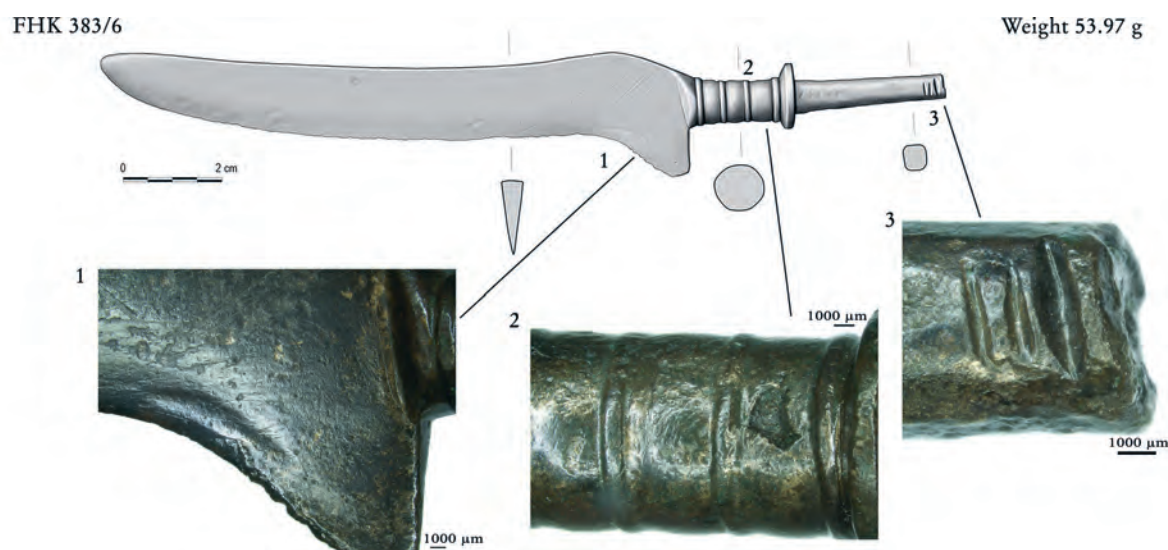


Fig. 29. Hidden-tang knife FHK 383/6. – 1. Characteristic indentation above the edge. Irregular striations suggest object use. – 2. Cavities between the hilt and the blade result from the casting process. Due to the shape of the hilt, the lost-wax technique is likely. – 3. Negative tool marks at the end of the tang from the removal of the casting jet. Visible traces of hammering below (Drawing: F. Siegmeth. – Photos: N. Mittermair).

Decoration: post-casting application of incised decoration on both blade sides; arched line incised following the course of the edge; incised triangles with hatching; x-shaped incisions with hatching and 4 vertical lines on upper side, alternating; fine dotted lines pierced into blade side; slightly larger dots above or next to triangle tips; arched rows of bows punched into surface with same tool
Corrosion: high degree of surface corrosion

Conservation: visible corrosion removal traces; patina partly removed; acrylic resin residue

FHK 383/6 (Fig. 29)

Typology: *Baumgarten* type

Dating: younger and late Urnfield period (Ha B1 – Ha B3)

Distribution: central Europe



Fig. 30. Decorated blade fragment INZ 220/6. – 1. Detail of incised parallel lines. – 2. Hammering evident on blade. – 3. The large notch in the edge shows signs of treatment, a continued object use is likely. Horizontal striations attest to (re-)sharpening. – 4. Detailed view of incised zig-zag lines (Drawing: F. Siegmeth. – Photos: N. Mittermair).

Length: 17.3 cm

Width: 1.8 cm

Height: 2.2 cm

Preservation: 100 %

Production: original position of casting jet located at end of tang; cavities on intermediate section and tang

Processing: negative tool marks from removal of casting jet; post-casting surface treatment including polishing of blade and intermediate section; hammering marks on blade especially lower part; horizontal resharpening striations visible on surface; tang hammered into rectangular shape

Use: sharpened blade; small and medium-sized notches along edge; diagonal scratches on blade surface

Decoration: segments of intermediate section prepared in mould/model

INZ 220/6 (Fig. 30)

Typology: fragment of a hidden-tang knife

Dating: younger and late Urnfield period (Ha B)

Distribution: central Europe

Length: 9.9 cm

Width: 0.4 cm

Height: 2.3 cm

Preservation: approx. 40 %

Processing: post-casting treatment of surface; horizontal resharpening striations; traces of hammering along faceted blade; especially in lower part

Use: large notch in edge; small-sized notches along edge

Decoration: post-casting application of incisions on back of blade; alternating motifs of transversely running parallel lines; x-shaped decorations and herringbone patterns

Deformation: bent blade c. 100°

Corrosion: visible surface corrosion

2. Pins

INZ 106/2 (Fig. 31)

Typology: *Mostkovice* type

Dating: Baierdorf phase (Bz D)⁷²

Distribution: Silesia, Bohemia, Moravia

Length: 13.2 cm

Ø Head: 1.0 cm

Ø Shaft: 0.35 cm

Preservation: 100 %

Production: flutes run irregularly due to casting-mould or casting-model production

Processing: casting surface and other production traces removed

Deformation: slightly bent pin shaft

Corrosion: a few areas with visible surface corrosion

Conservation: corrosion removal traces; acrylic resin residue

⁷² ŘÍHOVSKÝ 1979, 156–157. Unless stated otherwise, information about the typology, dating and distribution of the discussed pins was acquired from ŘÍHOVSKÝ 1979.

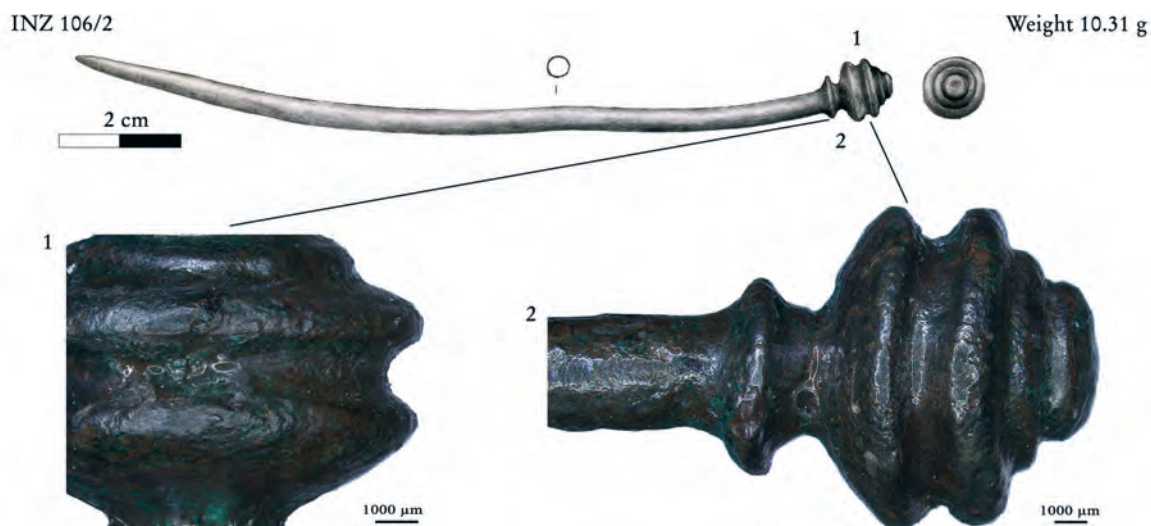


Fig. 31. Pin with *böhmischer Profilierung*. – 1. Detail of the incision shows no tool mark, making a preparation in a casting model likely. – 2. The irregular course of the incised line on the pinhead and no trace of the ‘cast-on’ technique affirm suspicions of production by the lost-wax technique. Dried remains of the resin-based liquid which was applied to the metal surface in the course of conservation work (Drawing: M. Imam. – Photos: N. Mittermair).

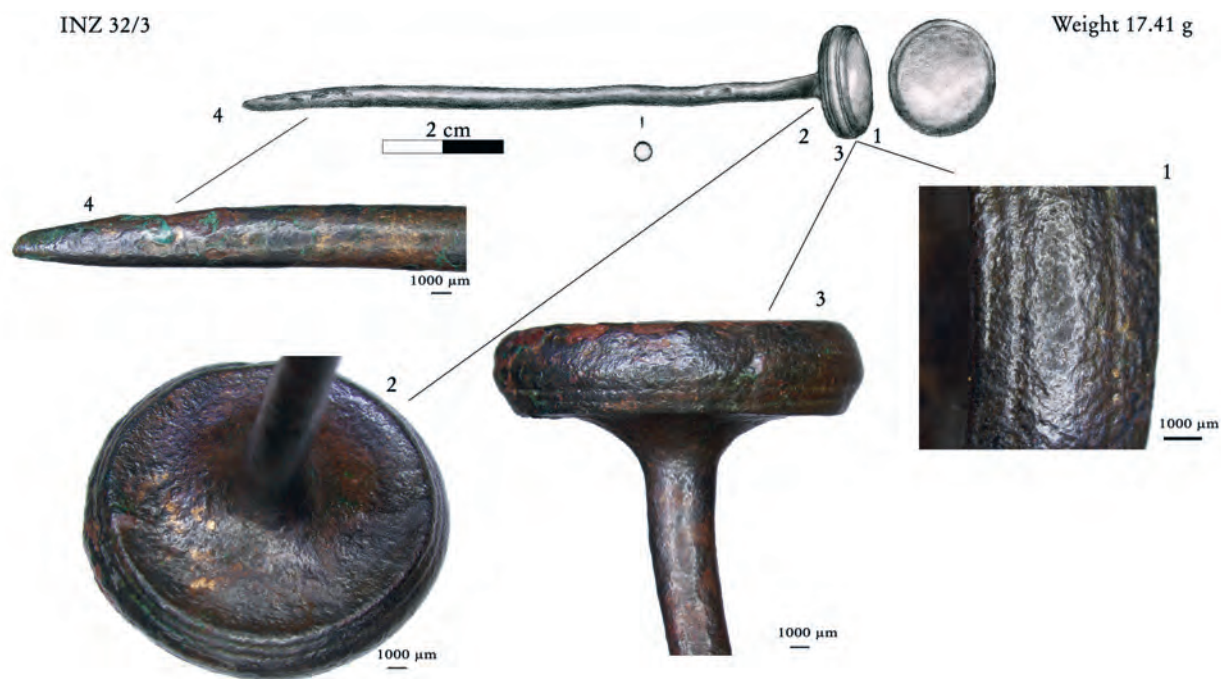


Fig. 32. Pin with seal-shaped head INZ 32/3. – 1. Detail of incised parallel lines on pinhead side. – 2. The surface on the bottom of the pinhead shows a less treated surface. – 3. Small-sized cavity in the side of the pinhead not fully removed by surface treatment. – 4. Detail of increased surface corrosion at the tip (Drawing: M. Imam. – Photos: N. Mittermair).

INZ 32/3 (Fig. 32)

Typology: *Petschaftkopfnadel*

Variant: with biconical head

Dating: older Urnfield period (Bz D – Ha A2)

Distribution: south Germany, Bohemia, Austria

Length: 10.8 cm

Ø Head: 1.9 cm

Ø Shaft: 0.35 cm

Preservation: 100 %

Production: shrinkage effects visible on the side of the head

Processing: post-casting treatment of surface; the surface on the slightly retracting bottom surface shows no traces of fine polishing

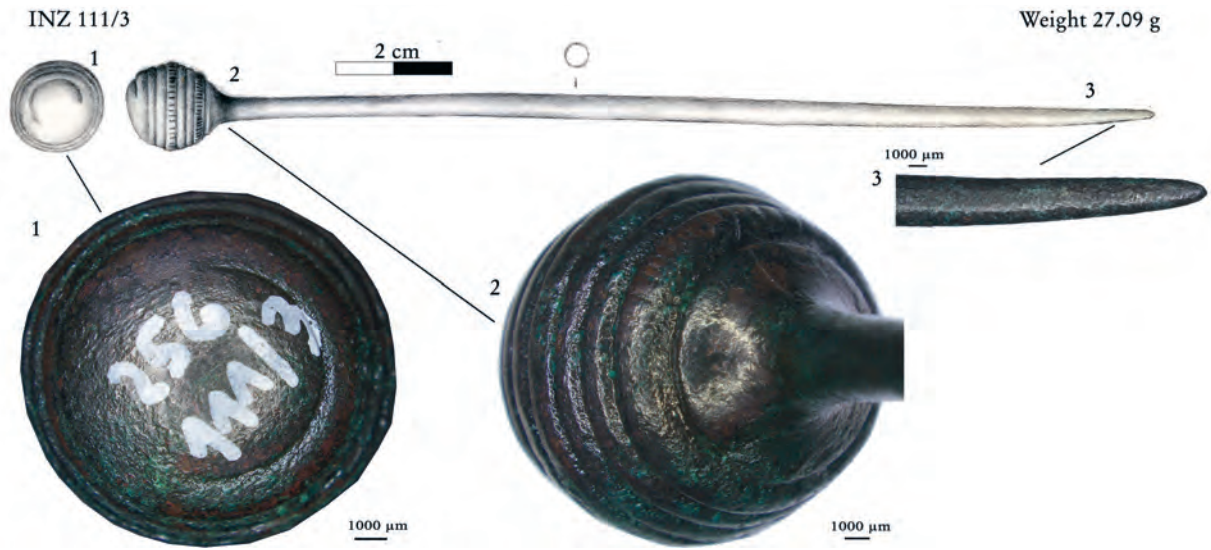


Fig. 33. Pin with globular head INZ 111/3. – 1. Asymmetry in the top view suggests production of the pinhead or possibly of the entire object in a two-part mould. – 2. Detail of pinhead from a bottom view. Original casting surface visible in the rib indentations. – 3. Detail of unworked tip (Drawing: M. Imam. – Photos: N. Mittermair).

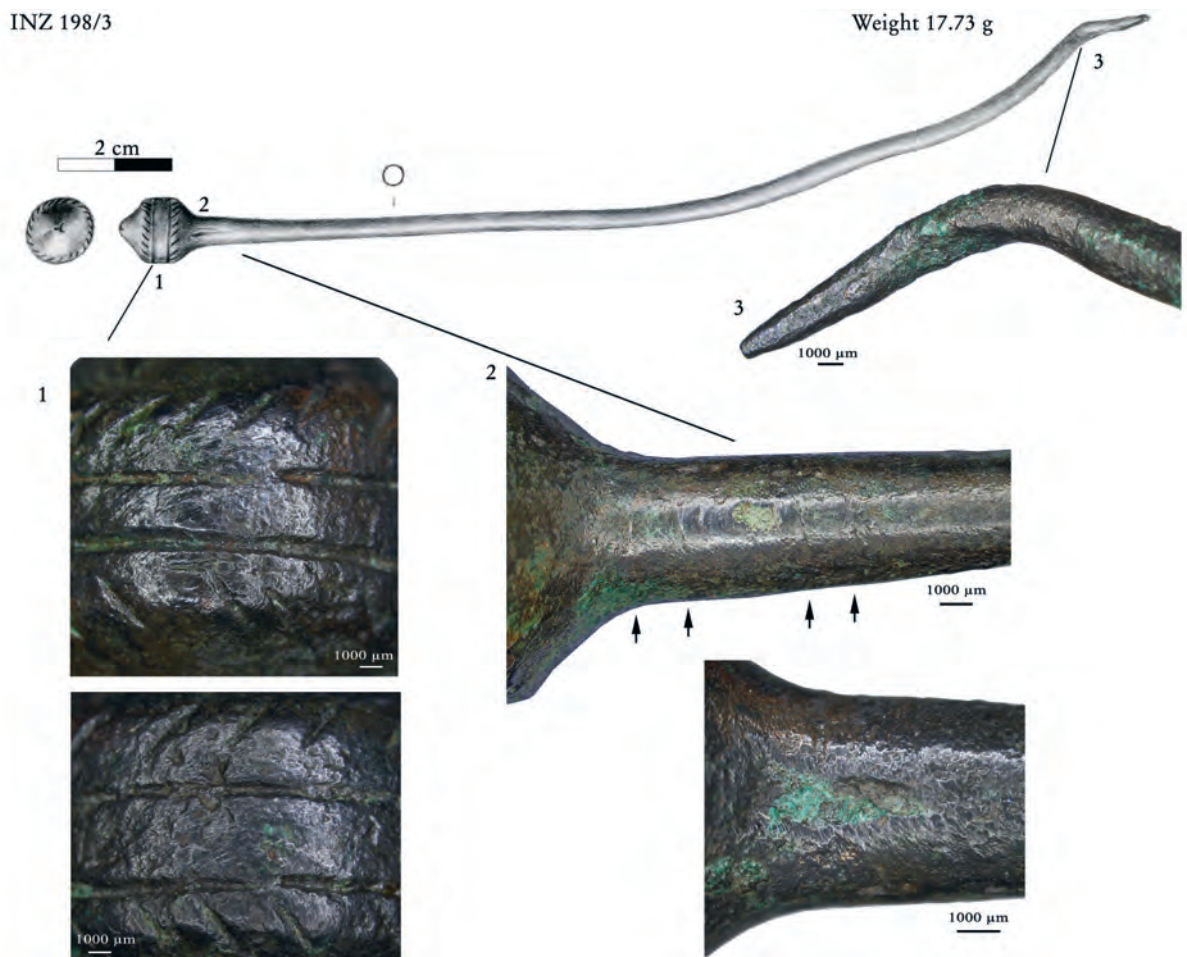


Fig. 34. Pin of type *Klentnice* INZ 198/3. – 1. Detail of unfinished incision line, starting point on the right. – 2. Abraded incisions on the pin shaft in a spiral motif. – 3. The bent tip may be a result of the pyre-burning process or sustained damage. – 4. Detail of diagonal indentations and lower unfinished incision line, starting point on the right. – 5. The irregular indentation below the pinhead is a result of the casting process (Drawing: M. Imam. – Photos: N. Mittermair).

Decoration: 4 shallow, linear, parallel incisions along the side of the head; irregular course indicates post-casting application
 Deformation: slightly bent pin shaft
 Corrosion: several areas with visible surface corrosion on pin shaft and head

INZ 111/3 (Fig. 33)

Typology: *Kugelkopfnadel* with horizontal ribs⁷³
 Dating: older Urnfield period (Bz D – Ha A2)
 Distribution: middle Danube region
 Length: 16.7 cm
 Ø Head: 1.6 cm
 Ø Shaft: 0.3 cm
 Preservation: 100 %
 Production: shrinkage defect visible on bottom and side of head at transitions to ribs
 Processing: post-casting treatment of surface

Decoration: seven cast ribs; post-casting application of small, parallel, vertical indentations on slightly broader ribs 1, 4 and 7
 Deformation: slight bend in pin shaft
 Heat exposure: vesicular surface on side of the pinhead
 Conservation: removal of patina visible in some areas
 Further remarks: asymmetric form of head; interruption in the course of the top rib and area of shallow depth in first indentation correlate

INZ 198/3 (Fig. 34)

Typology: *Spindelkopfnadel*
 Variant: *Klentnice*
 Dating: transitional period to younger Urnfield period (Ha A2/B1)
 Distribution: middle Danube region
 Length: 17.2 cm
 Ø Head: 1.2 cm
 Ø Shaft: 0.35 cm
 Preservation: 100 %

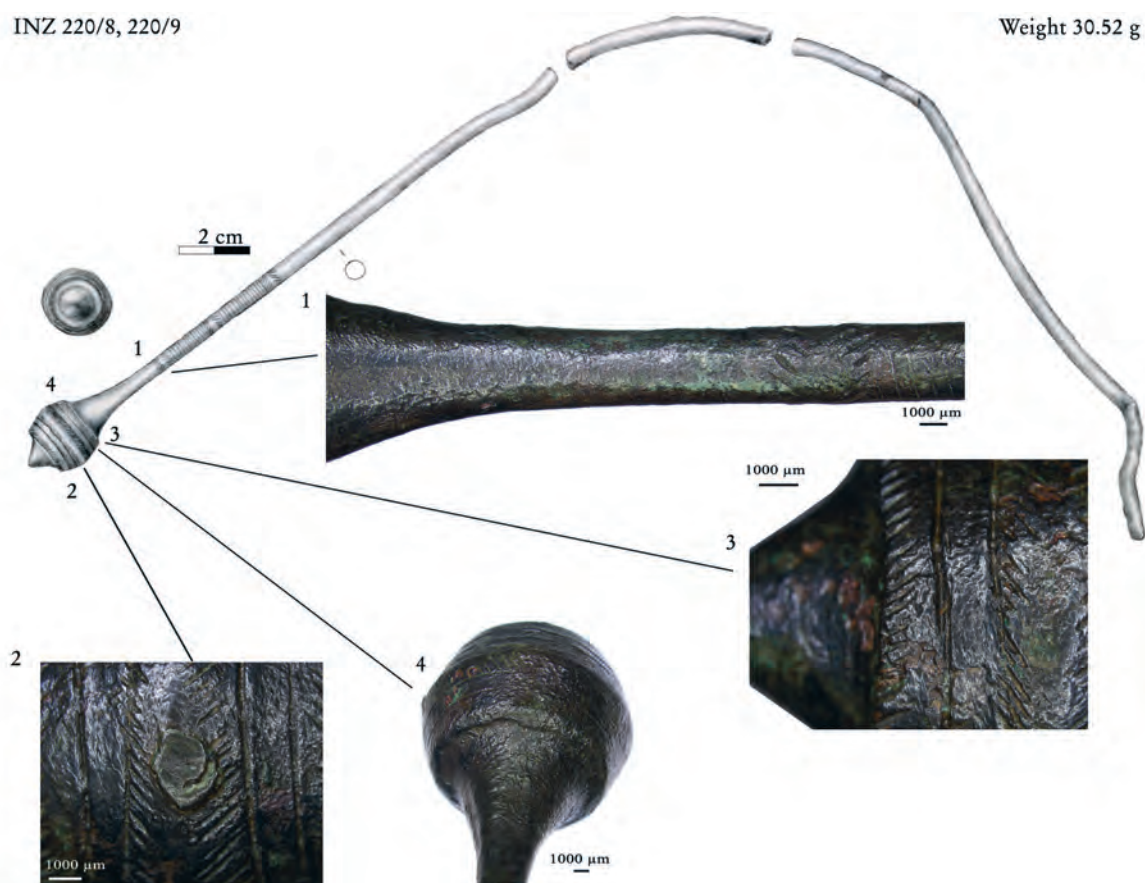


Fig. 35. Pin of type *Klentnice* INZ 220/8, 220/9. – 1. Pin shaft with first stages of decoration. – 2. The fragment melted onto and superimposing on the decorations of the pinhead likely derives from the pyre-burning process. – 3. Detail of diagonal indentations superimposed by the incision line (right) and overlapping the start and end of the incision line (left). – 4. Pinhead viewed from below showing vesicular surface (Drawing: M. Imam. – Photos: N. Mittermair).

⁷³ An object that closely resembled this was found in Grave 270 of the cemetery at Gemeinlebarn, see SZOMBATY 1929. – ŘÍHOVSKÝ 1972, Pl. 31/C.

Production: shrinkage defect on top of pinhead; triangular indentation at neck formed during casting

Processing: post-casting treatment of surface including polishing

Decoration: post-processing application of pinhead and shaft; 2 linear, parallel circumferential incisions on head with visible starting/end points; a less distinct incision in orientation of the linear incisions is visible; diagonal, parallel indentations running in mirror-inverted orientation on both carinations of pinhead; post-casting application of incised spiral decoration along neck

Deformation: bottom third of pin shaft bent

Corrosion: surface corrosion visible on one side of the pinhead

INZ 220/8, 220/9 (Fig. 35)

Typology: *Spindelkopfnadel*

Variant: *Klentnice*

Dating: transitional period to younger Urnfield period (Ha A2/B1)

Distribution: middle Danube region

Length: 13.7 cm

Ø Head: 1.95 cm

Ø Shaft: 0.3 cm

Preservation: fragmented; c. 60 %

Processing: post-casting treatment of surface including polishing

Decoration: post-processing decoration on middle part of pinhead and on shaft; 4 lines in total; linear, parallel, circumferential incisions with visible starting/end points on each half; errors attestable; superimposing diagonally oriented, mirror-inverted parallel indentations on each carination with irregularities in exact orientation and distance from each other; circumferential spiral and herringbone pattern on pin neck and shaft

Deformation: visible deformations on pin fragments INZ 220/8 due to heat exposure

Heat exposure: prominent heat exposure on pinhead and end of pin shaft of INZ 220/9; bends in all fragments in varying degrees

Corrosion: intense corrosion on pin fragments INZ 220/8 as a result of heat exposure

INZ 250/4 (Fig. 36)

Typology: *Keulenkopfnadel*

Dating: older to younger Urnfield period (Bz D – Ha B2)

Distribution: middle Danube region

Length: 11.9 cm

Ø Head: 0.75 cm

Ø Shaft: 0.35 cm

Preservation: 95 %

Processing: post-casting treatment of surface including polishing

Decoration: post-processing application of decoration on head; irregular circumferential herringbone pattern and partially superimposing diagonal row of indentations orientated in the opposite direction below; 1 linear circumferential incision at the top and 2 parallel lines mark the end of the decoration and occasionally encroach on the row of indentations

Deformation: bent tip

Corrosion: visible surface corrosion at the tip

Conservation: traces of corrosion removal visible on the neck

INZ 192/9 (Fig. 37)

Typology: *Zwiebelkopfnadel*

Dating: younger Urnfield periods (Ha A2/B1 – Ha B3)

Distribution: central Europe

Length: 2.9 cm

Ø Head: 1.7 cm

Ø Shaft: 0.4 cm

Preservation: c. 15 %

Production: cavity visible on surface of break; pinhead possibly cast on the pin shaft in a 'cast-on' technique (*Überfangguss*)

Decoration: post-processing decoration of pinhead; 2 concentric arched incisions around middle of pinhead; motif closed by 3 parallel, circumferential incisions; errors attestable; superimposing circumferential linear incision in middle of pinhead running through the concentric circular decoration

Heat exposure: vesicular surface proves heat exposure; breaks at tip of pinhead and pin neck

INZ 310/5 (Fig. 38)

Typology: *Zwiebelkopfnadel*

Dating: younger Urnfield periods (Ha A2/B1 – Ha B3)

Distribution: central Europe

Length: 5.9 cm

Ø Head: 1.95 cm

Ø Shaft: 0.35 cm

Preservation: fragmented; c. 90 %

Production: segmented transition from pinhead to pin shaft suggests casting of head in 'cast-on' technique (*Überfangguss*)

Processing: post-casting treatment of surface including polishing

Decoration: post-processing decoration on all fragments attestable; 4 circumferential diagonal, irregular rows of indentations running semicircularly and then inverting orientation while 3 or 4 linear incisions with identifiable starting/end points encase pinhead motif; errors attestable; decoration on pin shaft regularly alternating between incised superimposing herringbone or double-herringbone patterns to incised spirals

Deformation: recent break fits well with pinhead fragment; lower part of pinhead bent

Heat exposure: shortest pin fragment shows evident traces of heat exposure; pinhead fragment shows traces of heat exposure on surface

Corrosion: longer pin fragment with slight traces of surface corrosion

Conservation: slight traces of corrosion removal on longer pin fragment

INZ 17/18 (Fig. 39)

Typology: pin with biconical head

Dating: older to late Urnfield period (Bz D – Ha B3)

Distribution: middle Danube region

Length: 4.2 cm

Ø Head: 1.0 cm

Ø Shaft: 0.4 cm

Preservation: c. 30 %

Processing: post-casting treatment of surface including polishing

Decoration: post-processing decoration on entire preserved pin; 4 circular incisions on top of pinhead; errors attestable; atop and below circumferential linear incision along carination of pinhead, parallel, diagonal indentations in mirror-inverted orientation; incised spiral decor on pin shaft; below, circumferential vertical incisions structuring pin shaft in 4 segments, filled with occasionally superimposing orthogonally oriented indentations

Deformation: a c. 90° bend is attestable in the pin shaft directly before the break

Heat exposure: vesicular surface due to heat exposure on bottom of pinhead and shaft; molten surface on surface of break

Corrosion: visible surface corrosion on the pin shaft

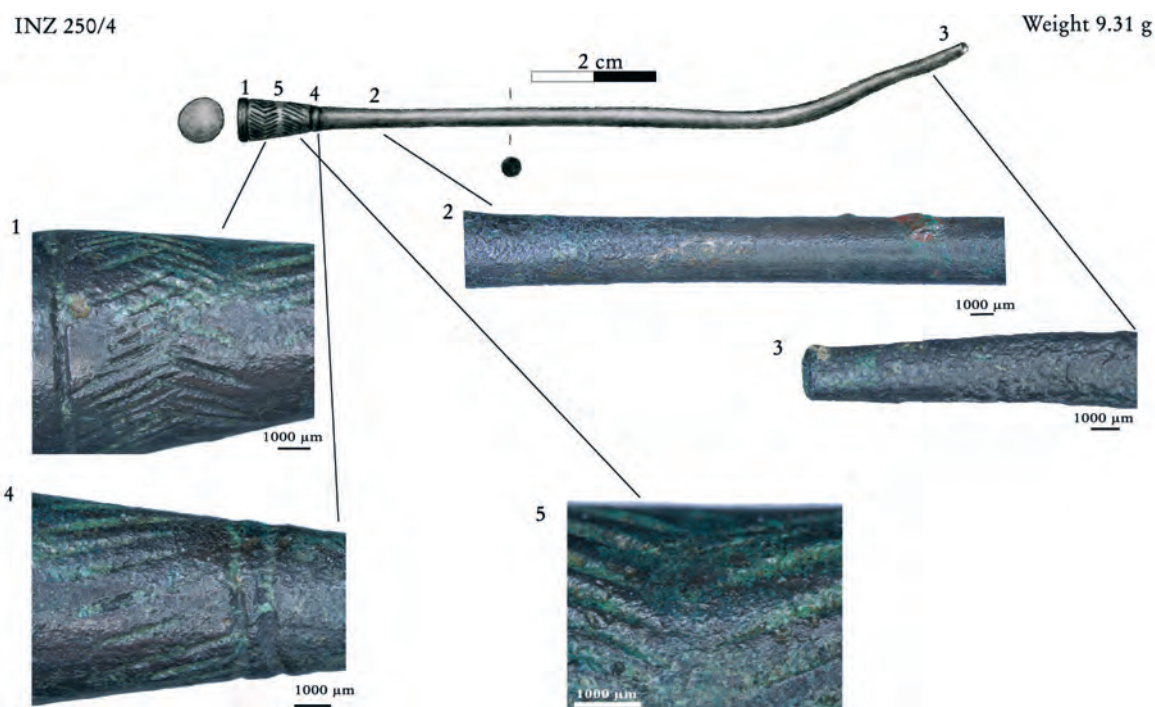


Fig. 36. Pin with *Keulenkopf* INZ 250/4. – 1. Imprecisions and irregularities in decoration application. – 2. Different degrees of heat exposure on the surface along the pin shaft. – 3. Vesicular surface and damage to the tip most likely deriving from the pyre-burning process. – 4. Bottom incision lines superimpose diagonal indentations due to irregular orientation of line. – 5. Detailed view of the decorations prove irregular use of an identical tool (Drawing: M. Imam. – Photos: N. Mittermair).

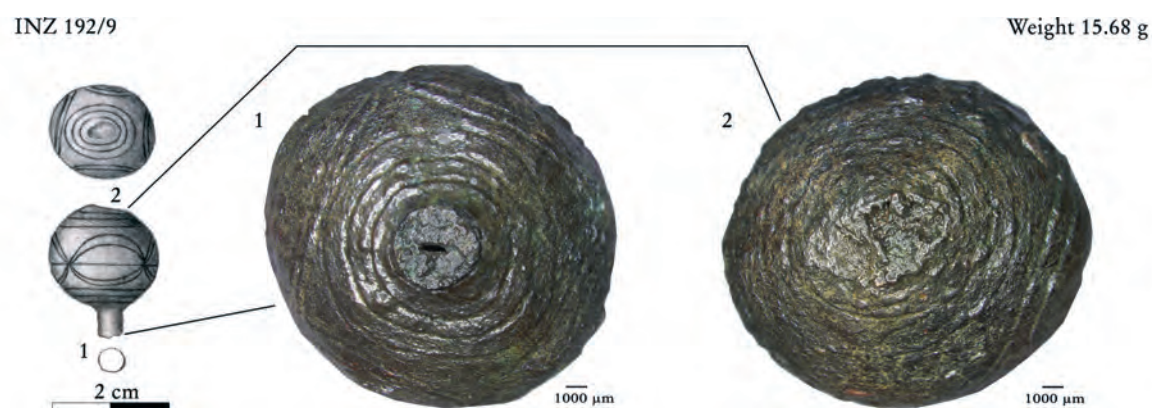


Fig. 37. Pin with onion-shaped head INZ 192/9. – 1. The oval cavity in the pin shaft fracture shows inaccuracies in the casting process. The irregular course of the incised lines is visible from the bottom view. – 2. Damage on top of pinhead and the vesicular surface make heat exposure evident (Drawing: M. Imam. – Photos: N. Mittermair).

FHK 347/6 (Fig. 40)

Typology: *Vasenkopfnadel*

Variant: with small head

Dating: younger Urnfield period (Ha A2/B1 – Ha B3)⁷⁴

Distribution: central Europe

Length: 12.1 cm

Ø Head: 0.6 cm

Ø Shaft: 0.25 cm

Preservation: 95 %

Production: possible remains of casting seams on bottom of pinhead opposite each other suggest production in a two-piece casting mould

Processing: post-casting treatment of surface including polishing

Decoration: approx. 2 cm of post-processing decoration preserved on pin shaft; alternating between circumferential indented single or double chevrons and incised fine spiral decor

⁷⁴ MARASZEK 1998, 43.

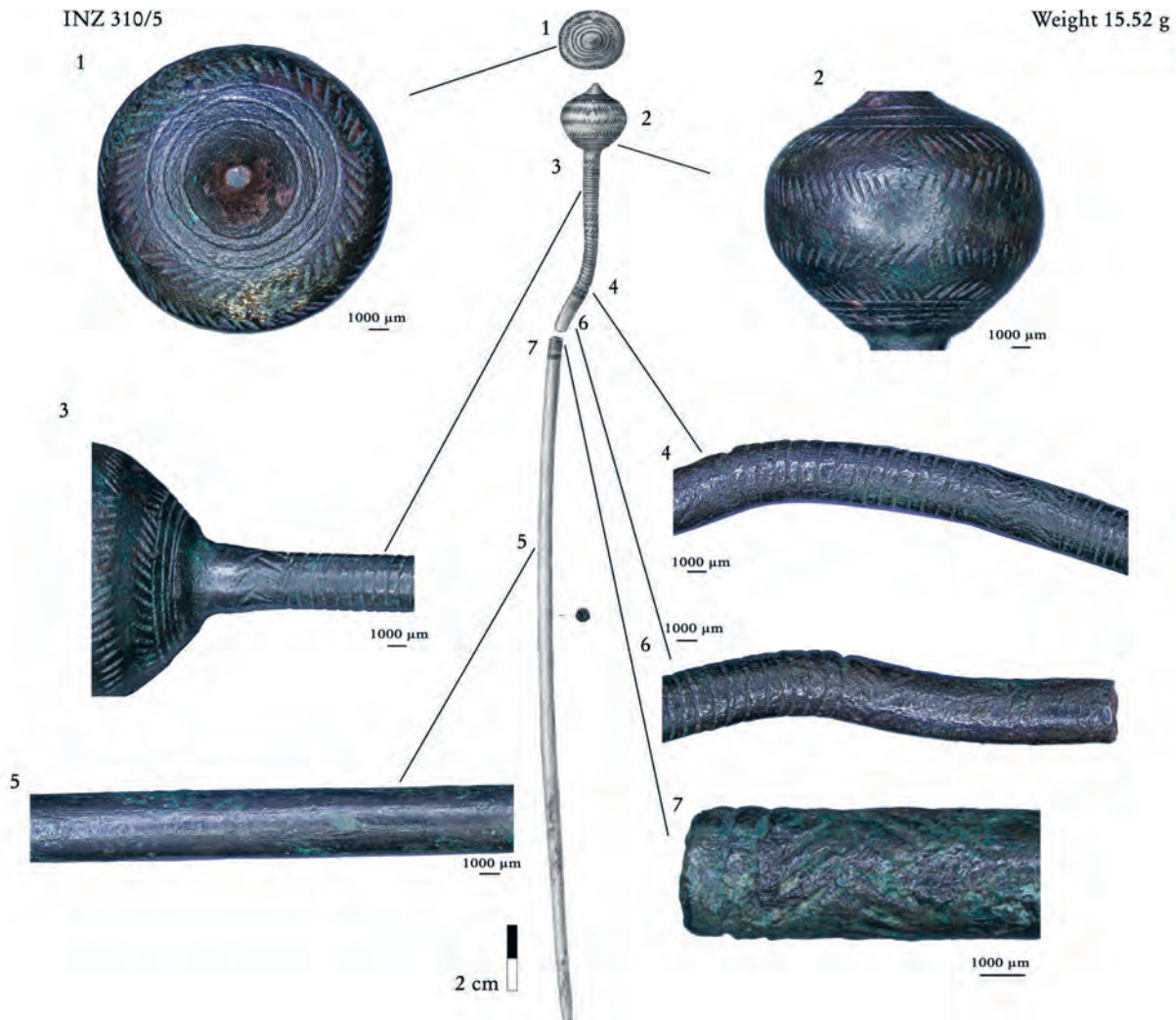


Fig. 38. Pin with onion-shaped head INZ 310/5. – 1. Top view of accurately decorated pinhead. – 2. The irregular course of the indentation lines is evident, the switch in orientations relatively uniform. Incised lines superimpose indentations. – 3. The retracting pin shaft suggests casting of the pinhead using the 'cast-on' technique. – 4. Detail of incised decorations on pin shaft. – 5. Striations on the pin shaft are likely a result of surface polishing. – 6. Bend in the pin shaft and a change in course without any trace of heat impact detectable. – 7. The tip of a fractured pin shaft with varying degrees of corrosion and continuing decoration may likely belong to a second pin (Drawing: M. Imam. – Photos: N. Mittermair).

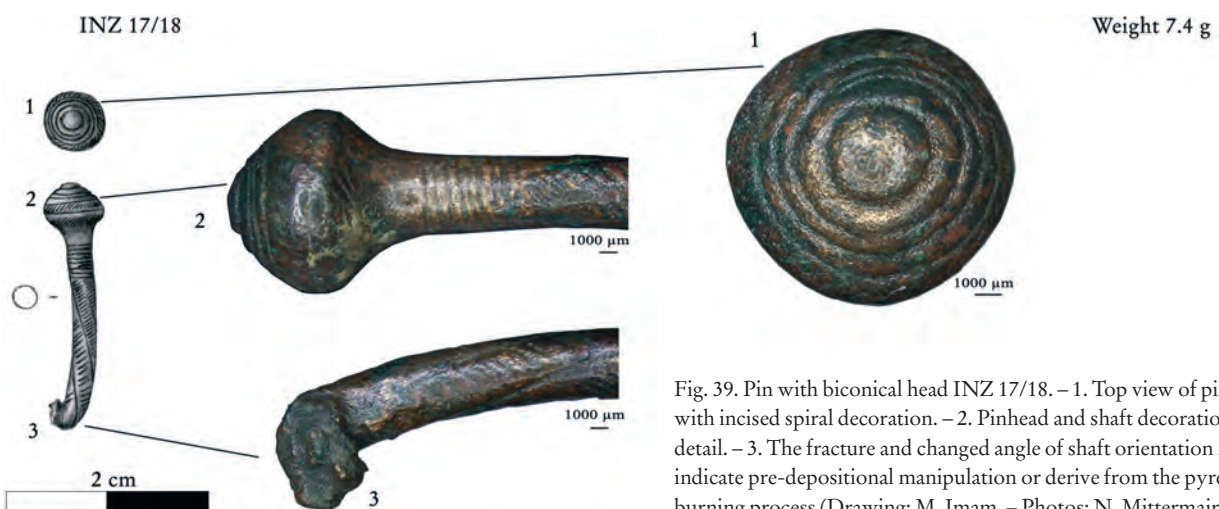


Fig. 39. Pin with biconical head INZ 17/18. – 1. Top view of pinhead with incised spiral decoration. – 2. Pinhead and shaft decorations in detail. – 3. The fracture and changed angle of shaft orientation may indicate pre-depositional manipulation or derive from the pyre-burning process (Drawing: M. Imam. – Photos: N. Mittermair).

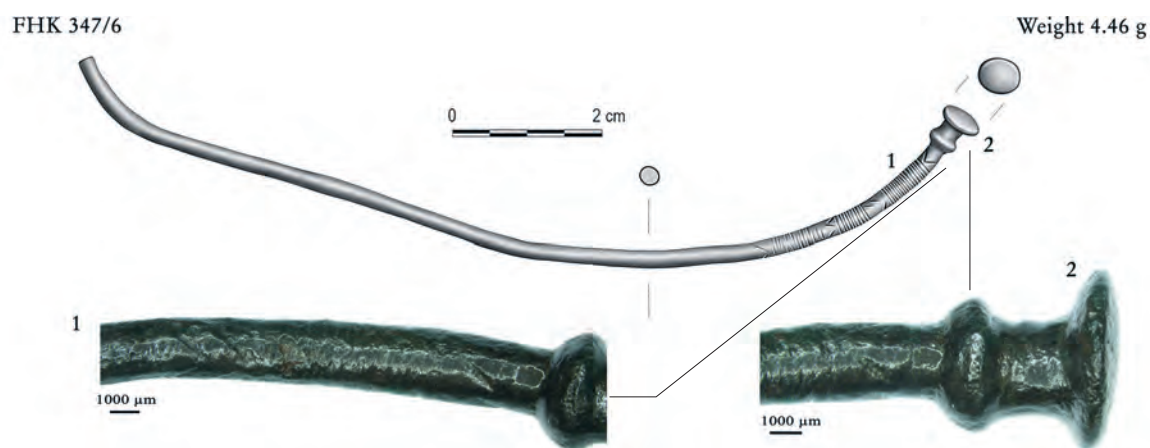


Fig. 40. Pin with small vase-shaped head FHK 347/6. – 1. Incised decorations on pin shaft. – 2. Detailed view of pinhead (Drawing: F. Siegmeth. – Photos: N. Mittermair).

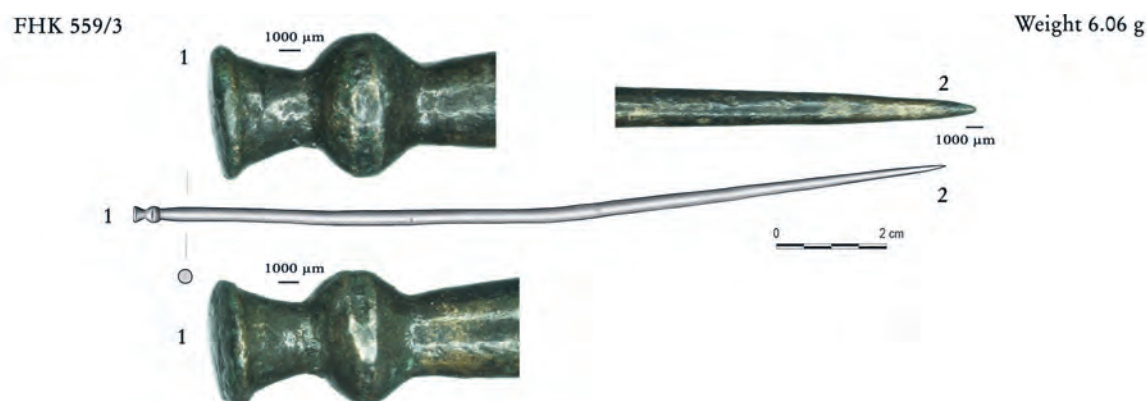


Fig. 41. Pin with small vase-shaped head FHK 559/3. – 1. Incisions on pinhead vary, possibly applied post-casting. Evidence of hammering in excess material accumulating along the transition of pinhead top and side. – 2. Detailed view of the regular course of the tip (Drawing: F. Siegmeth. – Photos: N. Mittermair).

Deformation: bent pin shaft

Heat exposure: vesicular surface on top of the pinhead; surface showing traces of heat exposure on pin shaft and surface of break

Conservation: traces of corrosion removal visible on the top of the pinhead and along the pin shaft

FHK 559/3 (Fig. 41)

Typology: *Vasenkopfnadel*

Variant: with small head

Dating: younger Urnfield period (Ha A2/B1 – Ha B3)

Distribution: central Europe

Length: 14.7 cm

Ø Head: 0.3 cm

Ø Shaft: 0.3 cm

Preservation: 100 %

Processing: post-casting treatment of surface including polishing

Decoration: fluting along carination in varying depths and widths, possibly originally running circumferentially

Deformation: slight bend in lower half

Heat exposure: distinct surface areas of pin shaft possibly exposed to heat

Corrosion: occasionally areas with visible surface corrosion

FHK 576/6 (Fig. 42)

Typology: *Vasenkopfnadel*

Variant: with small head

Dating: younger Urnfield period (Ha A2/B1 – Ha B3)

Distribution: central Europe

Length: 16.4 cm

Ø Head: 0.6 cm

Ø Shaft: 0.25 cm

Preservation: 100 %

Processing: post-casting treatment of surface including polishing; linear indentations visible within the middle of the twisted sides which are evidence of hammering the upper pin shaft into a rectangular form; negative of tool visible on bottom of pinhead node

Decoration: starting from pinhead, tightly twisted pin shaft loosening towards the unworked pin shaft

Deformation: lower half of pin shaft bent

Corrosion: a few areas with slight surface corrosion

FHK 581/4 (Fig. 43)

Typology: *Vasenkopfnadel*

Variant: with small head

Dating: younger Urnfield period (Ha A2/B1 – Ha B3)

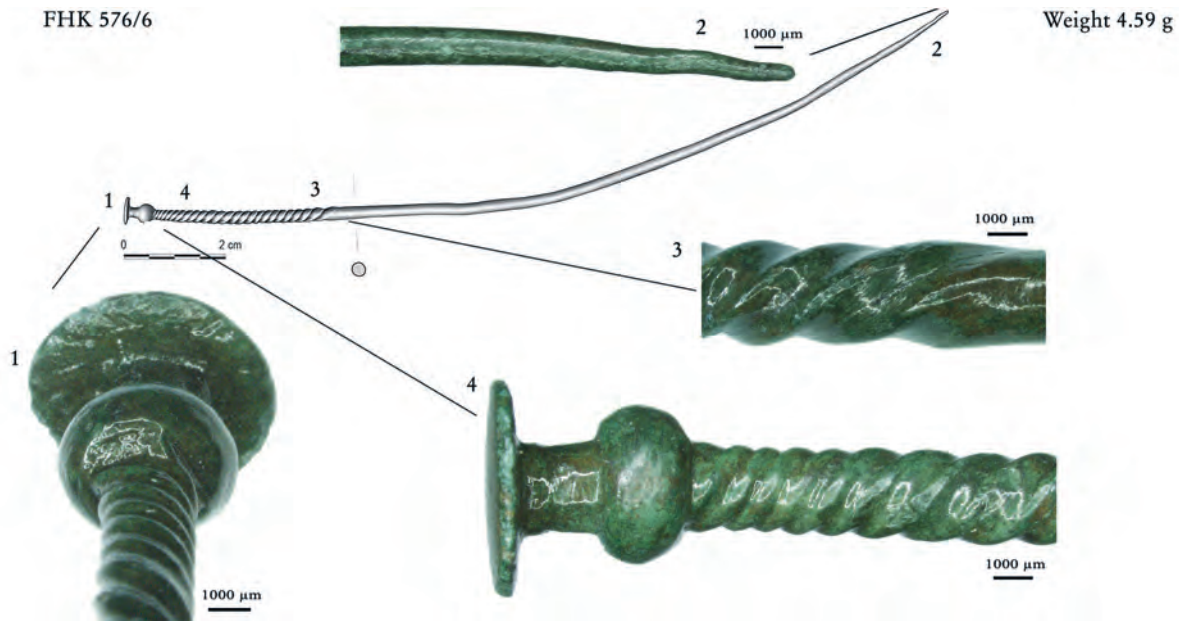


Fig. 42. Pin with small vase-shaped head FHK 576/6. – 1. Bottom view of pinhead showing striations on pinhead plate. – 2. The bent tip sustained damage. – 3. The fissure in the surface in the middle of the lowest torsion spiral is evidence of a stressed microstructure. – 4. Loosening course of torsion towards the pin shaft (Drawing: F. Siegmeth. – Photos: N. Mittermair).

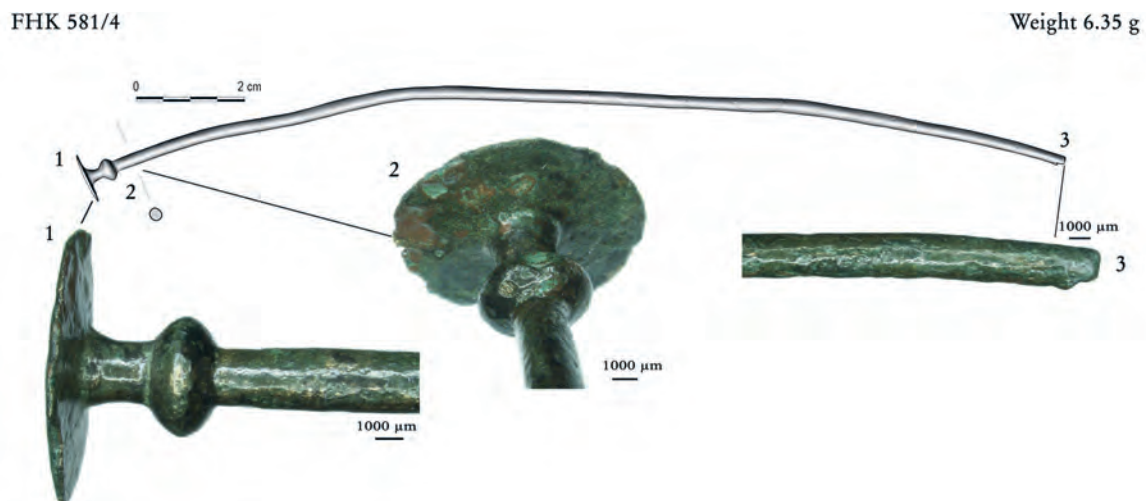


Fig. 43. Pin with small vase-shaped head FHK 581/4. – 1. Detailed view of pinhead. – 2. Bottom view of pinhead shows no signs of surface irregularities. – 3. Abraded fracture of pin shaft (Drawing: F. Siegmeth. – Photos: N. Mittermair).

Distribution: central Europe
 Length: 18.2 cm
 Ø Head: 1.0 cm
 Ø Shaft: 0.25 cm
 Preservation: 99 %
 Processing: post-casting treatment of surface including polishing;
 traces of hammering on bottom of pinhead attestable
 Deformation: bent pin shaft
 Corrosion: some areas with surface corrosion
 Conservation: acrylic resin residues

FHK 605/5 (Fig. 44)

Typology: *Vasenkopfnadel*
 Variant: with small head
 Dating: younger Urnfield period (Ha A2/B1 – Ha B3)
 Distribution: central Europe
 Length: 10.4 cm
 Ø Head: 0.8 cm
 Ø Shaft: 0.25 cm
 Preservation: c. 85 %
 Production: pinhead plate originally cast slightly thicker (2 mm) in
 shape, identifiable close to carination

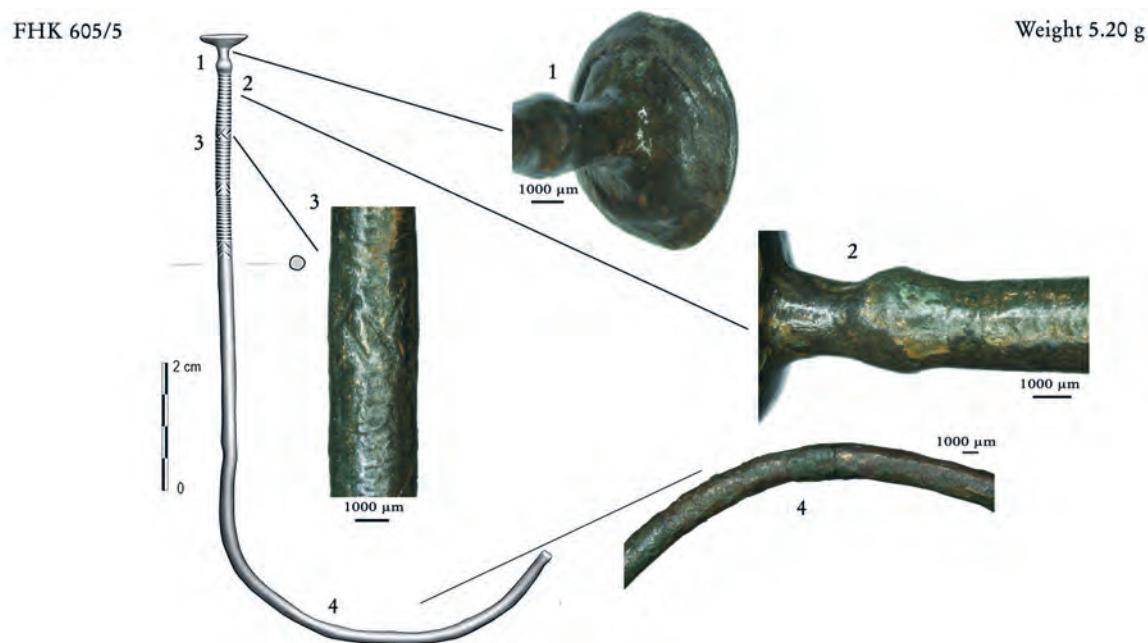


Fig. 44. Pin with small vase-shaped head FHK 605/5. – 1. Bottom view of pinhead with noticeable tool marks. – 2. Detail of pinhead node and starting spiral decorations. – 3. Overlap of herringbone decoration. – 4. Bend in pin shaft over 90° (Drawing: F. Siegmeth. – Photos: N. Mittermair).

Processing: post-casting treatment of surface likely; removal of uneven surface on bottom of pinhead less attestable
 Decoration: remains of post-processing pin shaft decoration visible; alternating fine spirals and chevron decoration
 Deformation: a c. 180° bend in pin shaft
 Corrosion: high degree of surface corrosion partially due to impact of heat
 Conservation: removal of patina visible in some areas

FHK 263/6 (one decorated shaft fragment from another pin) (Fig. 45)

Typology: *Vasenkopfnadel*
 Variant: with large head
 Dating: younger Urnfield period (Ha A2/B1 – Ha B3)
 Distribution: central Europe
 Length: 30.9 cm
 Ø Head: 1.6 cm
 Ø Shaft: 0.35 cm
 Preservation: fragmented; 100 %
 Processing: post-casting treatment of surface including polishing
 Decoration: post-processing application of circumferential row of round indentations on head of pin; 2 parallel circumferential linear incisions segmenting pin node; 3 rows filled with irregular diagonal indentations alternating in orientation; pin shaft decorated with alternating fine spirals and single or double chevron decoration with different orientations
 Deformation: 90° bend in pin shaft; at modern breaking point (rectangular cross-section) another bend identifiable
 Heat exposure: vesicular surface on part of pinhead and pin shaft fragment; shifted axis in pinhead and node resulting from partial fissure due to heat impact
 Corrosion: high degree of surface corrosion visible, mainly resulting from impact of heat
 Conservation: traces of corrosion removal attestable

FHK 553/2 (Fig. 46)

Typology: *Vasenkopfnadel*
 Variant: with large head
 Dating: younger Urnfield period (Ha A2/B1 – Ha B3)
 Distribution: central Europe
 Length: 17.5 cm
 Ø Head: 0.9 cm
 Ø Shaft: 0.3 cm
 Preservation: fragmented; 100 %
 Production: remains of casting seams at bottom of pinhead attesting production in a two-part casting mould and on one side even on carination from pin neck to node
 Processing: post-casting treatment of surface including polishing; though only outer bottom part of pinhead
 Decoration: post-processing decoration of pin node; 3 circumferential, linear incisions structuring the node in 4 segments filled with irregular rows of diagonal indentations in alternating orientation
 Deformation: slight bend in pin shaft
 Heat exposure: vesicular surface on side and top of pinhead
 Corrosion: surface corrosion on pin shaft fragment
 Conservation: removal of patina in several areas

FHK 596/8 (Fig. 47)

Typology: *Vasenkopfnadel*
 Variant: with large head
 Dating: younger Urnfield period (Ha A2/B1 – Ha B3)
 Distribution: central Europe
 Length: 26.1 cm
 Ø Head: 1.9 cm
 Ø Shaft: 0.35 cm
 Preservation: fragmented; 100 %
 Production: shrinkage defect on lower side of pin node

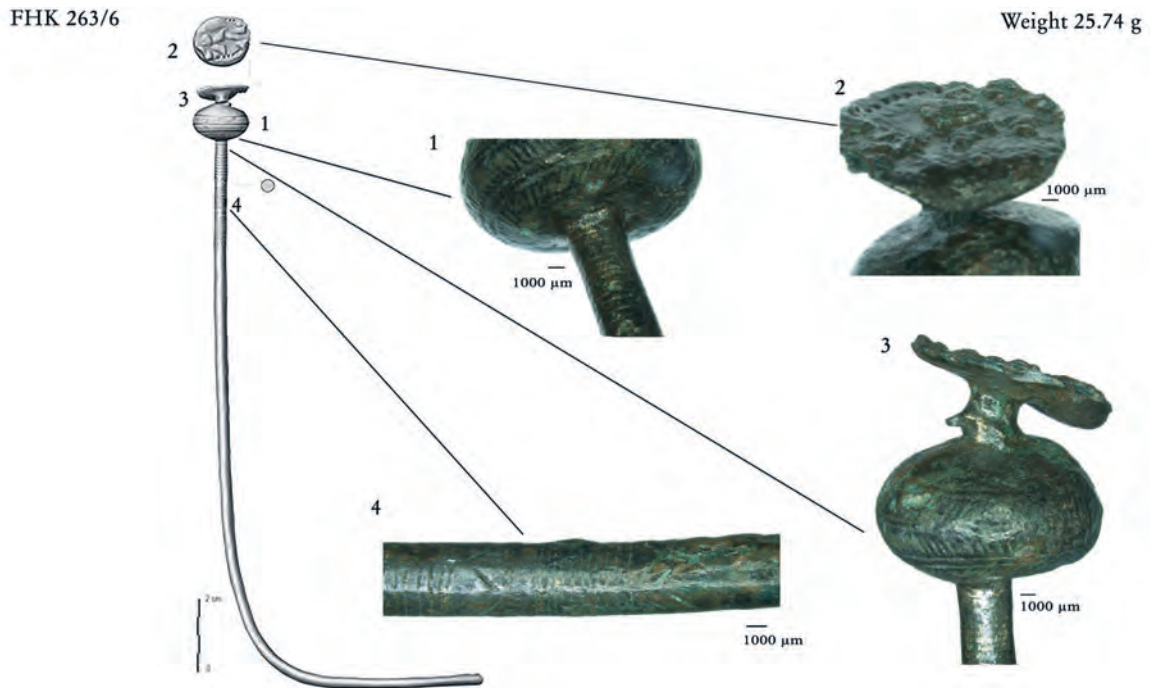


Fig. 45. Pin with big vase-shaped head FHK 263/6. – 1. Bottom view of decorated pinhead. – 2. Round indentation line along the top of the pinhead superimposed by vesicular surface. – 3. Clearly visible heat impact in the upper half of the pinhead. – 4. Detailed view of incised pin shaft (Drawing: F. Siegmeth. – Photos: N. Mittermair).

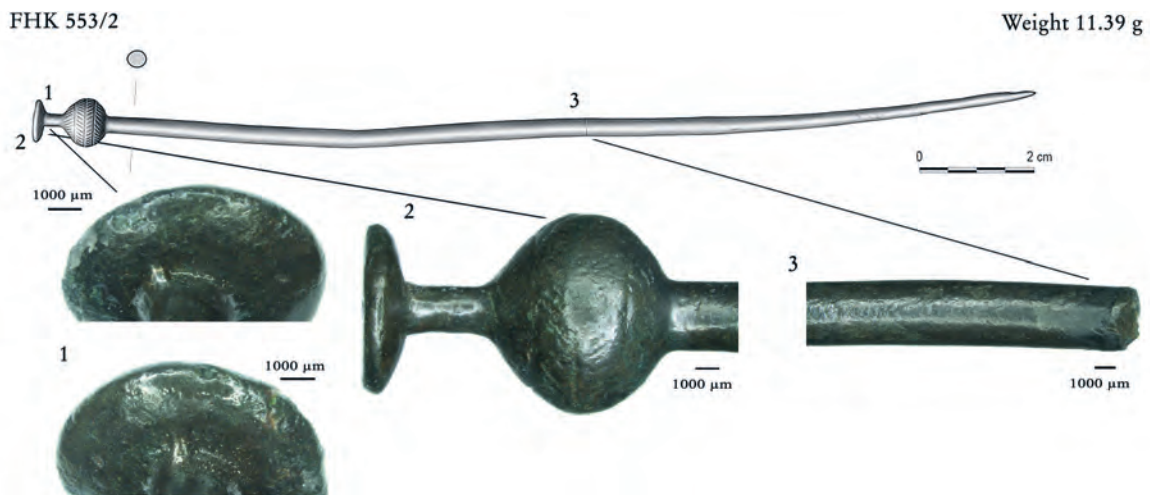


Fig. 46. Pin with big vase-shaped head FHK 553/2. – 1. Remains of casting seams exactly opposite each other is proof of the production of the pin within a two-part casting mould. – 2. Incised decorations on the pinhead node. – 3. The uncorroded fracture suggests post-depositional damage (Drawing: F. Siegmeth. – Photos: N. Mittermair).

Processing: post-casting treatment of surface including partial polishing (surface of pinhead bottom and top of node partly not fine polished)

Decoration: post-processing application of decoration; 3 irregular rows of diagonal indentations alternating in orientation; starting/end points partially attestable; 4 linear circumferential incisions

with partially attestable superimposing starting/end points; errors attestable

Deformation: especially in lower half of pin bend of c. 90°

Corrosion: high degree of surface corrosion in some areas of the pin shaft

Conservation: removal of patina along pin shaft; acrylic resin residues

FHK 596/8

Weight 25.31 g

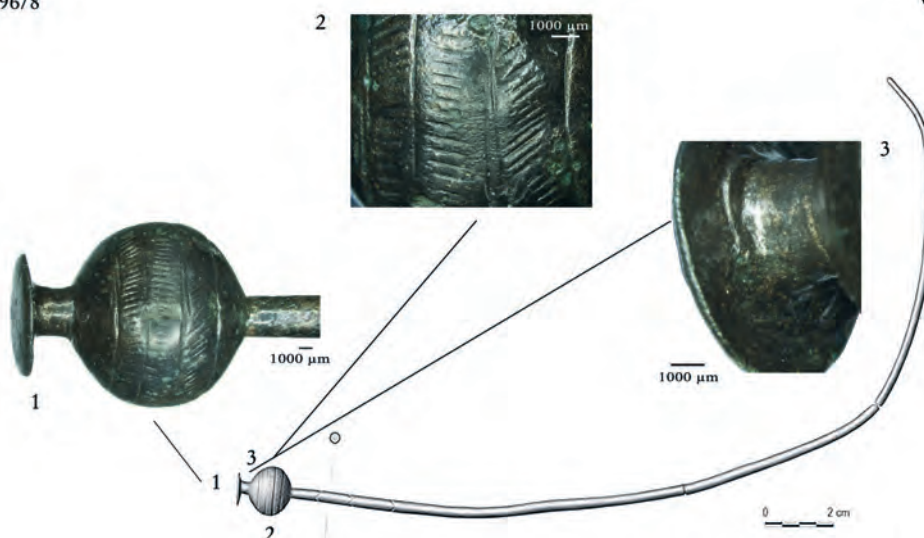


Fig. 47. Pin with big vase-shaped head FHK 596/8. – 1. Inaccuracies in overlapping incision lines. – 2. Detailed view of irregularly applied incision and superimposed indentations. – 3. The irregular course of the pinhead surface in bottom view derives from the casting mould or model (Drawing: F. Siegmeth. – Photos: N. Mittermair).

INZ 184/3

Weight 15.70 g

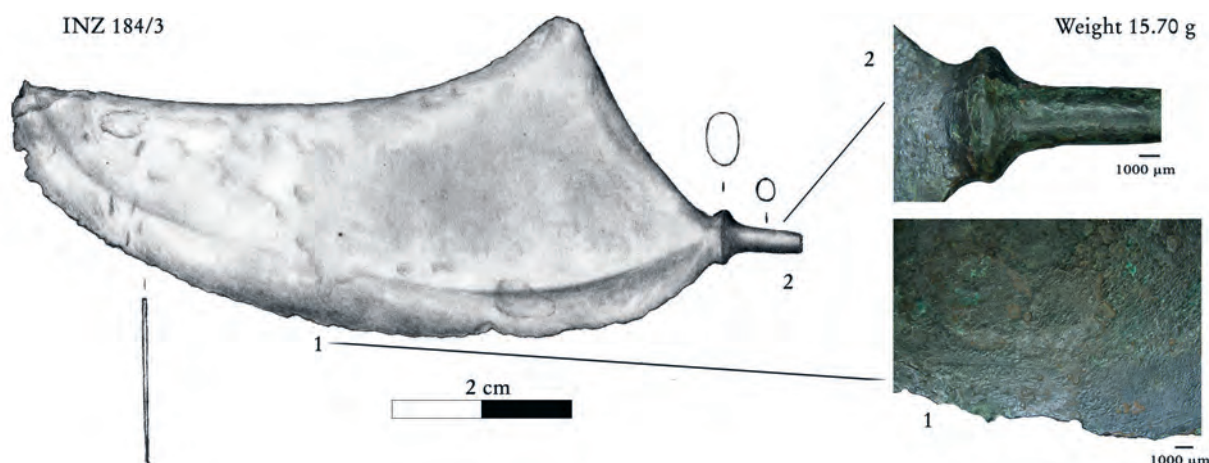


Fig. 48. Single-edged razor INZ 184/3. – 1. The state of preservation of the edge allows only for observation of a few diagonal striations, possibly deriving from the sharpening of the blade (right). – 2. Detail of the biconical node separating the tang from the blade part (Drawing: M. Imam. – Photos: N. Mittermair).

3. Razors

INZ 184/3 (Fig. 48)

Typology: *Herrnbaumgarten* type

Dating: younger Urnfield period (Ha A2/B1 – Ha B2)⁷⁵

Distribution: eastern Bavaria, Silesia, Moravia, middle Danube region

Length: 13.1 cm

Width: 0.5 cm

Height: 5.4 cm

Preservation: 100 %; high degree of medium- and small-sized breaks along edge

Processing: casting jet likely originally located at handle; post-casting treatment of surface including polishing; resharpening striations; 2 courses of hammering marks along edge

Use: traces of sharpened edge attestable at blade base

Deformation: slight bend in blade

Corrosion: high degree of surface corrosion

Conservation: attestable traces of corrosion removal

⁷⁵ JOCKENHÖVEL 1971, 210–211. Information relating to the chronological and regional distribution of razors derives from JOCKENHÖVEL 1971, if not stated otherwise.

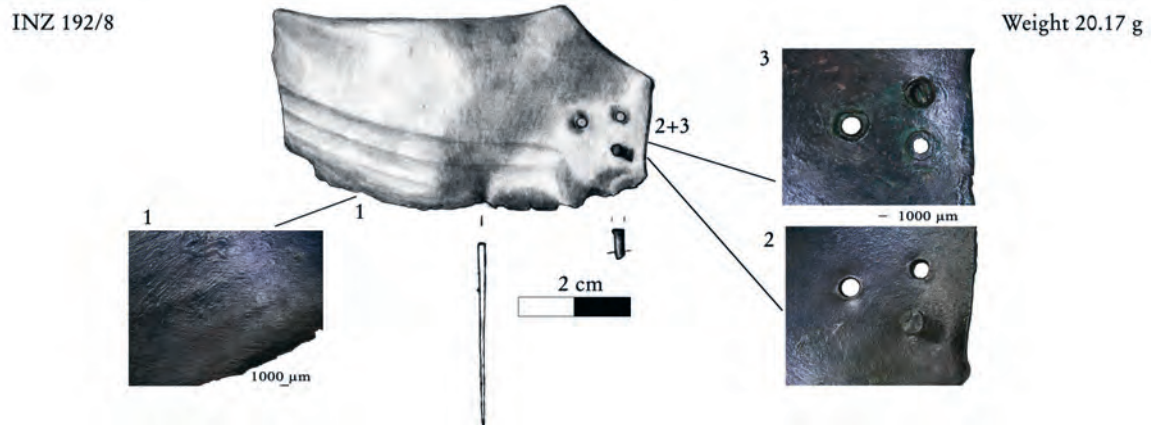


Fig. 49. Riveted razor INZ 192/8. – 1. Parallel oriented course of cold-working process along edge. – 2. Detectable bend in the object deriving from heat impact. Missing indentations along the rivets suggests a preparation during casting in the mould or model to ensure the correct size of the rivets. – 3. The minimal amount of excess material shows the identical orientation of the artefact during application of the organic hilt (Drawing: M. Imam. – Photos: N. Mittermair).

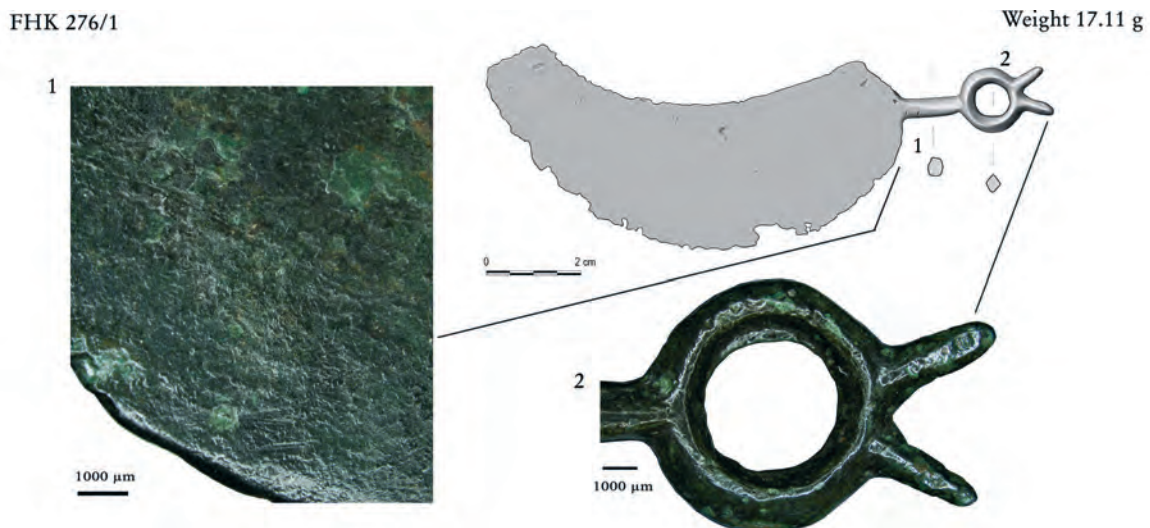


Fig. 50. Razor with ring handle FHK 276/1. – 1. Preservation state of edge in detailed view with a few horizontal striations possibly deriving from post-casting surface treatment. – 2. No signs of treatment inside the ring handle (Drawing: F. Siegmeth. – Photos: N. Mittermair).

INZ 192/8 (Fig. 49)

Typology: *Herrnbaumgarten* type
 Dating: younger Urnfield period (Ha A2/B1 – Ha B2)
 Distribution: eastern Bavaria, Silesia, Moravia, middle Danube region
 Length: 8.3 cm
 Width: 0.2 cm
 Height: 4.6 cm
 Preservation: 80 %; large and middle-sized breaks along edge
 Production: pre-casting preparation of rivet holes
 Processing: post-casting treatment of surface including polishing; striation pattern along blade; hammer marks on whole object; 3 courses of hammering marks along edge up to blade base; 3 rivets

pierced through material from same side; organic handle was likely not aligned with orientation of blade
 Use: traces of sharpened edge attestable
 Deformation: bent blade
 Heat exposure: slight traces of heat exposure
 Corrosion: high degree of surface corrosion
 Conservation: acrylic resin residues

FHK 276/1 (Fig. 50)

Typology: *Herrnbaumgarten* type
 Dating: younger Urnfield period (Ha A2/B1 – Ha B2)
 Distribution: eastern Bavaria, Silesia, Moravia, middle Danube region
 Length: 12.1 cm
 Width: 0.4 cm

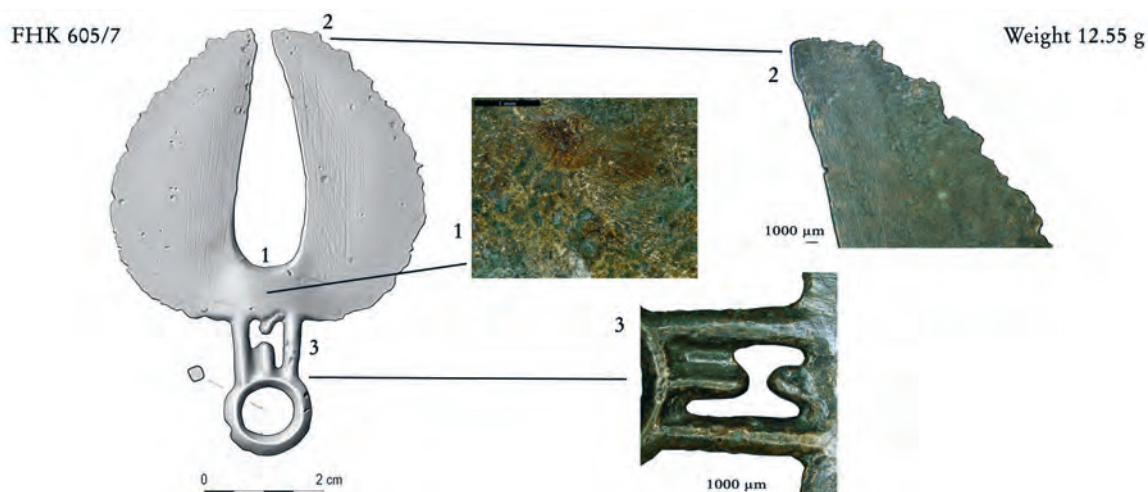


Fig. 51. Double-edged razor FHK 605/7. – 1. The detailed view of the dendritic surface is evidence of gradual post-casting cooling of the metal artefact as well as a lack of work steps influencing the microstructure of the area. – 2. Striations oriented horizontally to the blade attest to the surface treatment it underwent. Along the edges, cold-working procedures removed the striations. – 3. Casting defect visible at the hilt of the razor (Drawing: F. Siegmeth. – Photos: N. Mittermair).

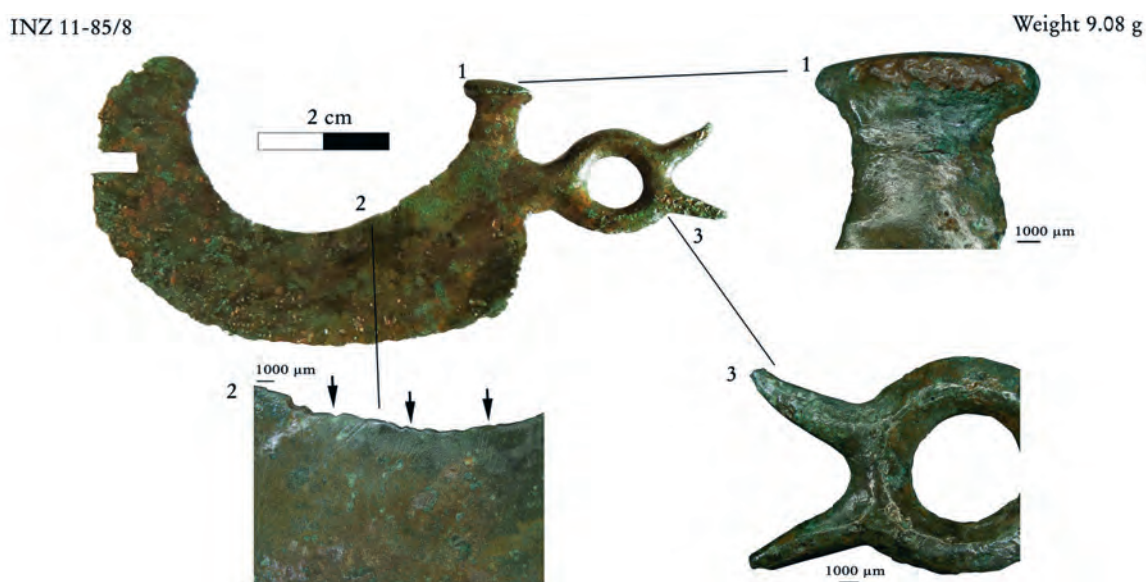


Fig. 52. Single-edged razor INZ 11/8 from Ha B-dating cemetery. – 1. Horizontal fissures are the result of intense hammering. – 2. Abraded geometric decorations account for the intensive artefact wear. – 3. Detail of the ring handle (Photos: N. Mittermair).

Height: 3.1 cm
 Preservation: 95 %; no original edge preserved
 Production: remains of casting seams inside ring knob and between spiked extensions
 Processing: post-casting treatment of surface including polishing; hammer marks attestable throughout whole object; especially along edge
 Corrosion: high degree of surface corrosion
 Conservation: traces of corrosion removal

FHK 605/7 (Fig. 51)
 Typology: *Nynice* type

Dating: younger and late Urnfield period (Ha B1 – Ha B3)
 Distribution: southern and eastern Germany, Bohemia
 Length: 7.3 cm
 Width: 0.3 cm
 Height: 5.2 cm
 Preservation: 100 %; original edge barely preserved
 Production: casting flaw visible in central part of handle; originally cast thickness of blade attestable in middle part of blade; handle mostly unworked; dendritic surface visible on blade surface above handle attesting long cooling phase and low degree of further working steps in this area

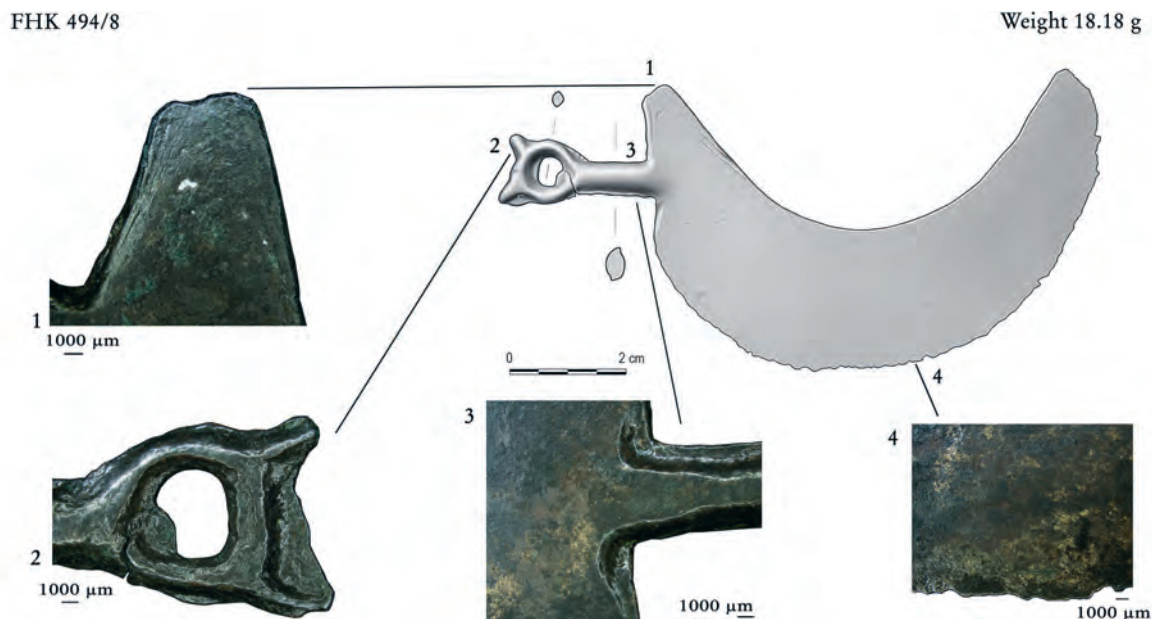


Fig. 53. Razor with ring handle FHK 494/8. – 1. Negatives of tool marks along the blade tip towards the hilt. – 2. Cold-shut casting defect visible at the ring handle. – 3. Asymmetry in the area of the hilt speaks for production in a two-part casting mould. – 4. Low preservation of the edge, horizontal striations suggest sharpening of the blade (Drawing: F. Siegmeth. – Photos: N. Mittermair).

Processing: post-casting treatment of surface including polishing; ring knob on one side shows traces of polishing on outer surface; striations running in orientation of blade; superimposed by hammer marks from tip to blade base along edge; last cold-worked side is drawn; fissures from hardening the blade visible on the surface

Use: due to preservation of edge, no traces of sharpening detectable; shape of objects suggests blade wear along tips

Corrosion: slight traces of surface corrosion visible

Conservation: parallel lines on tips attest corrosion removal process nearly orthogonally oriented to striations

Sample: for metallographic investigations taken from blade; oriented 90° to blade part axis

INZ 11/8 (Fig. 52)

Typology: *Určice* type

Dating: later Urnfield periods (Ha B1/B2 – Ha B3)

Distribution: Silesia, eastern Bohemia, Moravia, eastern Austria, northern Slovenia

Length: 5.8 cm

Width: 0.4 cm

Height: 3.6 cm

Preservation: 100 %; original edge barely preserved

Production: casting jet at back tip of crescent-shaped blade

Processing: casting jet hammered into node; post-casting treatment of surface including polishing; superimposed by hammer marks from tip to blade base along edge; fissures from hardening the blade visible under node

Use: traces of sharpened edge visible at tip; blade wear in central part of blade; end of decoration superimposed by reworking of blade

Decoration: post-processing application of incised decoration; downwards-oriented triangles from back of blade with hatching

Corrosion: slight traces of surface corrosion

Conservation: visible traces of corrosion removal processes in decorated area; acrylic resin residues

FHK 494/8 (Fig. 53)

Typology: *Určice* type

Dating: later Urnfield periods (Ha B1/B2 – Ha B3)

Distribution: Silesia, eastern Bohemia, Moravia, eastern Austria, northern Slovenia

Length: 10.5 cm

Width: 0.3 cm

Height: 2.5 cm

Preservation: 100 %; original edge barely preserved

Production: production in two-part mould likely; moulds not perfectly aligned; break on ring knob of handle result of casting flaw; casting seams on handle unremoved

Processing: visible tool mark negatives from casting seam removal on blade tips close to back of blade; post-casting treatment of surface including polishing; striation pattern along blade superimposed by traces of hammering on blade, especially along edge

Use: possible blade wear along front tip of blade

Conservation: visible traces of corrosion removal processes

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