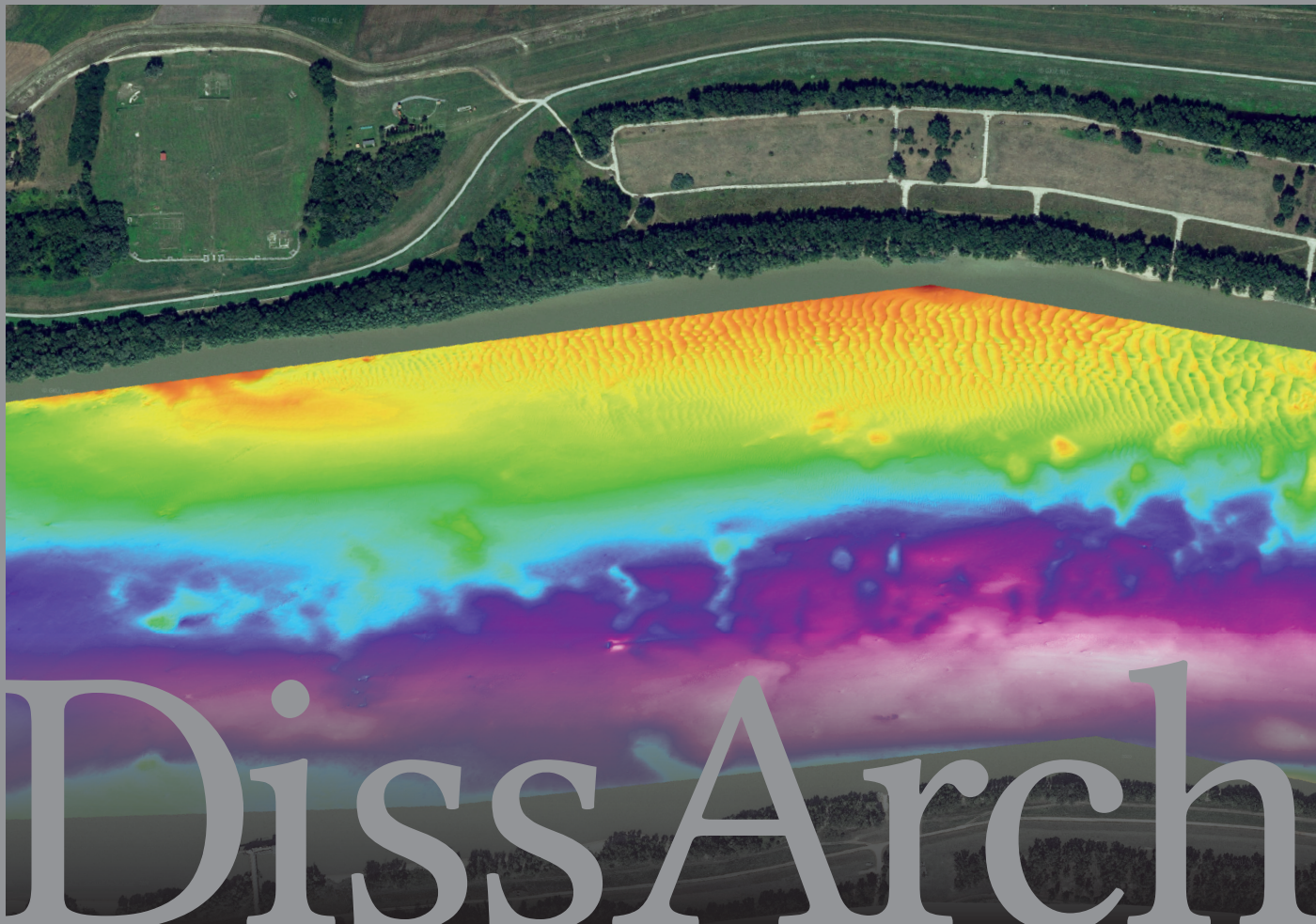


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Universitatis de Rolando Eötvös nominatae



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Late Bronze Age Arrowheads from Transdanubia and Beyond

Distribution, Chronology, Bronze Technology, and Use-Wear

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Abstract: The study provides a synthesis of Late Bronze Age arrowheads discovered in Transdanubia, western Hungary, supplemented by a selection of arrowheads and a harpoon head from the collection of the Hungarian National Museum, Budapest. This analysis was enabled by the reassessment of curated artefacts preserved in Hungarian museum collections within the framework of the research project *The Technology, Use and Manipulation of Weapons from Late Bronze Age Transdanubia*. During the Late Bronze Age, a diverse array of bronze arrowheads emerged in the region. These can be assigned to supra-regional types, such as Eckhardt's variants 1A, 1C, 3A, 4A, 4E, and 5A, along with local subvariants found in the studied region. The analyses, including microscopic examination of use-wear traces, have yielded insights into manufacturing technologies and functional aspects of these objects. The results indicate that most Transdanubian arrowheads were fully finished projectiles at the time of deposition in hoards, graves and settlement features. Some arrowheads exhibit traces of use, suggesting their application in both hunting and warfare. While the latter remains a plausible interpretation, further corroboration is required through comprehensive investigation of local settlements. Typologically, the finds reflect a clear supra-regional character with pronounced Central European affiliations. Based on currently available well-dated archaeological contexts, Transdanubia appears to have played a role predominantly in the later stages of the bronze arrowhead technological development. Apart from sporadic specimens, bronze arrowheads consistently occur from the Ha A1 through the Ha B phases, likely as a result of technological innovation, adaptation, and/or increased militarisation. The discovery of casting moulds for types 4A, 4E (subvariants A and B) and as-cast arrowheads (1A, subvariant A) further supports the idea that production was undertaken locally.

Keywords: bronze arrowheads, Hungarian Late Bronze Age, Transdanubia, distribution, typo-chronology, casting, serial production, post-casting treatment, use-wear

Introduction

During the period that Hungarian research considers the Late Bronze Age (Br B2–Ha B3) in Transdanubia, western Hungary, more than one hundred and fifty arrowheads have been found. Of these, only seven are associated with hoards and ten with graves. The majority derive from settlements, predominantly stray finds from Velem-Szent Vid. An additional eleven stray finds originate from various other locations within the study region (see [Catalogues A–B](#), [Fig. 1](#)). As will be detailed in the analyses of the typological variants, most of these arrowheads can be relatively dated between the Ha A1 and Ha B1 phases. A few finds can be securely assigned to the Ha B1–Ha B2 phases. Bronze arrowheads from earlier phases (Br B2–Br D) are generally absent from the analysed assem-

blage. Notable exceptions include two finds recovered from poorly defined archaeological contexts, namely an arrowhead from Somló Hill (Fig. 19.12/1) and another from Tihany-Óvár (Fig. 18.8), for which a Br B dating remains a plausible alternative (Fig. 2).¹

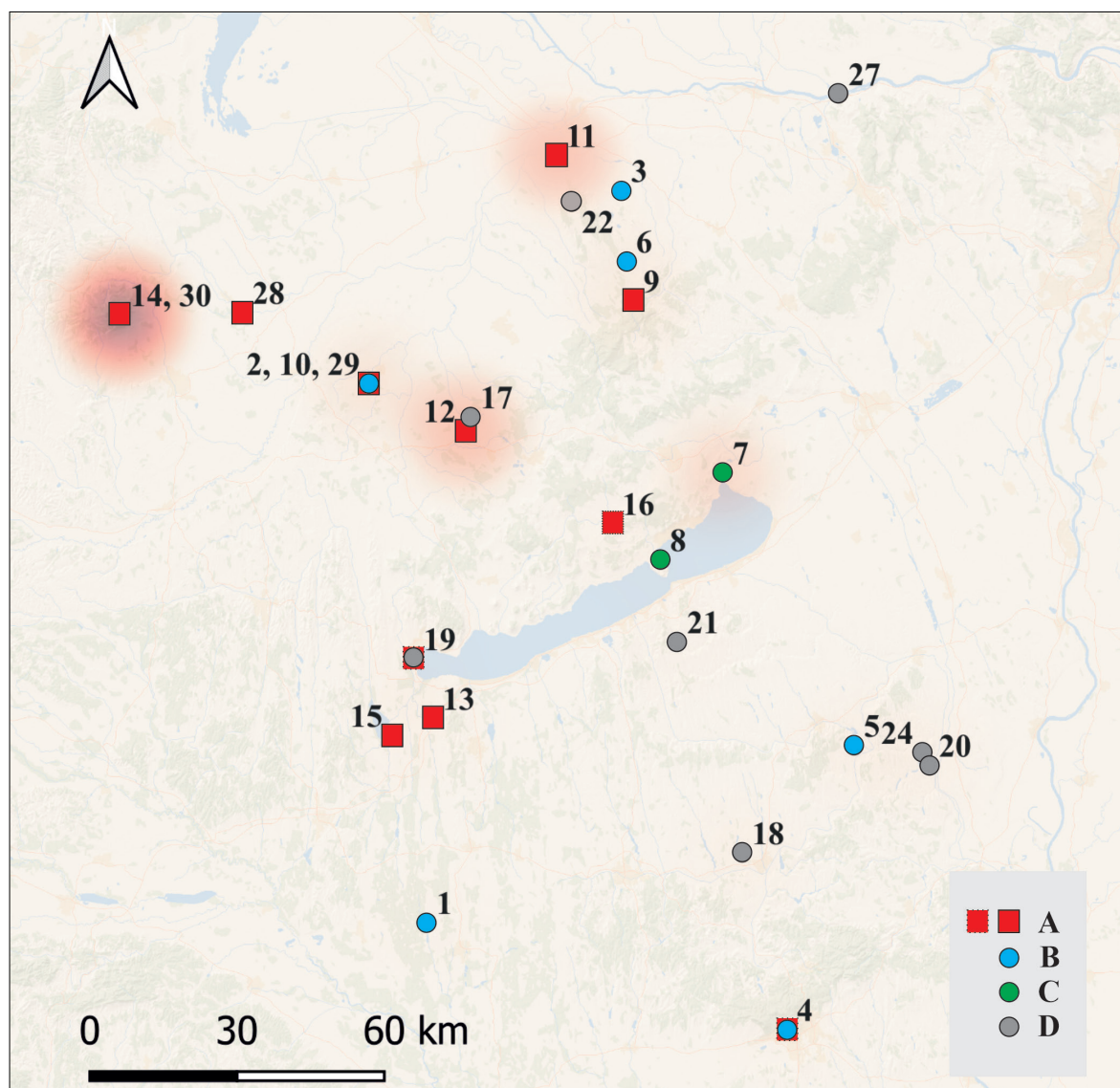


Fig. 1. Distribution of Late Bronze Age arrowheads in Transdanubia. A – settlements, B – hoards, C – graves, D – stray finds (see numbers in Catalogue A and B).

The study undertakes an analysis of the arrowheads, based on research carried out under the framework of *The Technology, Use and Manipulation of Weapons from Late Bronze Age Transdanubia* project. As part of this work, artefacts preserved in museum collections in Budapest and across Hungarian county museums were systematically re-documented. This process included the recording of the objects, assessment of their archaeological context—drawing from both academic literatures, where possible, archival sources—and the application of use-wear analysis to preserved arrow-

1 Two specimens from Tihany-Óvár (Fig. 18.8) and Somló Hill (Fig. 19.12/1) were originally catalogued together with Late Bronze Age material. However, newly acquired contextual information and in-depth typological analysis indicate that these artefacts are more accurately dated to the final stages of the Middle Bronze Age (Br B1). Their inclusion in the present catalogue and analysis is important, as they may mark the earliest adoption of metal arrowheads in the region.

lics, despite her extensive contributions to the study of metal artefacts and hoards, devoted only brief mention to arrowheads and harpoons. This may be attributed to the relatively low chronological ‘value’ of the widely distributed arrowheads, for creating relative chronological schemes.⁵ Noteworthy are the contributions of Géza Szabó, whose research on production technology provided important results concerning the technological characteristics, elemental composition, and metallographic structure of selected arrowheads from Velem-Szent Vid and Regöly-Veravár.⁶ More recently, Ilon has contributed new insights through the publication of finds from Ménfőcsanak,⁷ while Tarbay has explored the typo-chronology, technology and functional aspects of bronze harpoons and harpoon arrowheads,⁸ with his colleagues studied the production technology of arrowheads from Pázmándfalu and the Somló Hill in further detail.⁹

Despite the early international recognition of the local arrowheads, research conducted within Hungary has contributed relatively little to the development of modern classification framework for these artefacts. Given the supra-regional nature of the bronze arrowheads, a comprehensive evaluation of the local material necessitates a broader comparative perspective, particularly one encompassing Central and Southeastern Europe. For certain arrowhead types, meaningful typological comparisons must extend even beyond these regions. It would be futile to attempt a detailed enumeration of all publications that examine, classify, or discuss arrowheads analogous to those discovered in Transdanubia.¹⁰ From a research-historical perspective, only those studies will be considered here that are essential for assessing the arrowheads from western Hungary dated to the Late Bronze Age.

One of the very first was Naue in 1894 who proposed a classification scheme for Upper Bavarian arrowheads, referring to Hungarian specimens known at the time owing to Hampel’s monographs.¹¹ Coutil’s work also holds symbolic significance for Hungarian Bronze Age research. Not only did he present Bronze Age arrowheads from France that were known at the time, but he also referenced Hampel’s work, thereby establishing a connection between local Hungarian finds and their French counterparts.¹² Although Buchholz and Snodgrass focussed on a geographically distant region, their studies on Aegean arrowheads remain relevant.¹³ Several of the types they introduced find clear analogues within the Central European Bronze Age material, an observation that was further substantiated in Avila’s much later monograph.¹⁴ Mercer’s work is undeniably represents a turning point in the study of Bronze Age arrowheads. He recognised that this artefact type could be subjected to typo-chronological analysis on a broader geographical scale. Furthermore, his classification system continues to influence contemporary scholarship, particularly within Western Europe.¹⁵ Since the 1960s, an increasing number of both small- and large-scale studies have been published, focussing on regionally or nationally specific arrowheads from Ukraine to the United Kingdom. These contributions have significantly expanded the known corpus of finds, refine their chronology

5 [MOZSOLICS 1973](#), 47; [MOZSOLICS 1985](#), 47.

6 See [SZABÓ 1993](#); [SZABÓ 1999](#); [SZABÓ 2013](#).

7 [ILON 2015b](#), 237–238.

8 [TARBAY 2022b](#); [TARBAY 2023a](#).

9 [TARBAY *et al.* 2024](#); [TARBAY *et al.* 2025](#).

10 For references, see [TARBAY 2025a](#).

11 [NAUE 1894](#), 97–100.

12 [COUTIL 1912](#).

13 [BUCHHOLZ 1963](#); [SNODGRASS 1964](#), 141–156.

14 [AVILA 1983](#).

15 [MERCER 1970](#).

and distribution.¹⁶ Several studies with a typo-chronological orientation have been published that transcend their regional scope and/or interpret the arrowheads within broader geographical frameworks.¹⁷ Hansen's work is clearly one of them, particularly in the context of Carpathian Bronze Age research. Beyond his classification, he placed greater emphasis on the analysis of archaeological context in which these weapon components appear across various East Central European sites.¹⁸ Also notable among these are the volumes from the *Prähistorische Bronzefunde* series authored by the previously mentioned Avila, as well as Gedl, Overbeck, Říhovský and Vasić, which document finds from Germany, Greece, Poland, the Czech Republic, and Serbia.¹⁹ Eckhardt's 1996 monograph can be regarded as a further synthesis following Mercer's work. It offers one of the most comprehensive analyses of Bronze and Iron Age arrowheads from Central Europe. The typological framework he developed—arguably still the most functional in current use—is based on blade shape, hafting method (e.g., sockets, tangs), and additional morphological traits, such as spurs. The significance of Eckhardt's contribution lies not only in its meticulous typo-chronological framework, but also in its holistic approach. Rather than focussing solely on arrowheads, he addressed the entire weapon, including the bow and arrows, offering insights into their physical attributes, manufacturing techniques, and function.²⁰ Owing to their synthesising nature, Clausen's works can be regarded as a refinement of Eckhardt's work. Although primarily focused on Urnfield graves with weapons, Clausen interprets the material within a broader European context, contributing not only to the typological discourse but also updating several of Eckhardt's earlier chronological conclusions.²¹ Reinhold's synthesis of the Caucasian material uncovered in present-day Georgia and Russia offers a valuable glimpse into what, from the perspective of the Carpathian Basin, might appear as a culturally distant region. However, several local arrowhead types—dated between the end of the Middle Bronze Age and the Early Iron Age—exhibit notable morphological affinities with their Central European counterparts. This is particularly evident in the parallels between Eckhardt's type 1A and the Caucasian A1–A3 forms, as well as between his type 4A and the Caucasian B1 variant (Fig. 2).²²

Among the results of recent research four works should be highlighted for different reasons. The analysis of the Wrocław-Widawa hoard in Poland stands out. It represents the largest known hoard of deposited Bronze Age arrowheads to date. Beyond the evident significance of the assemblage itself, this study has yielded insights into the technological characteristics and use-wear patterns of the Eckhardt's 4A arrowheads. Unlike other weapons, Late Bronze Age arrowheads have generally received limited attention in this regard, making the results on Wrocław-Widawa valuable from a methodological point of view.²³ A recent study by Lysenko, Sinika, and Gutsul provides insights into the arrowheads of the northern Black Sea region, specifically those from Moldova and Ukraine—an area that has traditionally remained somewhat obscure from a Central European perspective. While their work clearly builds upon the foundations laid by earlier Soviet archaeological scholarship, it offers a new perspective on the region's arrowhead types, including ones (1A, 1C)

16 O'CONNOR 1980, 102–104, List 58–59; MEDVEDSKAYA 1980; RITTERSHOFER 1983, 228–231; BRIARD – MOHEN 198, 79–112; CHERNYAKOV *et al.* 1986; ZU ERBACH 1989, 92–93; VANCHUGOV – CHERNYAKOV 1991; HANSEN 1994a, 82–97; KLOCHKO 1995, 139–142; VERLAECKT 1996, 19; HRALA 2000; MÖSLEIN 2001; NOVOTNÁ 2004, 402–403, 407–409; PERKIĆ – LOŽNJAK DIZDAR 2005, 60–62; SALAŠ 2005, 72; KREUTLE 2007a, 115–118; KYTLICOVÁ 2007, 110; OSTERMEIER 2012, 149; DIETRICH 2013.

17 HÄNSEL 1968, 76; SICHERL 2004, 165–181.

18 HANSEN 1994a, 82–97; HANSEN 1994b, 599–600.

19 AVILA 1983; ŘÍHOVSKÝ 1996; GEDL 2014; VASIĆ 2015; OVERBECK 2018.

20 ECKHARDT 1996.

21 CLAUSING 1999, 375–385, Figs 27–28; CLAUSING 2005, 61–72.

22 REINHOLD 2007, 59–60.

23 BARON *et al.* 2020.

analogous to the Transdanubian material.²⁴ Among the most recent Western European studies, the work of Kayser Aguilar deserves attention. It provides crucial insights into Central European-related arrowhead types that appear across various regions of Spain and France, as well as their counterparts throughout the broader Mediterranean sphere. Her research introduces a new typological framework for arrowheads dated between the Early Bronze Age and the Iron Age. Although her new system differs from that of Eckhardt, the two can be synchronised at the level of individual artefacts.²⁵ The most recent comprehensive summary of Central European arrowheads was published by Inselmann *et al.* in the 2024 volume of the *Antiquity*, offering the newest results on the arrowheads from the Tollense battlefield. The study investigates the role of arrowheads in warfare by analysing the quantity and spatial distribution of specific types, aiming to identify the origin of the opposing forces involved in the conflict at Tollense. Undoubtedly, one of the most significant contributions of this work lies in its supplementary materials. Drawing upon individual studies of German archaeology, the database mainly incorporates and builds upon foundational works of Gedl, Říhový, Eckhardt, Clausen, and Sicherl. In doing so, it encompasses the full typological spectrum of arrowheads present in Transdanubia without including them.²⁶

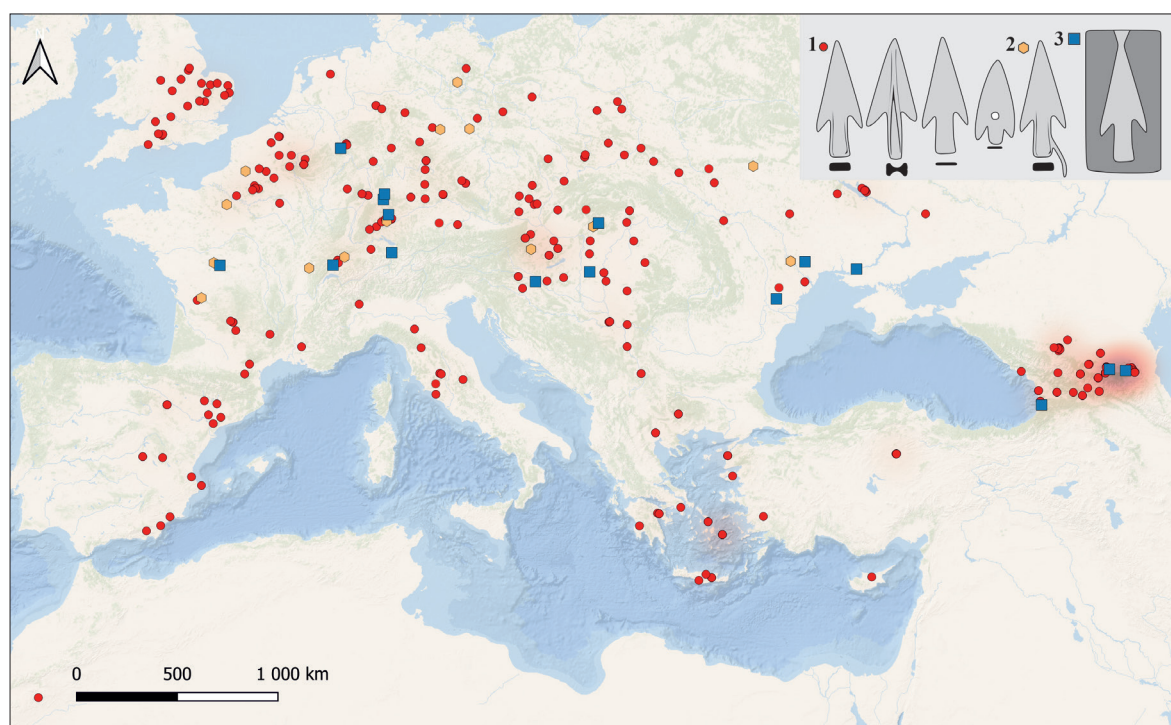


Fig. 3. Distribution of 1A and 1C arrowheads. 1 – variant 1A and its subvariants, 2 – variant 1C, 3 – potential casting moulds of variant 1A (see data in [TARBAY 2025a](#)).

Typo-chronology

Since the 19th century, the study of arrowheads has undergone considerable development. This trajectory has primarily followed a typo-chronological approach, while relatively little attention has been paid to the examination of technology and use. Regarding typology, although not discussed here in full detail, numerous classification systems currently exist for this artefact category.

²⁴ [LYSENKO et al. 2021](#).

²⁵ [KAISER 2003](#); [KAYSER AGUILAR 2004](#).

²⁶ [INSELMANN et al. 2024](#), Suppl. Mat.

This issue is not specific to arrowheads but rather reflects a broader methodological challenge within the study of European Bronze Age metalwork. When addressing the classification of the Transdanubian material, it is reasonable to adopt Eckhardt's (1996) typology. Although his framework does not explicitly include finds from the region under discussion, it nonetheless provides a basis for classifying the majority of Transdanubian arrowheads. This is due to the shared material heritage of the Tumulus and Urnfield cultures across Central Europe. Naturally, some degree of adjustment is required to reflect local specificities; however, in our view, these can be sufficiently accounted for by defining sub-variants. The variants adopted from Eckhardt's typo-chronological framework are as follows: 1A (barbed arrowheads with a rectangular cross-sectioned tang), 1C (barbed arrowheads with a rectangular cross-sectioned tang and a spur), 3A (barbed sheet metal arrowheads without a tang), 4A (socketed arrowheads with barbs), 4C (socketed arrowheads with barbs and a spur), 4E (socketed harpoon arrowheads with loop, barbs and a spur) and 5A (socketed arrowheads with leaf-shaped blades).²⁷ Based on typological arguments outlined in the analysis of the finds, we propose that two of the above-mentioned variants—namely 1A and 4E—can be further subdivided into distinct subvariants. Type 1A can be differentiated into subvariants A through D, while variant 4E may be divided into subvariants A and B. Additionally, the arrowhead classified as variant 3A represents an individual variation within this typological group (Fig. 2).

One might question the value of conducting an in-depth analysis of the Transdanubian Late Bronze Age arrowheads, given their strong affinities with West-Central European material and the availability of a recent and robust database compiled by the Tollense research group. Nonetheless, such an analysis remains worthwhile: by building upon their foundational work, a more nuanced study can be undertaken—one that appropriately evaluates the Transdanubian material within a broader European typological framework. The database curated by Inselsmann *et al.*, undeniably, most extensively developed for German finds. The scope of their inquiry naturally imposes certain spatial limitations, and as previously noted their compilation draws heavily on seminal works by Gedl, Říhovský, Eckhardt, Clausen, and Sicherl to incorporate material from other regions; however, this integration remains partial and uneven.²⁸ Consequently, aside from some Slovakian finds, the database lacks substantial representation of material from the Carpathian Basin and the Balkans—including the entire corpus of Hungarian arrowheads, as well as Greek and Serbian finds. It similarly omits artefacts from the northern Black Sea region, the Caucasus, and associated Anatolian sites.

There remains considerable potential to expand this dataset, not only towards Southeastern Europe and the Eastern Mediterranean, but also to westward, through the inclusion of West European material from Belgium, Britain, France, Italy, and Spain—especially in relation to Eckhardt's variant 1A. The Transdanubian region, positioned at the intersection of different cultural spheres, clearly necessitates a more comprehensive analytical perspective to fully appreciate its role in the development and distribution of Late Bronze Age bronze arrowheads. In support of this study, a new Mendeley dataset has been compiled and published, encompassing more than 2,500 artefacts identified as analogues of the Transdanubian material.²⁹ This dataset includes detailed metadata—such as site names, archaeological context, chronological position, quantity, key citations, and annotated notes—and serves as the basis for the evaluation presented here. The database builds primarily on the seminal works of Clausen, Eckhardt, Gedl, Kayser Aguilar, Říhovský, Vasić, Reinhold, Sicherl

27 ECKHARDT 1996, 26–30; INSELMANN *et al.* 2024, Suppl. Mat.

28 INSELMANN *et al.* 2024, Suppl. Mat.

29 TARBAY 2025a.

and Inselman *et al.*,³⁰ as well as on individual papers cited in its bibliography.³¹ Each entry was individually verified, allowing for new updates and typological refinements. The database strives for comprehensiveness, which is inherently unattainable given its vast geographic scope, ranging from Russia to Spain. Despite its current limitations, it is structured to support future expansion and provides a framework for integrating new finds. These likely include objects recovered through the ever-increasing number of metal-detecting surveys and the data to be made available in future publications.

1A (Eckhardt's Type 1, Variant A), Subvariants A–D

Studied finds (Subvariant A): Bakonyszentlászló 9/1–2 (Fig. 18.9/1–2); Bolhás II 1 [serrated tang] (Fig. 18.1); Győr-Ménfőcsanak 11/5, 11/12 (Fig. 19.11/5,12); Somló 12/13 [as-cast] (Fig. 20.12/13); Velem 14/38–40 (Fig. 22.14/38–40).

Studied finds (Subvariant B): Bakonyszentlászló 9/3 (Fig. 18.9/3); Velem 14/24 (Fig. 21.14/24).

Studied finds (Subvariant C): Somló 12/14–15 (Fig. 20.12/14–15); Velem 14/41–45 (Fig. 22.14/41–45).

Non-Transdanubian finds: Domonyvölgy 31 (Fig. 26A.31), Unprovenanced 33/2 (Fig. 26C.33/2).

Studied finds (Subvariant D): Somló 12/1 (Fig. 19.12/1).

Studied finds (1A, uncertain): Bakonyszentlászló 9/4 (Fig. 18.9/4), Kapospula 18/1 [1A or 2A] (Fig. 23.18/1); Velem 14/37, 14/49 [1A or 2A] (Fig. 22.14/37, Fig. 23.14/79).³²

According to Eckhardt, 1A arrowheads are characterised by their rectangular-sectioned, hammered tangs and barbs. While the majority were manufactured from bronze, examples made from meteoritic iron or organic materials such as bone or antler have also been discovered.³³ Based on finds from Lage Müssen,³⁴ these arrowheads were inserted into forked wooden shafts, which were secured with binding and, presumably, adhesive.

Bronze 1A arrowheads represent a supra-regional typological group with a widespread distribution across Europe (Fig. 3.1, Fig. 4).³⁵ Examples are known from a wide chronological and geographical range, including Austria (Br B1),³⁶ Belgium (Bronze Final IIb–IIIb),³⁷ Bulgaria (“LH II–III”),³⁸ Brit-

30 ECKHARDT 1996; ŘÍHOVSKÝ 1996; SICHERL 2004, 165–181; KAISER 2003; KAYSER AGUILAR 2004; CLAUSING 2005, 61–72; REINHOLD 2007; GEDL 2014; VASIĆ 2015; INSELMAN *et al.* 2024, Suppl. Mat. In the present paper, analogues are cited in a simpler format, referring either to catalogue numbers or table references.

31 See individual papers cited in TARBAJ 2025b.

32 In the case of specimens 14/37 and 14/79, the cross-section of the arrowheads tang (rectangular, D-shaped, circular, or lozenge-shaped) is unclear.

33 ECKHARDT 1996, 26. Examples for 1A arrowheads made of different materials: SÉRONIE-VIVIEN 1968; STUDENÍKOVÁ – PAULÍK 1983, Pl. 48.4; SCHOPPER 1995, Pl. 134A.2; REINHOLD 2007, Pl. 335.10–11, List 169 PfA2.KIS44; GEDL 2014, Nos 670, 690, 697–698; KERN – LOCHNER 2021, Fig. 4.25; HOFMAN *et al.* 2023, Fig. 1; INSELMAN *et al.* 2024, Suppl. Mat.

34 ACKERMANN-GRÜNEWALD 2001, 17, Pl. 2.2–4.

35 See MERCER 1970, 190–191, Fig. 5; ECKHARDT 1996, 410–411, Map 13; INSELMAN *et al.* 2024, Fig. 8, Suppl. Mat.; TARBAJ 2025a, 1A.

36 WILLVONSEDER 1937, Fig. 8.8; PITTIONI 1941, Pl. 12.18; HAMPL *et al.* 1981, Pl. 205.9, Pl. 223.23–24; ŘÍHOVSKÝ 1996, 132; CLAUSING 2005, 69; ADAMETZ – LOCHNER 2021, Fig. 3.30.

37 DESITTERE – WEISSENBORN 1977, Figs 23–24; MARIËN 1984, Fig. 23.c; WARMENBOL 1995, Pl. 2.2, 9, 39–40, Pl. 3.3, 10, 15, Pl. 4.11, 41, 45, Pl. 7.G, I, N; WARMENBOL 2019, Figs 1–2; LEBLOIS – WARMENBOL 2024, Fig. 1.

38 ALEXANDROV 2002, 75, Fig. 32.1–4.

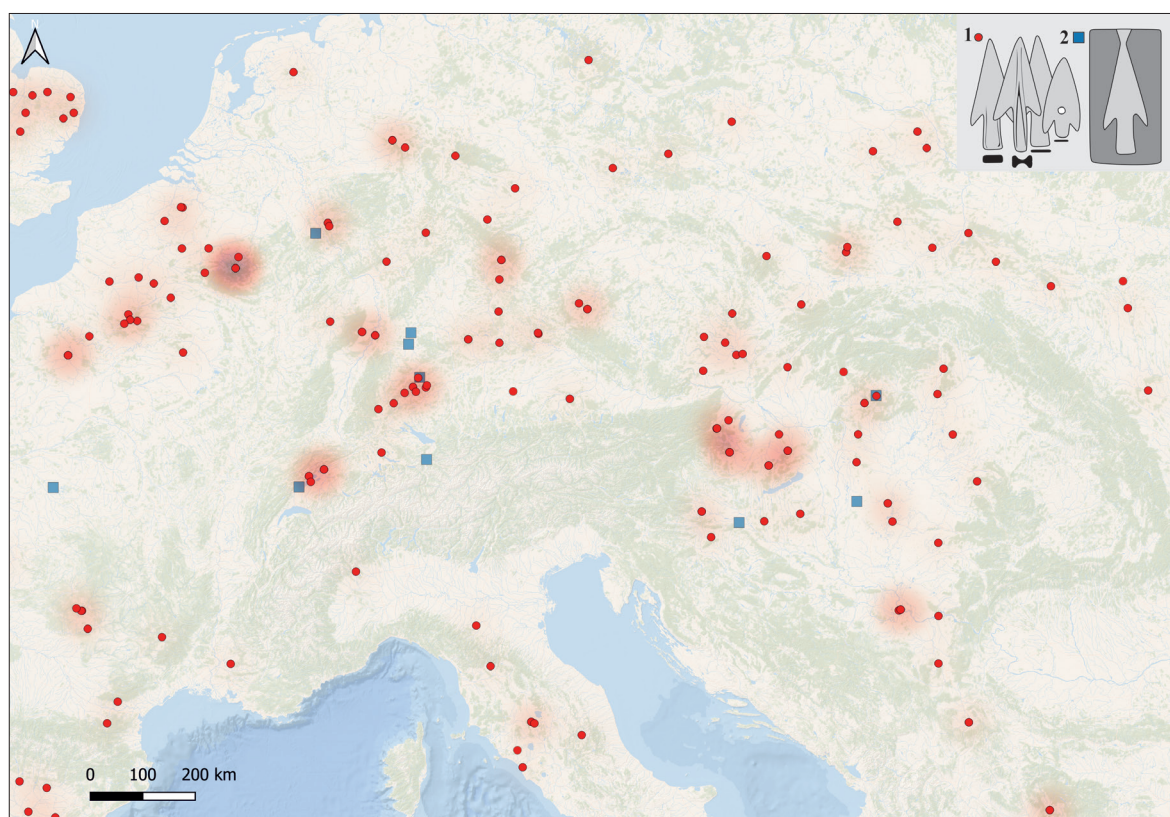


Fig. 4. Concentration of 1A arrowheads in Europe. 1 – variant 1A, 2 – potential casting moulds of variant 1A (see data in [TARBAY 2025a](#)).

ain,³⁹ Croatia,⁴⁰ Cyprus (LC II–GCI),⁴¹ Czech Republic (Br B – Br D–Ha A1),⁴² eastern Hungary (MBA, Br B2–C; Ha B1),⁴³ France (MBA),⁴⁴ Georgia (MBZ 2 – Ko C1),⁴⁵ Germany (Br B–C – Ha B),⁴⁶

39 McDONALD 2004; JOHNSON 2006; BROWN 2009; BYARD 2012; DARCH 2013; WILLIS 2014a; WILLIS 2014b; ASHLEY 2015; BOOTH 2015; GOODEY 2016; SCOTT 2018; CARAVELLO 2019; COBBY 2020; DOWNES 2020; GIBBONS 2020; HAYWARD TREVARTHEN 2020; BRUNDLE 2022; COX 2022; ALLNATT 2023; FITTOCK 2024; HANBIDGE 2024.

40 KARAVANIĆ 2009, Fig. 25.11.

41 CATLING 1964, 132–133, Fig. 16.11, Pl. 16.c.

42 ČUJANOVÁ – JÍLKOVÁ 1970, Pl. 45.21; ŘÍHOVSKÝ 1996, 130–136, Pl. 28.458, 460, 462, 467, 469; SICHERL 2004, Pl. 11.16–18; ROŽNOVSKÝ 2020, Fig. 2A.1; INSELMAN *et al.* 2024, Suppl. Mat.

43 TROGMAYER 1975, 80, Pl. 33.357; SZEVEŘÉNYI – KULCSÁR 2012, 327, Fig. 32b; V. SZABÓ – BÁLINT 2017, Fig. 16.5; V. SZABÓ 2019a, Fig. 90.

44 BREUIL 1903, Fig. 1.1; DE MORTILLET – DE MORTILLET 1903, Pl. 88.1086; COUTIL 1912, Fig. 1.13; PHILIPPE 1936, Fig. 50.13, 20–22, 35; BRIARD – MOHEN 1983, 97–98, Fig. 2.1–2; BLANCHET 1984, Fig. 215.2–3, 5–8, 16–17; CAMPOLO – GARCIA 2004, Nos 62–63; GASCÓ 2006, Fig. 3.4–5, 7, 9, 15.

45 KORIDZE 1965, Pl. 22.8–10; VORONOV 1969, Pl. 38.54; TEHOV 1980, Pl. 85.II.2; MIKELADZE 1985, Pl. 12.25–27, 37–39; MIKELADZE *et al.* 1985, Pl. 53; MIKELADZE 1990, Pl. 23.22; CHAVLEISHVILI 1991, Pl. 9.3; PAPUASCHWILLI 1998, Tab. 1, Pl. 3.26–27, Pl. 4.20–21; REINHOLD 2007, Fig. 70, Pl. 173.13–17, Pl. 194.4–6, Pl. 335.10–11, List 168 Pfa1.SAM11, SOS31, SOS41, List 169 Pfa2.ADZ25, GUR25, KIS44, IME22, IME29, MMT1, SAM11, SAM13, SOS31, List 170 Pfa3.AAB140, SVA15.

46 HEDINGER 1903, Pl. IV; BEHRENS 1916, Pl. 12.9; MARSCHALLEK 1944, 84–85, 217, Fig. 21; TORBRÜGGE 1959, Pl. 43.51, Pl. 57.20; HERRMANN 1966, Pl. 13B.4; HUNDT 1975, Fig. 7.2, Fig. 9.1; SCHLÜTER 1975, Pl. 5.3; PIRLING 1980, Pl. 4D, Pl. 4H.9, Pl. 18E.4, Pl. 46L.6; BERGER 1994, Pl. 16.32; PAULI 1994, Pl. 92.20; SCHOPPER 1995, Pl. 134A.2; ECKHARDT 1996, Pl. 1.5, Pl. 21.5, Pl. 29.4, Pl. 34.3, Pl. 36.10; B.V. 2000, Fig. 27.12; ACKERMANN-GRÜNEWALD 2001, 17–19, 25, Pl. 2.2–4; ABELS 2002, Pl. 19.24–27; CLAUSING 2005, 68–69, Pl. 9B.3, Pl. 15B.2–4, Pl. 21B.8, ►

Greece (LH I–LH IIB),⁴⁷ Italy (Final Bronze Age),⁴⁸ Moldova,⁴⁹ Morocco,⁵⁰ the Netherlands (1340 ± 35 BC),⁵¹ Ukraine,⁵² Poland (Period V/Ha B2–Ha B3),⁵³ Romania (Noua culture, LBA II),⁵⁴ Russia/Caucasus (Ko A – Ko D),⁵⁵ Serbia,⁵⁶ Slovakia (Br B1–Br B2, Radzovce II horizon),⁵⁷ Slovenia (Ha B1–Ha C1),⁵⁸ Spain (EBA/MBA–LBA),⁵⁹ Switzerland (Ha A–Ha B),⁶⁰ and Turkey (Boğazköy–Hattuša Unterstadt 1; Çine–Tepecik ‘Storeroom’, Troy VI and VII [Hisarlık]).⁶¹

The production of A1 arrowheads in Central Europe began towards the end of the Hungarian Middle Bronze Age (Br B1) and continued throughout the Late Urnfield period (Ha B3). The emergence of this form may have occurred earlier in Western Europe—particularly in Spain and France—where sheet-metal subvariants (e.g. Subvariant C) are documented as early as the local Early and Middle Bronze Ages.⁶² Among all bronze arrowhead types, Type 1 most closely imitates the flint stone and bone arrowheads from the Early and Middle Bronze Age. It is conceivable that the earliest examples of Type 1, including 1A, were metal prototypes inspired by earlier organic and lithic forms. Furthermore, it is plausible that manufacture of such arrowheads began independently in several regions, which would explain the widespread occurrence of morphologically similar types across Europe.

- Pl. 37B.3; OSTERMEIER 2012, Fig. 185.3; ZICH 2015, 129, Fig. left; MARASZEK 2015, 174, Fig. left; SCHMID-MERKL 2016, Nos 11.4, 69.1, 69.3, 69.7, Fig. 56; BLITTE *et al.* 2019, Fig. 3; INSELMAN *et al.* 2024.
- 47 BUCHHOLZ 1963, 26, Fig. 7.VIb, Fig. 12.n, p, r–t, x–z, v, alpha, beta; AVILA 1983, 103–107, Pl. 27.713, 717, 722–723, 724A–Q, 736C; HOCHSTETTER 1987, 25–26, Pl. 2.1–3.
- 48 MONTELIUS 1895, Pl. 35.12, Pl. 32.3, Pl. 126.4–5, 14, 18; BERNABÒ *et al.* 1997, Fig. 334.48; POGGIANI KELLER 2001, Fig. 6.14; BIETTI SESTIERI – MACNAMARA 2007, Pl. 200.836.
- 49 SÎRBU 2014, Fig. 6.2; LYSENKO *et al.* 2021, Fig. 2.1.
- 50 RUHLMANN 1932, 28, Fig. 2.
- 51 VAN DER VEEN *et al.* 1989, Fig. 39.39b; INSELMAN *et al.* 2024, Suppl. Mat.
- 52 KLOCHKO 2001, Fig. 79.17; KLOCHKO 2006, Fig. 96.5; DIETRICH 2013, 186, Fig. 3.Type 4F; KLOCHKO – KOZYMENKO 2017, 138, 188, Fig. 12, Fig. 25; LYSENKO *et al.* 2021, Fig. 2.3–6, 8–9, 12, Fig. 3.2–9.
- 53 GEDL 2014, Nos 565–566, 568–569, 570A–571, 573–577, 670, 690, 697–698.
- 54 COMAN 1980, Fig. 119.13; BĂLĂRIE *et al.* 2016, Fig. 6.
- 55 UVAROVA 1900, Pl. 57.3–5; KRUPNOV 1960, Fig. 9.8, Fig. 40.8; KOZENKOVA – KRUPNOV 1964, Fig. 21.2; KOZENKOVA – KRUPNOV 1966, Fig. 21.2, Fig. 36.5–6; KOZENKOVA 1977, Pl. 21.19–20; KOZENKOVA 1982, Pl. 11.26–27; DUDAREV 1991a, Pl. 21.5, Pl. 25.17–18, Pl. 38.15; DUDAREV 1991b, Pl. 11.10; DUDAREV 1992, Fig. 2; KOZENKOVA 1992, Pl. 23.9, Pl. 47.20, Pl. 60.20, Pl. 63.12, Pl. 70.7–9; KOZENKOVA 1995, Pl. 1.1, 23–27, 29; KOZENKOVA 2001, Fig. 51.4, Fig. 85.7, Fig. 86.2–3, 6; MARKOVIN 2002, Fig. 23.2–8, Fig. 28.1, Fig. 42.3–4, Fig. 51.3–4, Fig. 65.2–3, Fig. 70.6; REINHOLD 2007, List 168 Pfa1.CEC11, CEC25, CEC117, CEC120, CEC150–151, CEC186, KIS11, KIS15, KIS44, KIS66, KIS116, NOS35, NOS43, NOS60, List 169 Pfa2.CEC106, CEC150, CEC186, KIS1, KIS31, KIS40, KIS44, KIS56, KIS156, NOS12, List 170 Pfa3.CEC150–151, KIS44, KIS156, KRC85, NOS12, NOS18, PJA34, Pl. 202.7–11, Pl. 210.59, 63, Pl. 217.37, Pl. 220.33, Pl. 227.3–4, Pl. 229.29, Pl. 240.3, Pl. 288.3, Pl. 322.12–13, 15, Pl. 334.19, Pl. 339.5, Pl. 373.1–4, Pl. 396.19; BURKOV 2022, 782, Tab. 1.11.
- 56 FILIPOVIĆ 2015, 263–265, 267–268; VASIĆ 2015, 73–74, Nos 341, 344–349, 352–353, 355.
- 57 STUDENÍKOVÁ – PAULÍK 1983, 200, Pl. 35.12; OLEXA 1992, Tab. 1.5; ŘÍHOVSKÝ 1996, 132; FURMÁNEK 2019, 54–57, Pl. 40.10; PAŽINOVÁ *et al.* 2025, Fig. 8.6–7.
- 58 DULAR 2013, Fig. 29.4–5.
- 59 HARRISON *et al.* 1994, Nos 83, 534, 1181, 1259, 1787; DÍAZ-ANDREU GARCÍA – MONTERO RUIZ 1998, Fig. 23.1–2, Fig. 28.7; SIMÓN GARCÍA 1998, Fig. 79.10, Fig. 87.14; KAISER 2003, Tab. 2.16–17, Tab. 3.7, 13, 18, Tab. 4.7, Tab. 4.9, Appendix; SIRET – SIRET 2006, Pl. 26.51; LOBENSTEINER 2016, Fig. 1.1–4.
- 60 HEIERLI 1886, Pl. 1.14; ANTIQUITÉS LACUSTRES 1896, 15, Pl. 15.16; RYCHNER 1979, Pl. 128.22, 25; ECKHARDT 1996, Pl. 65.8, Pl. 66.1; CLAUSING 2005, 69; HOFMAN *et al.* 2023, Fig. 1 (meteoritic iron); INSELMAN *et al.* 2024, Suppl. Mat.
- 61 BLEGEN *et al.* 1953a, 270; BLEGEN *et al.* 1953b, XIV, Pl. 297.36–377; BOEHMER 1972, Pl. 29.860–862; BOEHMER 1979, 22–23, Pl. 15.3156, 3158–3161; KOPPENHÖFER 1997, Fig. 6.5–6; HÄNSEL 2014, 183, 198, Pl. 5.14; GÜNEL 2015, Fig. 10; PIENIAŻEK 2020, 35–36, 40–41, Nos 8, 19, 29, Fig. 4.
- 62 ECKHARDT 1996, 26; KAYSER 2003.

The production of 1A arrowheads continued over an extended period. The latest bronze examples remained in use into the Early Iron Age (Ha C–Ha D) across several regions, including the Czech Republic, Poland, Slovenia, and the Caucasus (Fig. 6). A notable case of early experimentation with meteoritic iron is represented by the find from Möriegen, Switzerland.⁶³ The manufacture of 1A arrowheads in iron was subsequently continued by the Hallstatt culture. Within Transdanubia, well-preserved examples have been recorded from the site of Boba.⁶⁴ Regarding Transdanubian 1A arrowheads—excluding the potentially early-dated example from Somló Hill (Fig. 19.12/1)—these artefacts primarily belong to the Late Bronze Age. Their relative rarity and concentration at only a few sites, combined with the absence of associated local casting moulds, suggest that either the concept of manufacturing such objects or the projectiles themselves, originated outside Transdanubia.

Variations within the 1A barbed tanged arrowheads, arising from technological or stylistic factors, justify their classification into subvariants: Subvariant A (cast and hammered with a rectangular-sectioned tang) (Fig. 2.1A/A), Subvariant B (cast and hammered, with a ribbed tang) (Fig. 2.1A/B), Subvariant C (sheet-metal arrowheads) (Fig. 2.1A/C), Subvariant D (sheet-metal arrowheads with a perforation) (Fig. 2.1A/D). These differences observable in the Transdanubian material, and, based on the illustrations published in the literature, it can be inferred that they also occurred beyond this region.⁶⁵

Subvariant A is among the most frequently occurring subvariants (Fig. 2.1A/A), with securely identifiable examples displaying a distribution pattern closely corresponding to that of 1C. The principal concentration of this subvariant lies in Central Europe, south-eastern Britain, and the Caucasus. The number of datable finds is insufficient to determine a single point of origin or multiple independent origins. The distribution of datable specimens indicates that, from phase Br C onwards, this subvariant developed into a supra-regional form (Fig. 5.1, Fig. 6.1–4). Its chronological range extends from the Br B1 to Ha C in Central Europe. Early examples have also been identified in Western Europe, particularly in Spain, suggesting a complex temporal and geographic context for its emergence, and the possibility of parallel developments of morphologically identical forms. Dating the Transdanubian examples presents certain challenges, as the majority derive from multi-period settlements—such as Somló and Velem—or were recovered as stray finds, often through metal-detecting surveys. An exception is the unpublished dual hoard from Bolhás. This hoard includes diagnostic artefacts such as Palotabozsok- and Debrecen-type axes, and Lovasberény-type bracelets, all emblematic of Ha B1 phase hoarding in Transdanubia. The treatment and composition of this assemblage also show strong parallels with the heavily fragmented hoards from Nagydobsza and Beremend in southern Transdanubia.⁶⁶ Further support for the dating Subvariant A is provided by arrowheads unearthed near the rampart at Bakonyszentlászló, a settlement dated by Nováki to the Ha A2–Ha B1 phase.⁶⁷

The defining feature distinguishing Subvariant B from Subvariant A is the presence of two cast ribs flanking the tang (Fig. 2.1A/B). Arrowheads of this subvariant have been discovered at the settlements of Bakonyszentlászló and Velem. They exhibit typological similarities with a ribbed arrow-

63 HOFMAN *et al.* 2023, Fig. 1.

64 PATEK 1993, 114, Fig. 100.1–5; ECKHARDT 1996, 26.

65 However, the definition of these variants in the literature remains problematic, as publications often omit specific details regarding the cross-sectional morphology of arrowhead tangs. These ambiguities have been recorded accordingly in the database. See [TARBAY 2025a](#).

66 [TARBAY 2022a](#), 131–148.

67 [NOVÁKI 1979](#), 102–105; [NOVÁKI *et al.* 2006](#), 132. In case of Velem, the arrowheads also originated from the fortification features ([HRAJALA 2000](#), 254–255, Fig. VII.20).

head recovered from Grave 31 in Lysice, Czech Republic, dated to Br D–Ha A1.⁶⁸ Arrowheads of this subvariant have been identified in Bulgaria (Fig. 5.2). Alexandrov classifies a comparable specimen as Koprivlen Type II, assigning it a tentative date of LH II–III (approximately Br B2 – Ha A2), based on parallels from the Aegean, such as Kastanas, and further eastern sites.⁶⁹ The deliberate carving of tang ribs into the casting moulds’ negatives—whether for functional or aesthetic purposes—underscores the validity of treating these arrowheads as a distinct subvariant. Although the Transdanubian examples lack secure archaeological context, the chronological phasing of the Bakonyszentlászló site may support a somewhat later date (Ha A2–Ha B1) relative to the Lysice or Koprivlen finds.

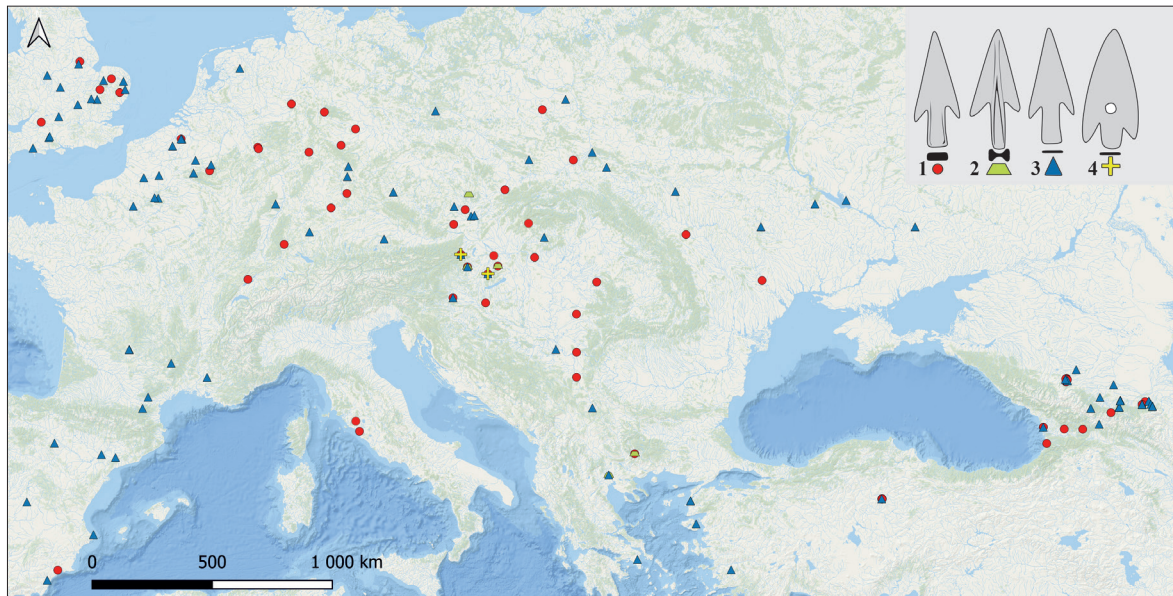


Fig. 5. The distribution of 1A arrowheads subvariants. 1 – subvariant A, 2 – subvariant B, 3 – subvariant C, 4 – subvariant D (see data in [TARBAY 2025a](#)).

While Subvariants A and C may appear morphologically similar, they are fundamentally distinct in terms of manufacturing technique. Subvariant C comprises barbed and tanged arrowheads fashioned from cast thin sheet metal or cast and subsequently flat-hammered into shape (Fig. 2.1A/C). This subvariant exhibits a remarkably wide distribution, extending from Spain to the Caucasus, and from Anatolia and the Aegean to the British Isles (Fig. 5.3). Notable concentrations occur on both sides of the Strait of Dover (southern Britain, Belgium, northern France) and in the Caucasus. Despite this broad distribution, relatively few examples of Subvariant C are securely datable, and even fewer can be confidently assigned to specific chronological phases. Nevertheless, some chronological insights can be inferred. The earliest datable specimens originate from Spain, while examples begin to appear in Central Europe during the Br B1 phase. Due to the limited number of datable contexts, it remains unclear whether these represent independent or parallel developments. In the Caucasus, Subvariant C arrowheads do not appear until after the Br D–Ha A1 phase, with a more pronounced presence during the Ha C–D phases of the Early Iron Age. This late development corresponds with similar finds in Poland (Fig. 6.5–8). In Transdanubia, Subvariant C specimens derive from multi-period settlements such as Somló and Velem, where the Ha B phase is dominant. However, a lack of archaeological context hampers precise dating. The Velem finds are undatable stray objects, whereas those from Somló Hill were recovered through metal-detecting surveys in an area occupied during the younger and late Urnfield periods as well as into the Early Iron Age (Fig. 17).

68 ŘÍHOVSKÝ 1996, 134, Pl. 28.469.

69 HOCHSTETTER 1987, Pl. 2.1, 5 (uncertain barbs); ALEXANDROV 2002, 75, 77–78, Fig. 32.6.

Subvariant D is represented by a single specimen recovered from Somló Hill prior to the initiation of the Hungarian National Museum research project (Fig. 19.12/1). This stray sheet-metal arrowhead is equipped with barbs, a short tang, and a central perforation in the blade (Fig. 2.1A/D). Typologically, the artefact exhibits hybrid characteristics, combining features of Subvariant C of type 1A with elements reminiscent of Eckhardt's 3A and 3B.⁷⁰ A comparable example is known from Grave 37 of the Pitten cemetery, Austria. Although the precise chronological attribution of this grave remains uncertain, it may tentatively be placed within the Br B1 phase.⁷¹ If this dating is accepted, the Somló stray find would correspond to the Middle Bronze Age—a chronological horizon that, according to recent field research, is currently underrepresented at Somló Hill, where the material record is otherwise dominated by finds from the younger and late Urnfield and Hallstatt periods.

Several casting moulds can potentially be associated with the different variants of the Type 1 arrowheads, including the examples from Bad Urach (Ha B2),⁷² Bamut (Ko A–Ko B1 = Br D–Ha A),⁷³ Besigheim,⁷⁴ Cholok Ochkhauri (Layer III: 9th–7th c. BC and a stray find),⁷⁵ Corcelettes,⁷⁶ Gorzano,⁷⁷ Heilbronn-Neckargartach (Ha B3),⁷⁸ Kherson,⁷⁹ Martizay,⁸⁰ Meckenheim (Ha B2/3),⁸¹ Seržen'-Jurt 1/VII (Ko A–Ko D),⁸² Schellenberg-Borscht,⁸³ Soltvadkert (Br C–Br D),⁸⁴ Slobodka,⁸⁵ Suvorovo-VI,⁸⁶ Sveti Petar Ludbreški (Ha B3–Ha C),⁸⁷ and Radzovce (Br C/D) (Fig. 3.3).⁸⁸ The distribution of these casting moulds spans a wide geographical area, from France to the northern and eastern fringes of the Black Sea. Although the majority have been recovered in western Central Europe, their occurrence in the Carpathian Basin, the northern Black Sea region, and the Caucasus strongly suggests that these arrowhead types were produced independently across multiple regions by different cultures. Unfortunately, many of these casting moulds remain difficult to date precisely. The earliest datable specimens have been discovered in the Carpathian Basin (e.g., Soltvadkert and Radzovce), whereas a slightly later example was found in the Caucasus, at the Ko A–B1 settlement of Bamut. By contrast, the western Central European casting moulds appear to correspond to the late Urnfield period.

Establishing a direct connection between 1A arrowheads and the casting moulds presents certain challenges. For instance, subvariant 1A achieves its defining rectangular-sectioned tang primarily

70 ECKHARDT 1996, 26, 28–29.

71 BENKOVSKY-PIVOVAROVÁ 1978, 83–84; HAMPL *et al.* 1981, 37–38, Pl. 205.9.

72 OVERBECK 2018, 127, 130, Pl. 23.36.

73 MAGOMEDOV 1972, 124–125, Fig. 8; REINHOLD 2007, 204, 419, Pl. 253.4.

74 OVERBECK 2018, 127, 130, Pl. 23.37.

75 CHAVLEISHVILI 1991, 18, Pl. IX.8, 10.

76 ANTIQUITÉS LACUSTRES 1896, 19, Pl. 33.3.

77 BERNABÒ *et al.* 1997, Pl. 334.47.

78 OVERBECK 2018, 129–130, Pl. 25.46.

79 KLOCHKO 2001, 201, Fig. 79.15.

80 CORDIER 1962, 848, Fig. 6 (right).

81 OVERBECK 2018, 128, 130, Pl. 24.41.

82 KOZENKOVA – KRUPNOV 1966, 83, Fig. 36.10; KOZENKOVA 1982, Pl. 9.17; REINHOLD 2007, 429–430, List 170 PfA3.CEC151.

83 KELLER-TARNUZZER 1941, 216–217, Fig. 62.

84 GAZDAPUSZTAI 1958, 270, Pl. 5.6; MOZSOLICS 1973, 80–81.

85 LYSENKO *et al.* 2021, 24, Fig. 4.1.

86 LYSENKO *et al.* 2021, 24, Fig. 4.2.

87 WANZEK 1989, 199–200, No. 39, Pl. 37d; KARAVANIĆ 2009, 79, Fig. 41.12.

88 HANSEN 1994b, 599, Fig. 51; PANČÍKOVÁ 2008, 138–139, Fig. 2.3, 6. A clay casting mould for an arrowhead from Piliny, Hungary, may also depict a 1A arrowhead, or alternatively a 4A (HAMPEL 1886, Pl. 4.2).

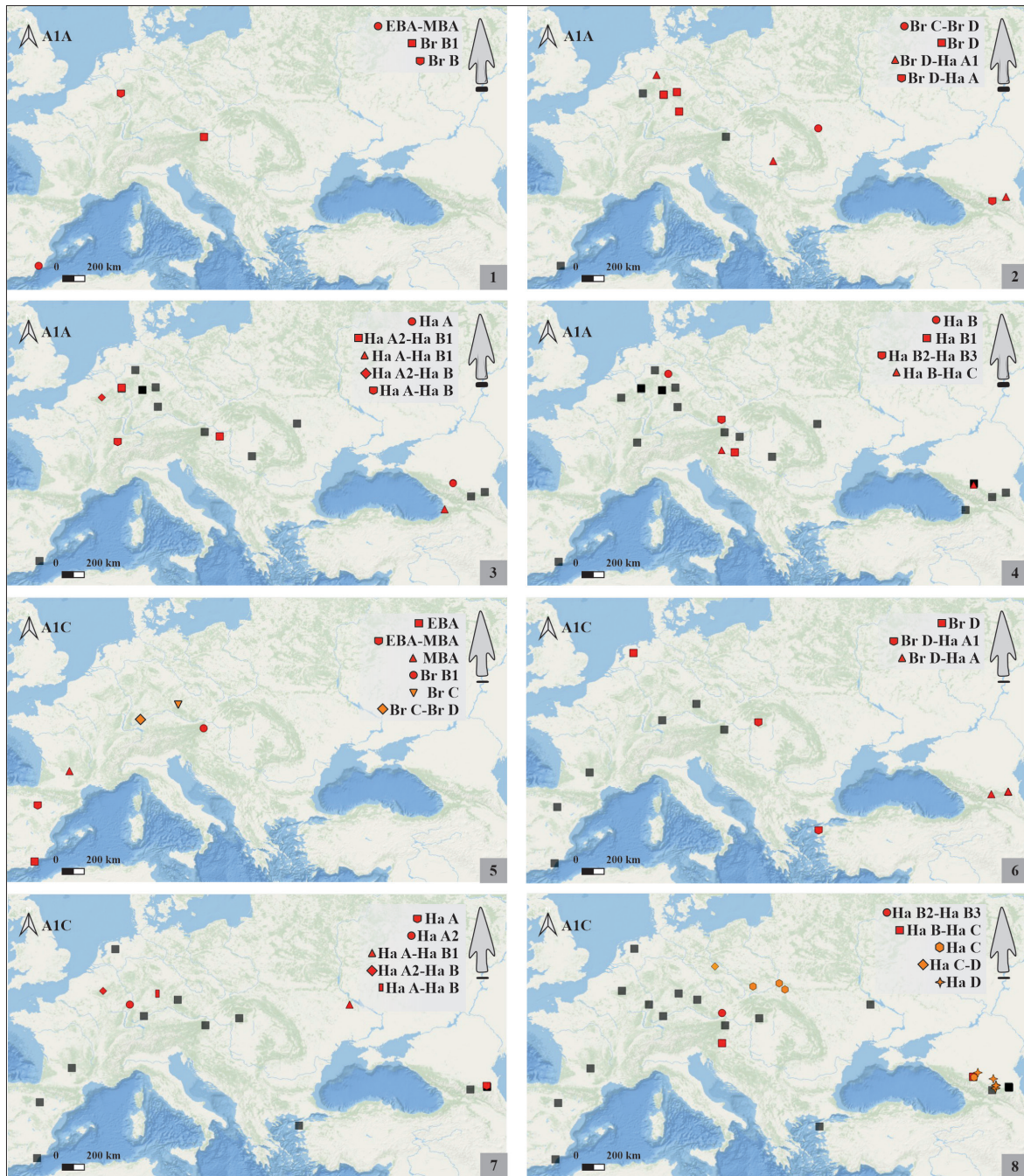


Fig. 6. Distribution through time. 1–4 subvariant A, 5–8 – subvariant C. Black squares represent older finds, red dots indicate younger ones (see data in [TARBAY 2025a](#)).

through post-casting hammering. The carved negatives of the casting moulds typically exhibit tangs with circular or lozenge cross sections, a feature attributable to the carving technique and the outline of the carving tool used. Rhomboid- and circular-sectioned tangs are easier to carve using single-edged or curved-edged awls.

Depending on the post-casting treatment, the final products may be categorised as either 1A (rectangular-sectioned tang) or 2A (circular-sectioned tang). Subvariants A and B were likely produced using two-part casting moulds with two negatives, as indicated by manufacturing traces such as casting seams along the tangs and their relatively solid cross-section. The use of two-part moulds is further supported by examples exhibiting fixing holes designed to secure the second mould part:

Bad Urach, Besigheim, Corcelettes, Heilbronn, Mecklenheim, and Suvorovo.⁸⁹ However, these subvariants could also have been produced using single-negative moulds. As-cast arrowheads, such as Somló 12/13 (Fig. 20.12/13), along with potentially similar examples from Štramperk⁹⁰ and Zemun⁹¹ suggest the use of single-negative moulds, similar to those employed in the production of sickles during the Late Bronze Age. An unprovenanced arrowhead from the Prehistoric Collection of the Hungarian National Museum (Fig. 26C.33/2), also reflects this production technique. The application of this method would typically result in tangs with a D-shaped or semi-circular cross-section, which post-casting hammering does not necessarily alter this feature. Subvariants C and D may also have been produced by casting,⁹² although alternative techniques likewise conceivable, such as shaping the arrowhead from sheet metal or flattening cast arrowheads into sheet form. This latter approach may explain how as-casts could have been produced in moulds like Mecklenheim,⁹³ which would otherwise yield atypically narrow barbs. Producing extremely flat sheet-metal arrowheads, as seen in Subvariant C and D, offers certain advantages, allowing a large number to be manufactured from a small quantity of metal. Evaluating their effectiveness against targets would require further experimentation. The results of Guitérrez Sáez and Lerma suggest that sheet-metal arrowheads are prone to bending,⁹⁴ implying that these arrowheads were either more securely mounted in shafts or employed against targets where penetration of hard surfaces (armour, fur etc.) was not required.

1A arrowheads could be cast individually, as demonstrated by examples from Cholok Ochkamuri, Georgia.⁹⁵ However, several of the casting moulds potentially associated with variant 1A exhibit characteristics indicative of serial production. These mould negatives reveal that multiple arrowheads (two, three, four, seven) could be produced in a single pouring action, with contemporary craftsperson employing a variety of creative gating systems to achieve this. Heilbronn and Besigheim illustrate a shared solution, in which three arrowheads were cast from the tip via a single pouring cup.⁹⁶ Bad Urach, Corcelettes and Sveti Petar Ludbreški are technologically analogous, implementing similar gating systems. In these cases, the arrowhead negatives were carved into a casting tree, either with the tang (Corcelettes, Sveti Petar Ludbreški) or blade tip (Bad Urach) connected to the main channel.⁹⁷ A comparable approach is observable in moulds from Gorzano, Martizay, Mecklenheim, Slobodka and Radzovce, where multiple arrowhead negatives were aligned linearly and interconnected. This technique requires the separation of individual arrowheads following casting.⁹⁸ Coutil also published an unseparated as-cast arrowhead pair from Bois du Roc, which likely originated from a similarly designed mould.⁹⁹ The Radzovce mould¹⁰⁰ refines this se-

89 [ANTIQUITÉS LACUSTRES 1896](#), Pl. 33.3; [GAZDAPUSZTAI 1958](#), Pl. 5.6; [KLOCHKO 2001](#), Pl. 79.15; [OVERBECK 2018](#), Pl. 23.36–37, Pl. 24.41, Pl. 25.46; [LYSENKO et al. 2021](#), Fig. 4.1–2.

90 [ŘÍHOVSKÝ 1996](#), 131, Pl. 28.460.

91 [VASIĆ 2015](#), 73, Pl. 18.345.

92 A casing mould from Tatićev, Serbia may have been used to produce flat arrowhead ([FILIPOVIĆ 2015](#), 263–264, Pl. 1.36).

93 [OVERBECK 2018](#), Pl. 24.41.

94 [GUITÉRREZ SÁEZ – LERMA 2015](#).

95 [CHAVLEISHVILI 1991](#), 18, Pl. 9.8, 10.

96 [OVERBECK 2018](#), Pl. 23.37, Pl. 25.46.

97 [ANTIQUITÉS LACUSTRES 1896](#), Pl. 33.3; [WANZEK 1989](#), Pl. 37.d; [OVERBECK 2018](#), Pl. 23.36.

98 [CORDIER 1962](#), Fig. 6 (right); [BERNABÒ et al. 1997](#), Pl. 334.47; [PANČÍKOVÁ 2008](#), Fig. 2.3, 6; [OVERBECK 2018](#), Pl. 24.41; [LYSENKO et al. 2021](#), Fig. 4.1. The possibility should not be excluded that the fragmented Seržen'-Jurt mould may also belonged to this technological type ([KOZENKOVA – KRUPNOV 1966](#), 83, Fig. 36.10; [KOZENKOVA 1982](#), Pl. 9.17).

99 [COUTIL 1912](#), 133, Fig. 2.

100 [PANČÍKOVÁ 2008](#), Fig. 2.3, 6.

rial production method through a different technique, also observable in the Soltvadkert mould.¹⁰¹ In these moulds, the arrowhead negatives were carved individually side by side, enabling serial casting not through a single gating system but by pouring the molten metal twice within a single operation on the same mould. The casting mould from Bamut represents a unique configuration: the arrowhead negative was carved below a sickle, functioning simultaneously as a riser and as a by-product of the sickle-casting process.¹⁰²



Fig. 7. Use-wear. 1 – rounded tip (Velem 14/7), 2 – hammered tip (Velem 14/28).

The post-casting treatment phase can be deduced from the macroscopic traces observed on these projectiles, published separately as a Mendeley Data set¹⁰³ and summarised in Fig. 9 alongside all studied arrowhead variants. Only a limited number of 1A arrowheads were available for analysis, revealing sparse technological evidence of their production. Following removal from the casting mould,

101 GAZDAPUSZTAI 1958, Pl. 5.6.

102 MAGOMEDOV 1972, 124–125, Fig. 8; REINHOLD 2007, 204, Pl. 253.4.

103 TARBAY 2025b.

1A arrowheads would have undergone comprehensive post-casting treatment. Hammering traces are observable on the blades of certain specimens from all sides, and the tangs were shaped into rectangular by hammering. Additional post-casting treatments were identified on a few artefacts,¹⁰⁴ including grinding (Somló 12/1) and sharpening (Bakonyszentlászló 9/4, Somló 12/1) (Fig. 8.2).

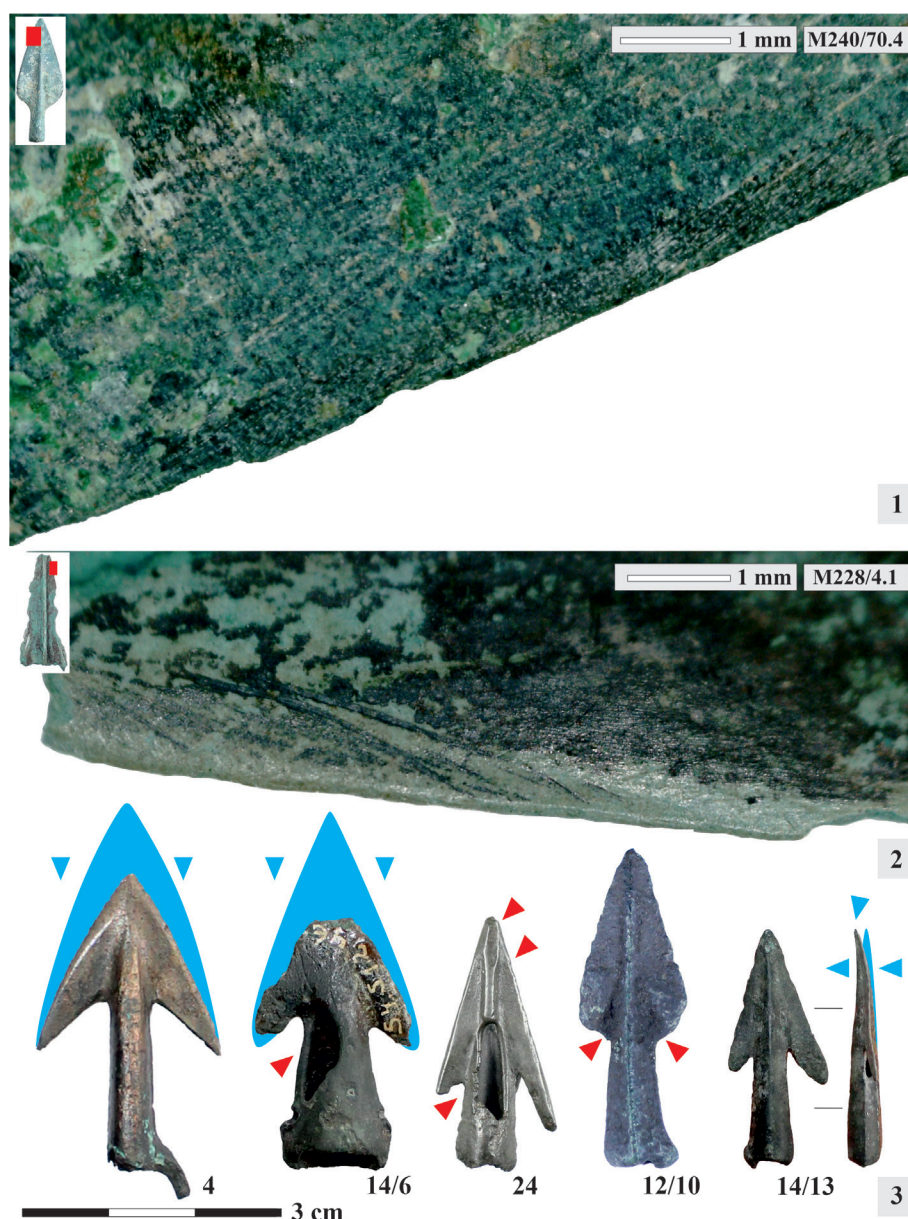


Fig. 8. Use-wear. 1 – sharpening and chipped edge (Velem 14/35), 2 – sharpening (Bakonyszentlászló 9/4); 3 – macro traces: 4 – reduced tip (Pécs-Jakab-hegy III), 14/6 – reduced tip, misrun (Velem-Szent Vid), 24 – misrun, hammered edge (Udvari), 12/10 – solid cast barbs (Somló Hill), 14/13 – bent tip (Velem-Szent Vid).

An example of 1A hafting is documented in Grave 4 at Behringersdorf, where a tanged arrowhead was mounted onto a slender wooden shaft and secured with bast-like threads exhibiting dark, resin-like residues.¹⁰⁵ It cannot be ruled out that Somló 12/1 (Subvariant D) may have functioned as a harpoon arrow. In this case, its hafting technique could have differed from that of other specimens.

¹⁰⁴ BARON *et al.* 2020, 14–15.

¹⁰⁵ HUNDT 1975, 10–12, Fig. 9.1; CLAUSING 2005, 72, Pl. 9B.2–3; JUNKMANN 2013, 326. See Iron Age example: ECKHARDT 1996, 282–283, Pl. 55.2–3.

Ethnographic parallels suggest that this sheet metal arrowhead, featuring a perforation, might have served as the terminal blade of composite organic harpoon heads, a replaceable component that could be exchanged throughout the weapon's use-life, thereby maintaining a consistently sharp cutting edge.¹⁰⁶

The observed micro-traces provide evidence for the use of 1A Transdanubian arrowheads.¹⁰⁷ An indentation or dent along the cutting edge of the Velem 14/24 arrowhead may have formed as a result of use-related damage, although experimental data are lacking to determine its exact cause. More convincing traces include bent blades and tips, as well as rounded tips, which are particularly evident on the Bakonyszentlászló 9/1 and 9/3 arrowheads. Rounded tips¹⁰⁸ may result from multiple reshaping events or re-use following impact. Bent tips are not the product of intentional damages but occur when arrowheads strike hard surfaces, such as armour or defensive weapon of different materials, or when a misdirected arrow impacts solid environmental features, e.g., defensive structures, stone, or wood. A cranial bone from Tollense with an embedded arrowhead also shows slight bending at the tip; Brinker *et al.* explain this damage to high-velocity penetration of the cranial bone.¹⁰⁹ The bending of larger sections, including entire blades, may be interpreted similarly to bent tips; here, the projectile likely struck with considerable force or encountered a particularly resilient target.¹¹⁰ The presence of these wear traces may indicate combat-related activity at Bakonyszentlászló-Kesellőhegy, where four arrowheads were discovered in close proximity to the rampart. The spatial distribution of these artefacts and the use-wear traces could potentially indicate a siege event—a tentative hypothesis that requires further investigation at the site.¹¹¹

1C (Eckhardt's Type 1, Variant C)

Studied finds: Velem 14/21 [with a spur or jet trace] (Fig. 21.14/21), 14/36 (Fig. 22.14/36).

Arrowheads with a rectangular-sectioned tang and a spur have been classified by Eckhardt as Type 1, Variant C. The spur typically terminates at the base of the tang;¹¹² however, in some cases, it projects from the midsection of the tang.

In addition to the two artefacts from Velem-Szent Vid, comparable examples for these arrowheads have been recorded in eastern Hungary,¹¹³ Germany (Br C–Br D – Ha A2–Ha B1),¹¹⁴ France (Final Bronze Age III),¹¹⁵ Italy,¹¹⁶ Switzerland,¹¹⁷ Russia/Caucasus (second half of 10th c. BC – end of 8th c. BC),¹¹⁸ and Moldova.¹¹⁹ The distribution of 1C is scattered, correlating with that of 1A, and shows no clear regional concentration (Fig. 3.2). As with other variants exhibiting similar features, such

106 PARK – STENTON 1998, 16–17.

107 See TARBAY 2025b.

108 HRYNKIEWICZ-BOGENRYTER – BARON 2022, 520, Fig. 1.c.

109 BRIKNER *et al.* 2018, 50–51, Fig. 3.7; INSELMANN *et al.* 2024, 11, Fig. 2.

110 See GUITÉRREZ – SÁEZ 2015, 180, Fig. 9.3.

111 NOVÁKI 1979, 85–89, 102–105, 135, Fig. 44.1–4.

112 ECKHARDT 1996, 26, 410, Map 7.

113 HAMPEL 1886, Pl. 28.1–2; HAMPEL 1892, 24.

114 ECKHARDT 1996, Pl. 5.5, Pl. 36.6, 10, Map 7; INSELMANN *et al.* 2024, Suppl. Mat.

115 COUTIL 1912, Fig. 2; PHILIPPE 1936, Fig. 50.24; COFFYN *et al.* 1981, Pl. 11.1; BRIARD – MOHEN 1983, 99–100, Fig. 1.1, 3.

116 DE MORTILLET – DE MORTILLET 1903, Pl. 88.1088.

117 COUTIL 1912, Fig. 1.6.

118 BURKOV 2022, 779, Tab. 1.16.

119 LYSENKO *et al.* 2021, Fig. 2.2, Fig. 2.10.

as Type 4C, it remains unclear whether the spur was intentional or merely a residual element from the casting jet. Consequently, the emergence of 1C was likely driven primarily by technological factors. It may be an experimental form in which a spur was added to the tang to enhance embedding properties. Alternatively, the spur could be a remnant of the casting process, interpreted either as an insufficiently treated casting jet or as a deliberately re-shaped component. Moreover, the few known examples of this type are difficult to date and provide only a broad chronological range between Br C–D and Ha B. The Velem arrowheads likewise remain undated, being stray finds originating from a multi-period Urnfield settlement. The above-mentioned technological possibilities—which could have resulted in spurred variants of Type 1 arrowheads at any time or in any location—may account for both the scarcity and the chronologically and spatially diffuse nature of 1C arrowheads. No casting moulds associated with 4C arrowheads are currently known; however, their production

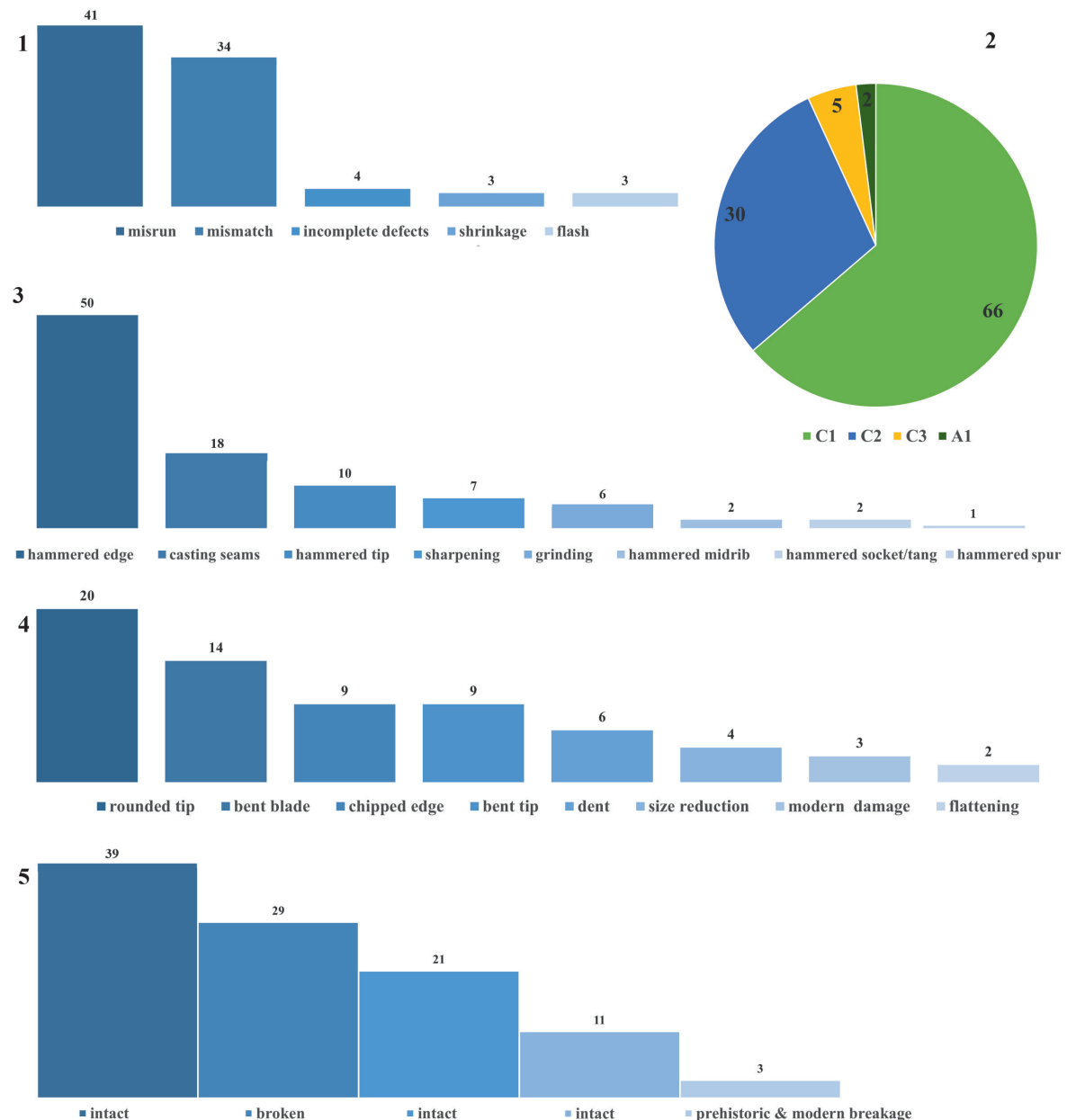


Fig. 9. Use-wear analysis of Transdanubian arrowheads. 1 – casting defects, 2 – technological groups (C1 = finished products, C2 = finished, used products, C3 = finished heavily used products, A1 = as-casts), 3 – production technological traces, 4 – use-wear traces, 5 – fragmentation (see data in [TARBAY 2025b](#)).

is presumed to have been analogous to that of type A1 (Subvariants A and B). Specifically, the spur could have been formed in several ways. As part of the gating system, it might have connected the arrowhead to a casting tree or a pouring cup, with its carving primarily serving to direct the flow of metal into the arrowhead negative. Alternatively, the spur could have been an intentionally carved feature within the mould, bearing no active role in the casting process. Of the two known specimens, only one (Fig. 21.14/21) was available for examination. This artefact displays characteristics of a finished product, including discernible hammering traces on its tip. The tip is also slightly rounded, which may indicate use.

“3A” (Eckhart’s Type 3, Variant A, individual)

Studied find: Győr-Ménfőcsanak 11/6 (Fig. 19.11/6).

The Győr-Ménfőcsanak 11/6 arrowhead is a compelling artefact. Typologically, it appears to have been crafted from sheet metal, has two barbs, and features a concave base reminiscent of flint predecessors (Fig. 2.3A). A notable feature of this arrowhead is a hole at its centre. The examination of the object was inconclusive as to whether the hole was intentionally made by the craftsman, resulted from later modifications, or was caused by fragmentation, as suggested by a crack originating from the upper half of the cutting edge. The irregular outline and damaged surfaces of the hole rather support the latter explanation.

Typologically similar arrowheads are known among the Bourget type in Western Europe, typically exhibiting two or more perforations. Their chronology spans from the Final Bronze Age I–II to the 7th–middle of the 6th century BC.¹²⁰ Eckhardt classifies these arrowheads as Type 3, Variant A, encompassing examples identical in shape to the Győr-Ménfőcsanak find but lacking perforations. The presence of a perforated hole is more specific to Type 3, Variant B, which Eckhardt dates to the Br D phase.¹²¹ Numerous similar arrowheads, both perforated and non-perforated, have been discovered in Greece, and Avila assigns them to various types dated between the LH I and LH IIIC.¹²² Only two known graves contain sheet-metal arrowheads similar to the Győr-Ménfőcsanak find with a single perforation: Pitten Grave 155, tentatively dated to the end of the Hungarian Middle Bronze Age (Br B1),¹²³ and Donja Brnjica Grave III.4, attributed to the Brnjica group (Br C – Br D–Ha A1).¹²⁴ A further notable example is a perforated arrowhead from the lake dwelling at Seewalchen am Attersee.¹²⁵ There is also a stray perforated arrowhead with similar characters allegedly found in Shchaslyve, Crimea, Ukraine, interpreted by Klochko and Kozymenko as an Aegean-influenced product.¹²⁶

An alternative scenario may explain why the Győr-Ménfőcsanak arrowhead appears atypical in Transdanubia. Unlike comparable Greek arrowheads, which have pointed barbs, the Győr-Ménfőcsanak arrowhead exhibits asymmetrical barbs: one is pointed, while the other has a rectangular end, and it shows traces of hammering along its surfaces.¹²⁷ This element more closely resembles the tangs of 1A and 1C arrowheads, raising the possibility that the object was a repaired arrowhead originally belonging to one of the above-mentioned types and that it may originally have had

120 HANSEN 1994a, 83–85, Fig. 49; GASCÓ 2006, 152, Fig. 1.19–21.

121 ECKHARDT 1996, 28–29, 414, Map 9.

122 See AVILA 1983, 85–103.

123 BENKOVSKY-PIVOVAROVÁ 1978, 84; HAMPL et al. 1981, 92–93, Pl. 223.19–20, 25–26.

124 VASIĆ 2015, Fig. 18.31.

125 WILLVONSEDER 1933, Fig. 21.8.

126 KLOCHKO – KOZYMENKO 2017, 138, Fig. 11.

127 e.g., AVILA 1983, Pls 23–26.

only a single barb (Fig. 19.11/6B). This technological interpretation urges caution against drawing deeper definitive conclusions from the possibility that the object belongs to 3A. The dating of the Győr-Ménfőcsanak find is also challenging, as the arrowhead originates from a multi-period Bronze Age site. Based on the assemblages discussed above, its dating can be placed within the Br B1 – Br D–Ha A1 timeframe (Fig. 2.3A).

4A (Eckhardt's Type 4, Variant A)

Studied finds: Balatonfüzfő 7/1–3, 5–7 (Fig. 18.7/1–3, 5–7); Barnag 16 (Fig. 23.16); BM 26 (Fig. 23.26); Celldömölk-Ság-hegy 10/1–4 (Fig. 18.10/1–2, 4); Celldömölk-Ság-hegy IV 2 (Fig. 18.2); Doba 17 (Fig. 23.17); Győr-Ménfőcsanak 11/1–4, 7–11, 14–17, 19 (Fig. 19.11/1–4, 7–11, 14–17, 19); HNM 25/1–2 (Fig. 23.25/1–2); Kapospula 18/2 (Fig. 23.18/2); Pázmándfalu III 3 (Fig. 18.3); Pusztaszemes 21 (Fig. 23.21); Regöly 5/2 (Fig. 18.5/2); Somló 12/2, 7, 11 (Fig. 20.12/2, 7, 11); Tikos 13 (Fig. 20.13); Transdanubia 23 (Fig. 23.23); Udvari 24 (Fig. 23.24); Velem 14/1–10, 12–15, 17–20, 23, 26–28, 34, 46–60, 74–75, 77–781 (Fig. 20.14/1–7, Fig. 21.14/8–10, 12–15, 17–20, 23, Fig. 22.26–27, Fig. 22.14/28, 34, 46–48, Fig. 23.14/49–60, 74–75, 77–78, 80–81). Individual (with a collar): Somló 12/3 (Fig. 20.12/3). Non-Transdanubian sites: Unprovenanced 33/1 (Fig. 26C.33/1), 34/1–2 (Fig. 26D.34/1–2).

Casting mould: Danube River 27 (Fig. 24.27).

Socketed barbed arrowheads without a spur are classified by Eckhardt as Type 4, Variant A, and are considered among the most widespread arrowhead types of the European Late Bronze Age (Fig. 2.4A).¹²⁸ In addition to the Transdanubian examples, their distribution extends across Austria (Ha A1),¹²⁹ Belgium (Bronze Final IIb–IIIb),¹³⁰ Croatia (Phase II),¹³¹ Czech Republic (Br B1–Ha B3),¹³² East

128 MERCER 1970; ECKHARDT 1996, 29; ŘÍHOVSKÝ 1996, 113–114, 126–127; SICHERL 2004, 166; CLAUSING 2005, 63–65; INSELMAN *et al.* 2024, 8, Fig. 7, Suppl. Mat.

129 HEGER 1888, Fig. 17, Fig. 21–22; HOERNES 1900, Pl. 4.4; SZOMBATHY 1929, Pl. 1.3, Pl. 23.6; WILLVONSEDER 1937, Pl. 43.9; PITTIONI 1941, Pl. 13.2–3; REITINGER 1968, Fig. 251.3; ZU ERBACH 1985, Pl. 25A.6–10, Pl. 25B.4, Pl. 46.11; STUPPNER 1990a, No. 459; STUPPNER 1990b, 517; STUPPNER 1990c, 519; LAUERMANN 1991, 37, Pl. 4.5–7; LOCHNER 1991, 27, 70, 89, 91, Pl. III.6, 10, Pl. IV.11, Pl. 89.3; ECKHARDT 1996, Pl. 54.1, Pl. 57.5, 10–11; ŘÍHOVSKÝ 1996, 127, 132; CLAUSING 2005, 61, 65; KREN – SCHMITSBERGER 2013, 274, Fig. 56.2; LAUERMANN – RAMMER 2013, Pl. 90.4, Pl. 97.18–32; TREBSCHKE – PUCHER 2013, Fig. 19.4–5; ADAMETZ – LOCHNER 2021, Fig. 3.30; LAUERMANN *et al.* 2022, Pl. 21.1, 6, Pl. 70.8–9; GRIEBL – BIEDERER 2022, Pl. 15.1; INSELMAN *et al.* 2024, Suppl. Mat.

130 DE LOË 1931, 5, Fig. 9.2; WARMENBOL 1995, Pl. 1.17.

131 VINSKI-GASPARINI 1973, Pl. 60.15; PERKIĆ – LOŽNJAK DIZDAR 2005, Pl. 2.14; DIZDAR *et al.* 2016 (unpublished, pers. comm. with Daria Ložnjak Dizdar).

132 SMOLÍK 1882, Pl. 1.4; RYCHLÝ 1883, Pl. 16.16; WOLDŘICH 1884, Pl. 6.32; PÍČ 1889, Pl. 39.19, Pl. 40.4; SCHMIDT 1893, 76; WOLDŘICH 1893, Pl. 1.12; BENEŠ 1959, Pl. 25.4; PLESL 1961, Pl. 62.1–2; HRALOVÁ 1962, Pl. 36.16–18; BENEŠ 1966, 7, No. 13A, Pl. 1.10; VÁŇA 1968, Fig. 50.2; ČUJANOVÁ – JÍLKOVÁ 1970, Pl. 28.5, 14, Pl. 32A.6, Pl. 33D.18, Pl. 39C.18, Pl. 45.22, Pl. 52A.3, Pl. 57.2–3, 9, Pl. 59A.4–6, Pl. 60A.9–11, Pl. 76A.10, Pl. 94C.10, Pl. 102D.14, Pl. 104B.10, Pl. 105E.18; JOCKENHÖVEL 1971, Pl. 54A.6–7, Pl. 55A.6–11, Pl. 55B.4, Pl. 68A.4–5; FURMÁNEK 1973, Fig. 8.3; HRALA 1973, Pl. 39.8; MÍCHÁLEK 1979, Pl. 72.15; SALDOVÁ 1988, Pl. LIV.8a; ECKHARDT 1996, Pl. 43.11, Pl. 44.1, Pl. 47.13–14, Pl. 48.9, Pl. 49.10, Pl. 52.2, Pl. 53.6, 8, 10; ŘÍHOVSKÝ 1996, 110–127, Nos 284–296, 299, 301–310, 319–343, 346, 350–352, 354–361, 364–365, 368–369, 374–384, 386–399, 407–408, 410, 412, 414–416, 421, 423–427, 430, 432; HRALA 2000, Fig. VII.99, 102, 109, 117, 120–121; VOKOLEK 2002, Pl. 14.6–7; VOKOLEK 2003, Pl. 40.21, Pl. 53.5, Pl. 57.14, Pl. 62.2–3, Pl. 134.29, 41, Pl. 168.3, 6, Pl. 214.14–16, Pl. 313.18–19, Pl. 335.4, 26; SICHERL 2004, 165–173; CLAUSING 2005, 65; SALAŠ 2005, Pl. 323.2; KYTLICOVÁ 2007, 110, Pl. 39A.10–11, Pl. 113B.2, Pl. 148.9–11; WALDHAUSER 2007, Fig. 3.9–11; CHVOJKA 2009, 467, Pl. 41.3, Pl. 77.3, Pl. 79.11; VÍCH 2012, Fig. 12.12–13; SALAŠ 2018, Pl. 4.95; ROŽNOVSKÝ 2020, Fig. 2.1; HLÁSEK – CHVOJKA 2022, Fig. 2.14, 16, 19; VÍCH 2023, Fig. 5.11–12; INSELMAN *et al.* 2024, Suppl. Mat.; BENEŠ *et al.* 2025, Fig. 7.4–5, 7–10, 12–15.

Hungary (Br B2–Br C – Ha B1),¹³³ Denmark,¹³⁴ France (Final Bronze Age),¹³⁵ Germany (Br A3 – Ha C),¹³⁶ Greece (MM I, LH IIIC1–IIIB, EIA),¹³⁷ Italy (Recent Bronze Age – Final Bronze Age, EIA),¹³⁸ Ukraine,¹³⁹ Poland (Period III – IV, Ha C–D),¹⁴⁰ Romania (mainly Ha A1),¹⁴¹ Russia/Caucasus (Ko C –

- 133 KUBÍNYI 1861, Pl. 15.70–71; ÉRDY 1871, Fig. 16; MOZSOLICS 1973, Pl. 5.4; KOVÁCS 1975b, Fig. 1.2; TROGMAYER 1975, Pl. 27.307.2, Pl. 45.508.5; KEMENCZEI 1984, Pl. 36.10; FEKETE 2002, Pl. 1.10; V. SZABÓ 2019a, Fig. 85; SOMOGYVÁRI 2024, Pl. 13.1, 3, Pl. 21.4.
- 134 BROHOLM 1953, 37, Pl. 5.10.
- 135 COUTIL 1912, Fig. 1.11; PHILIPPE 1936, Fig. 46.7; BRIARD – MOHEN 1983, 103–104, Fig. 1.1–6; GASCÓ 2006, Fig. 1.22–23.
- 136 VON SCHAB 1876, Pl. 11.186; ZIEGLER 1893, Pl. 6.1; BELTZ 1910, Pl. 25.30; GROSSE 1919, Pl. I.8, 10; BEHRENS – SPROCKHOFF 1930, Fig. 5.1; BIRTNER 1932, Fig. 3.26; BOHM 1935, Pl. 17.2, 5, Pl. 19.4, 6; HOLSTE – JORNS 1935, Fig. 4.1; KIMMIG 1940, Pl. 7E.3; PETSCH 1940, Pl. 5.8; COBLENTZ 1952, Pl. 32.3, 5, Pl. 45.9, Pl. 49.8, Pl. 56.11, Pl. 58.4, Pl. 68.16; FEUSTEL 1958, Pl. 28.3, Pl. 32.3; TORBRÜGGE 1959, Pl. 1.8–9, Pl. 14.13, Pl. 18.7, Pl. 21.23, 25, Pl. 24.28, Pl. 26.5–6, Pl. 32.14, Pl. 43.43, 46–47, Pl. 44.1, 25–26, Pl. 45.8–11, Pl. 46.16, Pl. 48.20, Pl. 49.16, Pl. 54.35, Pl. 68.13, Pl. 76.15–16; KÖSTER 1968, Pl. 7.10, Pl. 8.5; SCHUBART 1972, Pl. 9.D2, Pl. 48.F4; HUNDT 1975, Fig. 7.1, Fig. 8, Fig. 9.2; DEHMLow 1978, Fig. 78.1, Fig. 121.4, Fig. 126.5–7; HOCHSTETTER 1980, Pl. 27.2–4; PIRLING 1980, Pl. 4H8; KOSCHIK 1981a, Pl. 34.9, Pl. 43.7–9, Pl. 73.8, Pl. 104.1; FRÖHLICH 1983, Pl. 62.11–18, 31–32, Pl. 65C.3, Pl. 79B.10, Pl. 83B.3, Pl. 85C.1–2; LUDWIG-LUKANOW 1983, Pl. 38C; RITTER-SHOFFER 1983, Pl. 36.2; BERGER 1984, Pl. 6.10, Pl. 75.11–12; LAUX 1989, 54, Fig. 3.5; BRÜGMANN 1991, Fig. 47.12; LEINHOS – PREHN 1991, Fig. 2.g, i; MÖBIUS 1991, Fig. 47.11; ABELS *et al.* 1992, Fig. 21.2; WÖLFELICK *et al.* 1992, Fig. 49.11–12, 14; FEUSTEL 1993, Pl. 31.1–2, Pl. 32.12; FLEISCHMANN *et al.* 1993, Fig. 49.3; HENNIG 1993, Pl. 2.15, Pl. 24.34–35, Pl. 37.8, Pl. 67.15; LfD 1993a, Fig. 40.3–4; LfD 1993b, Fig. 43.5; WERNER – LfD 1993, Fig. 43.7–8; BERGER 1994, Pl. 11.8, Pl. 16.3–7, 10, 14, 33; LfD 1994, Fig. 85.26–27; PAULI 1994, Pl. 1.1, Pl. 92.4, 7, 10, 16; ABELS *et al.* 1994, Fig. 13.9; LfD 1995, Fig. 84.1; SCHOPPER 1995, Pl. 3.13, Pl. 24.6, Pl. 67.6, 9, Pl. 71B.9–10, Pl. 82.7–10, 14, Pl. 101.7, Pl. 137.3, Pl. 164A.9, Pl. 167B.1, Pl. 185A.1, Pl. 185C.7–8; ECKHARDT 1996, No. 162, Pl. 1.2, 5, Pl. 3.1, 9, Pl. 4.4, 10–11, Pl. 5.1–4, 6, 11, Pl. 6.1, 6–7, Pl. 7.1, Pl. 9.7–8, Pl. 11.2, Pl. 15.2, 8, Pl. 16.4–5, 7–12, 14–15, Pl. 17.5, Pl. 19.13, Pl. 20.3, Pl. 21.8, Pl. 22.1, Pl. 23.8, Pl. 25.1, Pl. 26.3, 12–13, Pl. 27.10, Pl. 35.3, 7, Pl. 36.9; ŘÍHOVSKÝ 1996, 113; B. V. 1997, Fig. 79.26; GLÄSER *et al.* 1997, Fig. 74.1; HÄNSEL – HÄNSEL 1997, 118–120; FRISCH 1998, Fig. 4.12–13; PFAUTH 1998, Pl. 45.9, Pl. 48.5–6, Pl. 49.3–4, 6–7, Pl. 51.6–7, Pl. 118.7, Pl. 212.5–12, Pl. 221.12; WIRTH 1998, Pl. Friedberg 3.10–11; LIPSDORF 1999, 51, Fig. 45; RIND 1999, Pl. 23.24; EBNER 2001, Pl. 17.6, Pl. 28.19; LIPSDORF 2001, Fig. 130; MÖSLEIN 2001, Fig. 2.5, 11, 17–35; ORLIŇSKA 2001, Pl. 32.1; ABELS 2002, Pl. 18.1, 2, 4, 6, 8, 15, 18, 22, 28, 32–34, 36, 39–43, 46–48, 52–53, Pl. 19.1–3, 5, 7–10; CLAUSING 2005, 63–65, Nos 243, Pl. 9B.4, 6–8; Pl. 12.4–6, Pl. 16B.4–5, Pl. 19A.6–8, Pl. 21B.3, Pl. 67B.1–6, Pl. 68A.1–2, Pl. 69B, Pl. 70B.1, Pl. 72.2, Pl. 74D.1, Pl. 78A.1–2, Pl. 80A.2–5; GERLACH 2005, Fig. 86.7; SCHÜTZ 2006, Pl. 49.1, Pl. 80.3, Pl. 164.12–13, Pl. 166.3, 6, Pl. 187.21, Pl. 201.8, Pl. 256.3; ZYLMANN 2006, Fig. 2.14; KREUTLE 2007b, Pl. 177B.4, Pl. 177D.1, Pl. 177E.1; WIRTH 2007, Fig. 9; SCHUSSMANN 2009, Fig. 4; DEICKE 2011, Fig. 59.1, 60, Pl. 6.1, Pl. 11.1, Pl. 14.2; OSTERMEIER 2012, Fig. 86.4, 9–11, 13–14, 16, 18, 20–26, 29–31, 33–35, 38–43, 45–46, Fig. 117.2, Fig. 125.8, Fig. 141.3–4, Pl. 145.3–4, Fig. 154.10–12, Fig. 163.2, 4–5, 7–8, 10–11, 13, 17–19, 21, Fig. 179.23–25, Fig. 197.11–12, Fig. 209.3–5, Fig. 219.3, Fig. 234.10; MARASZEK 2015, 174, Fig. right; DOMBROWSKY 2017, Nos 15–16, 44, 48, 60–61, Fig. 10.1–2; SCHNEIDER 2017, Pl. 7.3, Pl. 59.1; BMV 2018a, Fig. 50.1–2; BMV 2018b, 200–201; BLITTE *et al.* 2019, Fig. 3; MÜNDLS-LUGAUER 2019, Fig. 65; ZUBER 2020, Fig. 2.5; INSELMANN *et al.* 2024, Fig. 4.1–16, Suppl. Mat.
- 137 BUCHHOLZ 1963, 27, 43, Fig. 7.VIIIb, Fig. 15.i–j; AVILA 1983, 114–115, 146–147, 149, Nos 771–773, 1090, 1092, 1164.
- 138 KELLER 1866, Pl. 62.19, Pl. 65.11; MONTELIUS 1895, Pl. 15.6, Pl. 30.9, Pl. 35.9, 11, Pl. 70.9, Pl. 126.13; MÜLLER-KARPE 1959, Pl. 73Q.2; PERINI – SALZANI 1976, Pl. 1.31; URBAN 1993, 145, Fig. 72.15, Fig. 75; POGGIANI KELLER 1994, Fig. 25; CARANCINI 1997, Fig. 237.125; POGGIANI KELLER 2001, Fig. 3.23–24, Fig. 6.21; BIETTI SESTIERI – MACNAMARA 2007, Pl. 28.128, 132–133; BOREL 2010, Fig. 5.2–3; FUGAZZOLA DELPINO – PELLEGRINI 2010, Pl. XVII.12, Pl. 27.2; MAGGIULI 2017, 981, Fig. 3.V.US 11289.8; RECCHIA – CAZZELLA 2019, Fig. 8.9–11.
- 139 VANCHUGOV – SUBBOTIN 1989, 58–59, Fig. 3.6; KLOCHKO 2001, 202, Fig. 79.16; KLOCHKO 2006, 205, Fig. 96.1–4, Fig. 101.14; OKHRIMENKO *et al.* 2018, Pl. 82.1.
- 140 JANSSEN 1935, 35–36, Fig. 49; GEDL 2014, 31–44, Nos 46–53, 55–67, 70–120, 122–133, 161–251, 253–258, 262, 266; BARON *et al.* 2020, Fig. 3; INSELMAN *et al.* 2020, Suppl. Mat.
- 141 HAMPEL 1886, Pl. 28.3; NÁNÁSI 1974, Fig. 5.3; PETRESCU-DÎMBOVÎȚA 1977, Pl. 165.4–5, Pl. 202.8–9, ►

Ko E),¹⁴² Serbia (Br D),¹⁴³ Slovakia (Br B2–Br C – Ha A–Ha B1),¹⁴⁴ Spain (EIA),¹⁴⁵ Switzerland (Br B – Ha B).¹⁴⁶ The distribution of these arrowheads shows a concentration in Moravia, Bavaria,¹⁴⁷ and southwestern Poland, with associated casting moulds documented from the northwestern edge of the Carpathian Basin through Moravia, Bavaria, Poland, and northern Germany. This pattern indicates that 4A arrowheads can be regarded as having a predominantly Central European character (Fig. 10.1–2). However, when examined chronologically, the spatial distribution reveals a more complex narrative (Fig. 11).

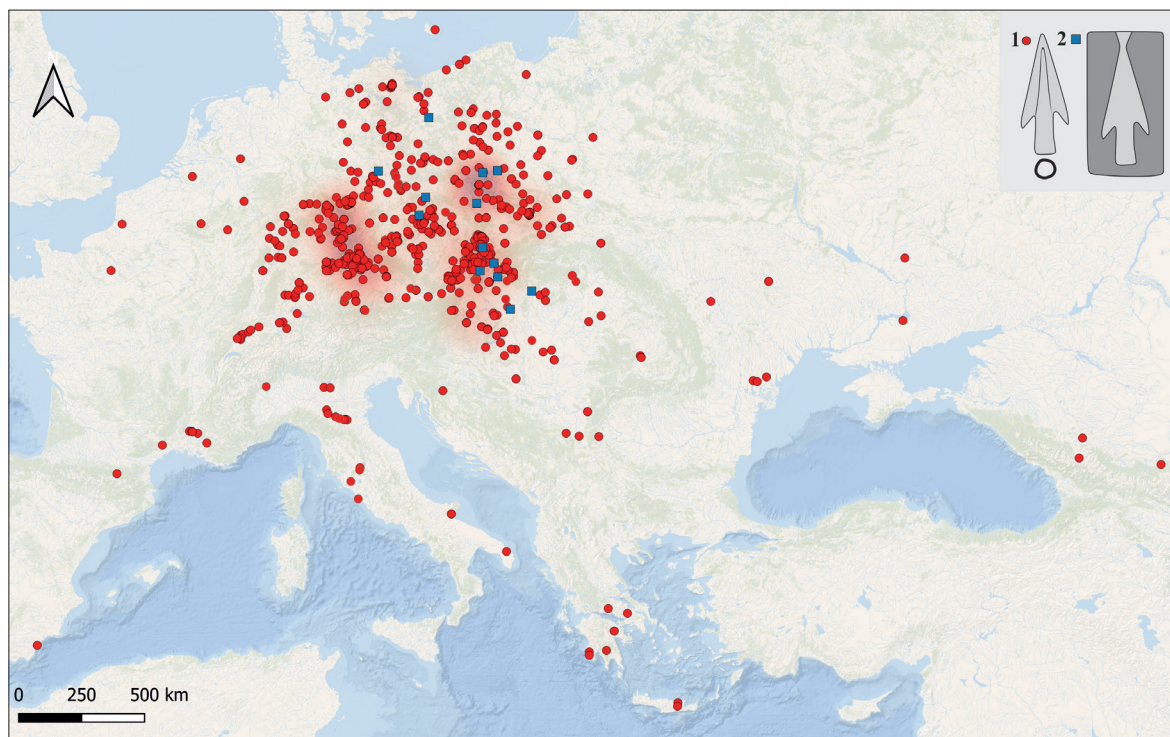


Fig. 10. Distribution of 4A arrowheads. 1 – 4A arrowheads, 2 – casting moulds (INSELMANN *et al.* 2024, Suppl. Mat.; TARBAY 2025a).

4A arrowheads emerged during the Middle Bronze Age (Br A), reaching their peak usage in the Late Bronze Age and continuing, albeit markedly more sporadically, into the Early Iron Age. The earliest examples have been identified in southern Germany, the Czech Republic, eastern Hungary,

► Pl. 251.19; FLORESCU 1991, 115–116, No. 476, Fig. 141.2.

142 KOZENKOVA 1982, Pl. 11.2; KOZENKOVA 1995, Pl. 2.1; REINHOLD 2007, Pl. 330.12, List 173.PfB1.CEC150, KAB19, KIS44.

143 FILIPOVIĆ 2015, 263–265, 267–268; VASIĆ 2015, 74–75, Nos 363–365.

144 MAJLÁTH 1890, 239; EISNER 1933, Pl. 39.5; BUDINSKÝ-KRIČKA 1947, Pl. 19.9; IŽOF – TOČÍK 1981, Fig. 49.6; STUDENÍKOVÁ – PAULÍK 1983, Pl. 35.1–10, 14–16; VELIAČIK 1983, 47, Pl. 10.3; VELIAČIK 1991, Fig. 20.24–25; ECKHARDT 1996, Pl. 48.10–11, Pl. 49.1–3, Pl. 50.7, Pl. 51.10–11, Pl. 52.1, 9, Pl. 50.3; ŘÍHOVSKÝ 1996, 127, 132; PARE 1998, 401, Fig. 44E.1; BARTÍK – FARKAŠ 2001, Fig. 2.2; FURMÁNEK *et al.* 2016, 52, Pl. 17.5; BENEDIKOVÁ – PIETA 2018, Pl. 1.5–8; BOBEK – ELSHECK 2020, Pl. 2.3–4, Pl. 2.6; BIŠTÁK *et al.* 2024, Fig. 12.6; INSELMANN *et al.* 2024, Suppl. Mat.; KOBAL’ – KOTORVÁ JENČOVÁ 2025, Pl. 4.1.

145 RAMÓN 1983, 316, 321, No. 23, Fig. 2.23; LORRIO *et al.* 2016, 29–31.

146 KELLER 1861, Pl. 2.17; KELLER 1866, Pl. 48.26; GROSS 1883, Pl. 15.29; HEIERLI 1886, Pl. 1.11–12; RYCHNER 1979, Pl. 128.30; RYCHNER-FARAGGI 1993, Pl. 8.26; ECKHARDT 1996, Pl. 65.5, Pl. 66.3, Pl. 68.10; Pl. 69.6; CLAUSING 2005, 65; BENGUEREL *et al.* 2024, Fig. 22.41; INSELMANN *et al.* 2024, Suppl. Mat.; MAISE *et al.* 2024, Fig. 7.

147 INSELMANN *et al.* 2024, 8, Fig. 7.

and Greece: e.g., Borotice (Br B1),¹⁴⁸ Bühl im Ries (Br A3/Br A2–Br B1),¹⁴⁹ Kiskunmajsa (Br B1),¹⁵⁰ Malia (MM I),¹⁵¹ and Meclov (Br B1).¹⁵² Datable finds tend to cluster in the Czech Republic during the Br B phase, expanding both westwards and south-eastwards in the Br B–C. From the Br C–Br D onwards, 4A arrowheads appear in northern Europe, becoming widely distributed by the end of the Ha A2–Ha B1 and reaching more remote regions. In the Ha B phase, their distribution largely mirrors earlier trends, with concentration in the Czech Republic and sporadic occurrences in the Carpathian Basin. By the Early Iron Age, 4A arrowheads become increasingly rare, primarily documented in southern and southwestern Poland (Fig. 11). This distribution pattern likely reflects the gradual regional adaptation of the 4A arrowhead type, while military campaigns, such as those evidenced at the Tollense battlefield, may also have contributed to its spread.¹⁵³

One of the earliest 4A arrowheads from Transdanubia was recovered from a hoard, excavated at Pázmándfalu (Hoard III), dated to the Ha A1 phase on the basis of the associated objects.¹⁵⁴ The Regöly-Veravár hoard similarly represent this phase. The Balatonfüzfő cemetery has been dated by Ilon to Br D2–Ha A1, with Grave 6, which contained arrowheads, belonging to its later phase, corresponding to Ha A1.¹⁵⁵ An arrowhead was also discovered at the Tikos-Homokgödrök Urnfield settlement (Br D2–Ha A1), although its archaeological context remains unclear.¹⁵⁶ The youngest example of this arrowhead variant from Transdanubia derives from Celldömölk-Ság-hegy Hoard IV, dated by Mozsolics to the Románd horizon (Ha B2). As a *Schreibtschfund*, however, the contextual and chronological reliability of this alleged assemblage is questionable.¹⁵⁷ At present, it appears that Transdanubian 4A arrowheads can be securely dated to the Ha A1 phase. It is also entirely possible that this arrowhead variant remained in use during the Ha B phase, given its presence at multi-period Urnfield settlements such as Ság Hill, Velem-Szent Vid, and Somló Hill, where the Ha B represent the dominant horizon. To date, however, only stray finds have been discovered at these sites (Fig. 2.4A).

In sum, the 4A arrowheads do not appear to be a local innovation, as no well-dated early specimens from this region have been discovered. Although the Transdanubian material is abundant, most finds lack archaeological context, rendering the regional chronology of this variant uncertain. Datable arrowheads suggest that this form emerged during the Ha A1–Ha B2 phases, corresponding to the Urnfield period in the region under study. The casting mould from the Danube River between Almásneszmély and Győr indicates that local production might also have taken place. Among the known Transdanubian arrowheads, one from Somló Hill (Fig. 20.12/11, Fig. 27A) aligns closely with this mould in terms of dimensions, barb curvature, and the proportional relationship between the barbs and socket length. The artefact was fitted to one of the negatives of the mould and showed a precise match. However, a removed casting jet trace on the socket indicate that the Somló arrowhead was produced using a different casting mould. Nevertheless, the similarities between one of the mould negatives and this arrowhead imply that they were made according to the same model. Among the 4A arrowheads, we also identified matching and potentially matching finds. Another

148 ŘÍHOVSKÝ 1996, 111, Pl. 23.290.

149 RITTERSHOFER 1983, 228–231, 358, Fig. 9.5, Pl. 36.2.

150 MOZSOLICS 1973, 147, Pl. 5.4.

151 AVILA 1983, 114, Pl. 29.772.

152 SICHERL 2004, 264, No. 247.

153 INSELMANN *et al.* 2024.

154 V. SZABÓ 2019a, 62–64, Fig. 48; V. SZABÓ 2019b, 174–178, Fig. 17.

155 ILON 2015a, 33–41.

156 POLGÁR 2015, 144, 149, Fig. 7.

157 MOZSOLICS 1979, 87, Pl. 12.10; MOZSOLICS 2000, 39, Pl. 22.11.

arrowhead from Somló Hill (Fig. 20.12/2) and a stray-find from Velem-Szent Vid (Fig. 22.14/30) show close similarities in dimensions (see Catalogue A.12/2 14/30, Fig. 27B), outline, and the proportion between barb and socket lengths.¹⁵⁸ Both bear a casting-jet traces on the rim, positioned in opposite directions. Based on casting mould analogues elaborated below, these two arrowheads may have been cast as a pair, connected through the channels of a gating system, or produced according to the same model. Corresponding dimensions and outlines are also observable among certain arrowheads from the Balatonfűzfő burials—particularly between Nos 7/1–7/3 which may have been created using identical moulds or following the same model design (Fig. 18.7/1–7/3).

A casting mould used for the production of 4A arrowheads, found beside the Danube River (between Almásneszmély and Győr) (Fig. 24.27).¹⁵⁹ Such casting moulds (for 4A and 4C) are also known from the Czech Republic, Slovakia, and Poland: Battaune Grave 1 (Period IV/V),¹⁶⁰ Brozánky,¹⁶¹ Čechůvky,¹⁶² Cieplowody (Period V),¹⁶³ Dębica (Period V),¹⁶⁴ Gävernitz (“4C”),¹⁶⁵ Horné Plachtince (advanced Piliny culture),¹⁶⁶ Myślibórz,¹⁶⁷ Olšany u Prostějova Pit K528 (Br B2–Br C1, “4C”),¹⁶⁸ Oybin,¹⁶⁹ Uherský Brod,¹⁷⁰ Pobedim,¹⁷¹ Sułów,¹⁷² and Těšice.¹⁷³ It is important to note that the production technologies of 4A and 4C arrowheads were analogous, and in certain cases (e.g., Dębica,¹⁷⁴ Uherský Brod,¹⁷⁵ etc.), the same moulds may have been employed to produce both variants. In such instances, the channels could subsequently have been shaped into spurs, although spurs typically terminate at the rim of the arrowheads. The preserved casting moulds are two-part moulds, having two negatives, and containing a casting core.¹⁷⁶ Casting defects¹⁷⁷ have been observed on several Transdanubian 4A arrowheads, some of which appear directly related to this casting method (Fig. 9.1). Along the narrow edges of certain specimens, unremoved casting seams are visible, occasionally accompanied by flashes (Fig. 8.12/10). Mismatch defects, a typical casting defect associated with

158 Slight formal divergences, differences of less than 1 mm in size and a few tenths of a gram in weight, may have been caused by casting defects and by shaping of the barbs during the post-casting treatment phase.

159 ILON 2022, 150, No. 31, Fig. 3.5.

160 WINKLER – BAUMANN 1975, 82–85, Fig. 3.1.

161 BLAŽEK *et al.* 1998, 166, Pl. 22.100.

162 ŘÍHOVSKÝ 1996, 122, 126, Pl. 26.411.

163 GEDL 2014, 78–79, Pl. 8.629.

164 GEDL 2014, 78–79, Pl. 8.630A–632.

165 BIERBAUM 1956, 180–182, Figs 3–4.

166 FURMÁNEK 1977, 257, 271, Pl. 20.2; PANČÍKOVÁ 2008, 132–133, Fig. 3.6.

167 GEDL 2014, 79, Pl. 9.637; BARON *et al.* 2020, 14, Fig. 10.d. Relatively few relevant use-wear analyses have been conducted on Bronze Age arrowheads, including variant 4A, which could serve as a basis for comparison. Our observations are most comparable to the results from the Wrocław-Widawa hoard (GUTIÉRREZ SÁEZ – LERMA 2015; BARON *et al.* 2020, 14–15, Fig. 11, Tab. 5).

168 FOJTÍK 2015, 202–205, Pl. 65.4.

169 COBLENZ 1962, 370, Fig. 6.2.

170 ŘÍHOVSKÝ 1996, 119, Pl. 25.375A.

171 PANČÍKOVÁ 2008, Fig. 2.11.

172 GEDL 2014, 79, Pl. 9.638.

173 ŘÍHOVSKÝ 1996, 123, Pl. 27.422; ILON 2024a, 292. It is possible that the casting mould fragment from Ligota Woźnicka depicts a type 4A arrowhead, cast from the tip and supported by a casting core inserted through the socket (BOHR *et al.* 2012, 145, Fig. 4.a–b, d).

174 GEDL 2014, 78–79, Pl. 8.630AB–631AB.

175 ŘÍHOVSKÝ 1996, Pl. 25.375A.

176 ECKHARDT 1996, 66, Fig. 35.

177 See casting defects: TARBAY 2025c.

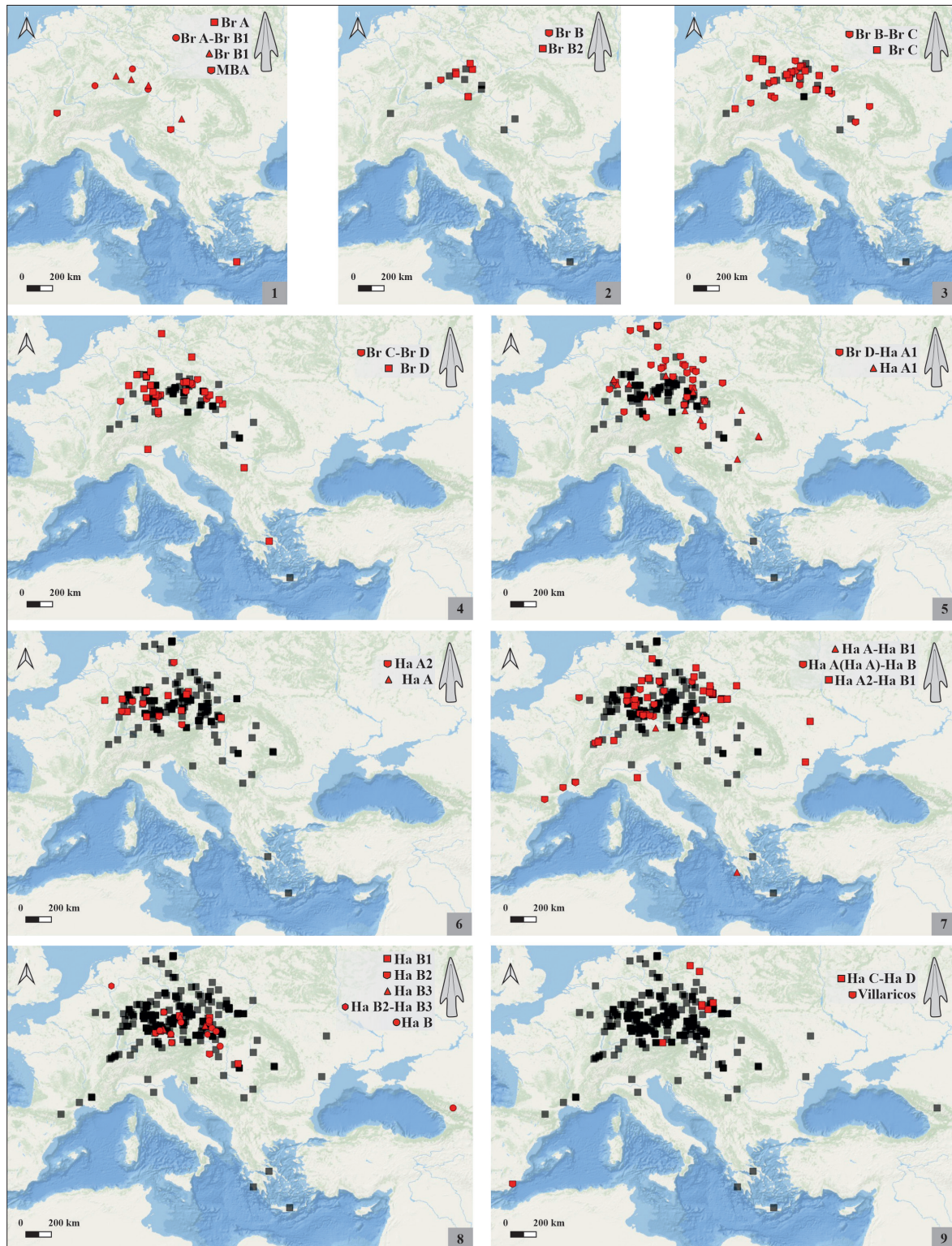


Fig. 11. The distribution of 4A arrowheads through time. Black squares represent older finds, red dots indicate younger ones (INSELMANN *et al.* 2024, Suppl. Mat.; TARBAY 2025a).

two-part moulds with two negatives, are frequent, as are misruns (Fig. 8.24)¹⁷⁸ along the socket. Incomplete casting was observed only in the case of Velem 14/20, where the lower half of the ar-

178 Some interpret these casting defects as possible spots used for the absorption of poisons; see with further references in DEICKE 2011, 67–68.

rowhead was partly missing. The identified defects are typical of the period and do not render the objects unusable. In each case, the arrowheads were manufactured as functional weapons, as evidenced by traces resulting from post-casting treatment. A distinctive casting technique, analogous to that used in the casting of spearheads,¹⁷⁹ was observed in the Ménfőcsanak 11/8 and 11/16 (Fig. 19.11/8, 11/16), as well as the Velem 14/6 (Fig. 20.14/6) arrowheads. This object was using a casting core secured by a fixing rod, which both stabilised the core during casting and created small peg-holes to facilitate more secure hafting.¹⁸⁰

Arrowhead casting cores are unknown in the archaeological record. In theory, such cores could have been made from different materials. Eckhardt and Oberbeck have argued that the use of a metal casting core was more likely, considering the smooth inner surfaces of socketed arrowheads.¹⁸¹ The casting mould from the Danube River may exemplify this technology. This mould was probably composed of three parts. These components were not employed simultaneously but rather sequentially, with negatives carved on different sides of the raw stone block—reflecting its reuse throughout the mould's lifecycle. The initial phase is visible on Side A of the mould (Fig. 24.27 Side A), where the intention appears to have been to cast a three-pronged core joined at the base, using an additional mould segment. This core could then be inserted into a subsequent arrowhead mould. When the core mould was recycled, 4A arrowhead negatives were carved into the reverse side, together with corresponding negatives designed to accommodate the three-pronged casting core. On Side B, the features observed on Side A appear already integrated, with dimensions remaining consistent. By employing a well-stabilised three-pronged metal casting core within the mould, it was possible to cast three arrowheads per pour until the stone material deteriorated. The principle of this technology is also seen in the Early Iron Age metal casting mould from Mosul, on the River Tigris (Iraq), which—although more complex—also utilised a three-part metal core system at its base to enable serial production.¹⁸²

In most 4A arrowhead casting moulds, the direction of metal flow is typically from the socket, although in certain cases—such as at Těšice—casting occurred from the tip.¹⁸³ The mould from Bat-taune Grave 1 shows an arrowhead cast in the direction of the socket through a small channel, which could either be removed (4A) or reshaped into a spur (4C).¹⁸⁴ The majority of casting moulds contain negatives for two arrowheads, arranged in different configurations. The Horné Plachtince mould demonstrates that multiple arrowheads could be cast when their blades were joined together.¹⁸⁵ Connections between the arrowheads were formed by channels extending from the middle or the base of the socket negatives, as seen in examples from Dębica, Brozánky, Oybin, Uherský Brod, and Sułów.¹⁸⁶ Another mould from Dębica illustrates a technological configuration also observed in the production of 1A arrowheads, where the negatives are arranged linearly and joined at their tips.¹⁸⁷ The Danube River mould depicts three arrowheads cast from the direction of the tip.¹⁸⁸

Following their removal from the moulds, the 4A arrowheads underwent post-casting treatments (Fig. 9), which included the removal or hammering of the casting seams along the narrow sides of

179 TROMMER – BADER 2013.

180 ECKHARDT 1996, 66–67, Fig. 35.2; OVERBECK 2016, 126.

181 ECKHARDT 1996, 67–68; OVERBECK 2018, 126.

182 See ECKHARDT 1996, 68; HELLMUTH KRAMBERGER 2016, 27, Fig. 31.

183 ŘÍHOVSKÝ 1996, Pl. 27.422.

184 WINKLER – BAUMANN 1975, Fig. 3.1.

185 PANČÍKOVÁ 2008, Fig. 3.6

186 COBLENTZ 1962, Fig. 6.2; ŘÍHOVSKÝ 1996, Pl. 25.375A; GEDL 2014, Nos 630AB–631AB, 638.

187 GEDL 2014, No. 632; BLAŽEK *et al.* 1998, Pl. 22.100.

188 ILON 2022, 150, No. 31, Fig. 3.5.

the socket. Removed casting jets were typically left untreated, although their trace was sometimes superficially flattened by hammering. Hammering traces observable on various parts of the 4A arrowheads—from the socket to the midrib, blade, and tip—indicate that the as-cast objects underwent comprehensive shaping by this method, similarly to contemporaneous spearheads (Fig. 7.2). For one specimen from Velem (Fig. 20.14/3), metallographic analysis by Géza Szabó illustrates this process particularly well on the barbs.¹⁸⁹ From a technological perspective, all studied Transdanubian 4A arrowheads are finished products, regardless of casting defects or the extent of post-casting treatment (Fig. 9.2). Potential traces of use observable on a few examples, mainly due to poor preservation and micro-fracturing along their cutting edges. Rounded tips are the most common feature, observed on several arrowheads from Velem (14/7–10, 13–14, 18, 20, 23, 26–28, 34), Pázmándfalu III (3) and Balatonfűzfő (7/1) (Fig. 7.1). Among the arrowheads from Velem, bent blades (14/9, 14/17, 14/27–28) and bent tips¹⁹⁰ (14/5, 14/139) were also observed (Fig. 8.3). Additionally, certain arrowheads, such as those from Pécs-Jakab-hegy III and Velem (Fig. 8.4, 14/6), display evidence of size reduction or reworking. In these cases, the tip appears shortened to an atypical degree, possibly reflecting cyclical repair and maintenance through prolonged use.¹⁹¹

4C (Eckhardt's Type 4, Variant C)

Studied finds: Balatonfűzfő 7/4 (Fig. 18.7/4); Győr-Ménfőcsanak 11/13, 11/18 (Fig. 19.11/13, 18); Kölesd 20 (Fig. 23.20); Pécs III 4 (Fig. 18.4); Somló 12/16 (Fig. 20.12/16); Velem 14/22, 31, 69–71 (Fig. 21.14/22, Fig. 22.14/31, Fig. 23.14/69–71). Uncertain: Regöly 5/1 (Fig. 18.5/1).

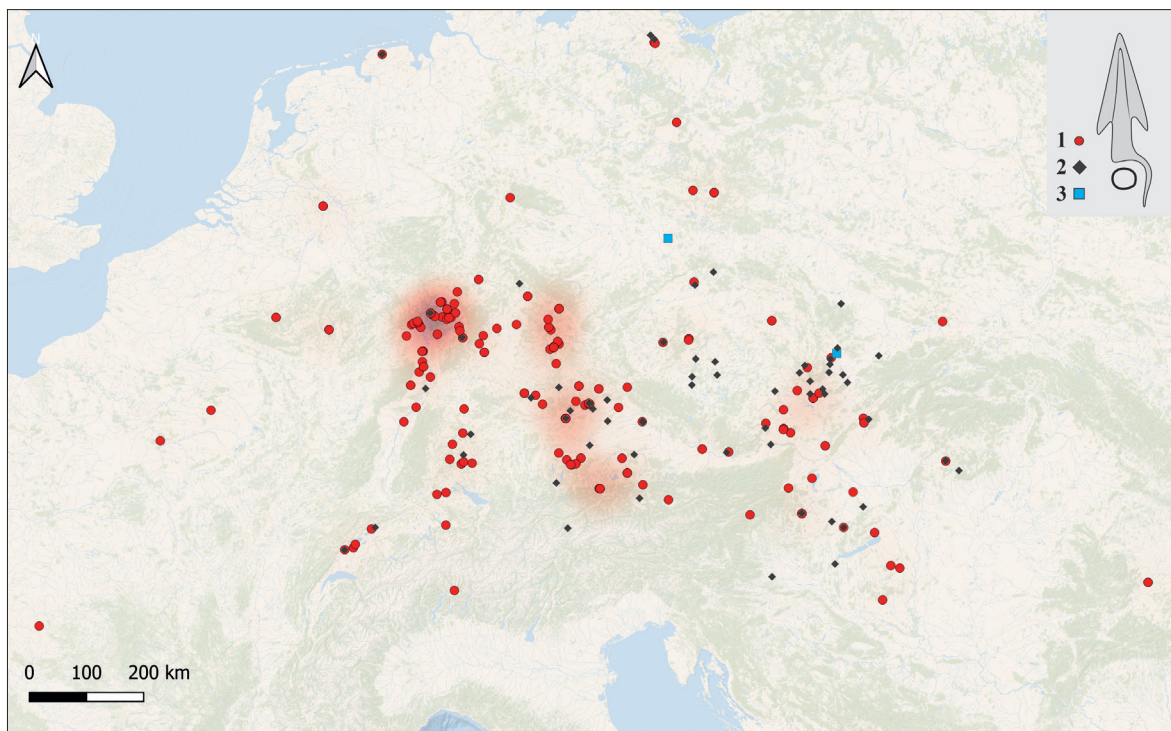


Fig. 12. Distribution of 4C arrowheads. 1 – 4C arrowheads, 2 – typologically uncertain examples, 3 – casting moulds may belong to 4C arrowheads (INSELMANN *et al.* 2024, Suppl. Mat.; TARBAY 2025a).

189 SZABÓ 1999, 333, Fig. 6.3.

190 BARON *et al.* 2020, 15; INSELMANN *et al.* 2024, Fig. 2.

191 See Use-wear results in TARBAY 2025b.

According to Eckhardt's typology, the distinction between variants 4A and 4C lies in the presence of a spur.¹⁹² It may be located at the rim of the socket, along one of its narrow sides, or at the centre of the socket opening (e.g., Köles-Hangospusztá). The spur may have been formed intentionally during casting or hammered out from the remains of the pouring cup's channel following the object's removal from the mould.¹⁹³

This type of arrowhead¹⁹⁴ is present in Austria (Br D–Ha A1 – Ha A1),¹⁹⁵ Belgium (Final Bronze Age IIb–IIIb),¹⁹⁶ France,¹⁹⁷ Germany (Br C–Ha B3),¹⁹⁸ Czech Republic (Br B2–Br C1 – Ha B3),¹⁹⁹ East Hungary,²⁰⁰ Poland,²⁰¹ Romania (Ha A1),²⁰² Slovakia,²⁰³ and Switzerland (Wagenhausen – Br D2–Ha A1).²⁰⁴ Variant 4C arrowheads exhibit a distribution pattern closely aligned with that of variant 4A, a similarity explainable by their close technological and morphological relationship. It is likely that the addition of a spur represents an innovation of the 4A form, intended to improve embedding upon impact. The earliest 4C specimens appear slightly later, around the beginning of the Late Bronze Age: Dýština (Br C),²⁰⁵ Gräufelfing-Lochham (Br B–Br C).²⁰⁶ As with variant 4A, their

192 MERCER 1970, 186–187, Fig. 3B, Fig. 4; ECKHARDT 1996, 30.

193 CLAUSING 2005, 65. It is often unclear in the literature whether 4C arrowheads features a broken spur or the remains of a casting jet. See TARBAY 2025b, 4A/C.

194 MERCER 1970, 185–190; ECKHARDT 1996, 414–416, Map 10; INSELMANN *et al.* 2024, 9, Fig. 8, Suppl. Mat.

195 PITTIONI 1941, Pl. 13.4; ANGELI 1959, Pl. 4.2; HAMPL *et al.* 1981, Pl. 237.10; LOCHNER 1991, 115, No. 87; ECKHARDT 1996, Pl. 54.12, Pl. 56.9, 11, Pl. 57.4, 6, Pl. 59.2, 4, 11; CLAUSING 2005, 67; ADAMETZ – LOCHNER 2021, Fig. 3.30; LAUERMANN *et al.* 2022, Pl. 21.2–3, 7, Pl. 30.1; LAUERMANN – RAMMER 2013, Pl. 97.18–32.

196 WARMENBOL 1995, Pl. 1.1, 16.

197 COUTIL 1912, Fig. 1.1; MOHEN 1977, 111, No. 279, Fontainebleau/77-3.

198 LINDENSCHMIT 1902, Pl. 7.16; KIMMIG 1940, Pl. 42.17; TORBRÜGGE 1959, Pl. 76.14; HERRMANN 1966, Pl. 41.F7, Pl. 208.R; HENNIG 1970, 145, 147, Pl. 75.18; HUNDT 1975, Fig. 7.2, Fig. 8; SCHULZ 1977, Fig. 3k; KOSCHIK 1981a, Pl. 9.6, Pl. 34.10; ZYLMANN 1983, Pl. 33A; IRLINGER 1988, 59–60, Fig. 30; PIEPER *et al.* 1990, Fig. 36.6; WÖLFELICK *et al.* 1992, 77, Fig. 49.13; HENNIG 1993, Pl. 2.13, 16; STRAUB 1993, Fig. 43.6; BERGER 1994, Pl. 16.9, 11–13; SCHOPPER 1995, Pl. 106.10; ECKHARDT 1996, Pl. 1.1, 7, Pl. 5.3, Pl. 7.1, 4, Pl. 8.9, Pl. 9.2, 8, Pl. 12.3, Pl. 15.11, Pl. 16.12–15, Pl. 20.5–7, 11, Pl. 23.5, Pl. 25.4, 10–11, Pl. 26.11, Pl. 27.11; ŘÍHOVSKÝ 1996, 113; RUHMANN – FÖRTSCH 1996, Pl. 112.15; BAUMGARTNER – KREISARCHÄOLOGIE 1997, Pl. 79.30; HÄNSEL – HÄNSEL 1997, 118–120; WIRTH 1998, Pl. Friedberg 3.10–11; RIND 1999, Pl. 38.34; B. V. 2000, Fig. 27.11; MÖSLEIN 2001, 208, Fig. 2.1–4, 6–8, 10, 12–16; ABELS 2002, Pl. 18.5, 10–14, 17–21, 24, 29–30; LfD 2002a, Fig. 63.15; LfD 2002b, Fig. 65.12; MEIER – WILD 2003, Fig. 35.5–6; VOKOLEK 2003, Pl. 134.30–31; CLAUSING 2005, 65–68, No. 266, Pl. 9B.5, Pl. 10.3, 5–6, Pl. 14.2–3, Pl. 19A.2–5, 9, 11, Pl. 19.B1, Pl. 21A.2, Pl. 21B.2, 4, Pl. 56C.2–4, Pl. 67A.1, Pl. 67B.7, 12, Pl. 67D.1, Pl. 68B.1–2, Pl. 70C.1–2, Pl. 71D.1–4, Pl. 75B.1–5, Pl. 75D.1–2, Pl. 75E.1–2, Pl. 75F.1–2, Pl. 76A.1, 3, Pl. 76B.1, Pl. 77A, Pl. 78C.1–4, Pl. 78D.1–4, Pl. 78B.1, Pl. 79B.1–2, Pl. 80A.1, Pl. 81.4–5; SCHÜTZ 2006, Pl. 73.1–2, Pl. 183.3, Pl. 187.21–22; ZYLMANN 2006, Fig. 12, 15–17, 19, 20; KREUTLE 2007a, 117; KREUTLE 2007b, Pl. 146.21, Pl. 177B.2,5, Pl. 177D.3; OSTERMEIER 2012, Fig. 86.12, 17, 32, 36, Fig. 131.3, Fig. 145.2, Fig. 163.6, 15–16, 20, Fig. 179.22, Fig. 197.10, Fig. 234.6, 9; BLITTE *et al.* 2019, Fig. 3; MÜNDS-LUGAUER 2019, Fig. 65; INSELMANN *et al.* 2024, Fig. 4.28–29, Suppl. Mat.

199 ECKHARDT 1996, Pl. 47.10; ŘÍHOVSKÝ 1996, 112–127, Nos 298, 311, 317–318, 349, 363, 366–367, 370, 400–402, 405, 418, 428; KYTLICOVÁ 2007, 110, Pl. 89.126, Pl. 128A.6–7, Pl. 148.12; FOJTÍK 2015, Pl. 65.4; SALAŠ 2018, Pl. 3.91, Pl. 4.92–94.

200 HAMPEL 1886, Pl. 28.4a–b; KEMENCZEI 1984, Pl. 6.16 (uncertain).

201 GEDL 2014, Nos 121, 259, 261.

202 PETRESCU-DÎMBOVIȚA 1977, Pl. 202.12–13.

203 MASÁRIK 1933, Fig. 45.5 (uncertain); STUDENÍKOVÁ – PAULÍK 1983, Fig. 35.11, 13; ECKHARDT 1996, Nos 334–335, Pl. 43.14; ŘÍHOVSKÝ 1996, 132; BOBEK – ELSCHKE 2020, Pl. 2.5, 7.

204 TROYON 1860, Pl. 9.1; KELLER 1866, Pl. 50.2; GROSS 1883, Pl. 15.34; PRIMAS 1972, Fig. 1.2; FISCHER 1997, Pl. 38.93; LEUZINGER *et al.* 2023, Fig. 7.

205 ŘÍHOVSKÝ 1996, 274, Pl. 25.372.

206 KOSCHIK 1981a, 169, No. 75A; KOSCHIK 1981b, Pl. 34.10.

emergence in the same region was followed by dispersal into multiple directions, including into the Carpathian Basin. In Transdanubia, the appearance of 4C arrowheads was relatively late, with securely dated examples associated with the Ha A1 phase, coinciding with the regional spread of variant 4A. One of these arrowheads derives from the Pécs-Jakab-hegy Hoard III, whose time of deposition is the Ha A1 phase.²⁰⁷ The other was recovered from the 6th grave at Balatonfűzfő, which belongs to the same chronological phase within the cemetery.²⁰⁸

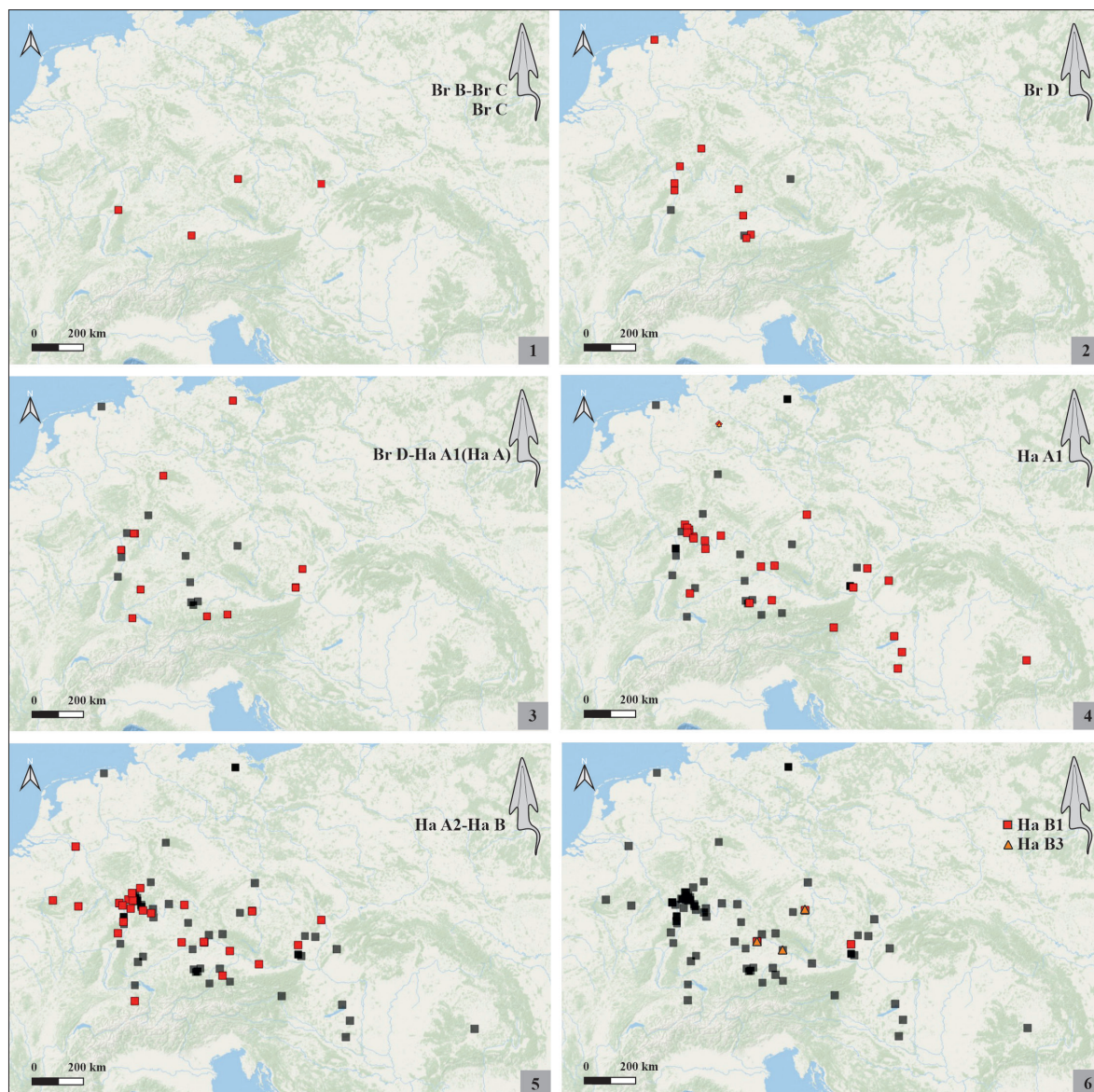


Fig. 13. Distribution of 4C arrowheads through time. Black squares represent older finds, red dots indicate younger ones (INSELMANN *et al.* 2024, Suppl. Mat.; TARBAY 2025a).

Although the arrowhead from Regöly (Fig. 18.5/1) corresponds to the Ha A1 phase—based on the content of the hoard as noted by Kőszegi,²⁰⁹ its classification remains problematic. The published images show an arrowhead with a broad, rounded-triangular blade reminiscent of Eckhardt’s 4B

207 MOZSOLICS 1985, 171.

208 ILON 2015a, 33–41.

209 KŐSZEGI 1993.

variant.²¹⁰ Géza Szabó has also noted that the blade surface exhibits significant abrasion,²¹¹ which may have rendered the barbs and their outlines indistinct. The disappearance of barbs could have been caused by a flash defect. A close analogue is one of the arrowheads from Somló Hill (Fig. 20.12/10), originally intended as a variant 4A specimen, but when flashes filled the area between the barbs, this ultimately resulted in an object with a leaf-shaped blade (variant 5A).

From a technological perspective, including both casting technique and post-casting treatment, 4C arrowheads are nearly identical to variant 4A. The distinction lies in the formation of the spur, which is either deliberately cast by carving it into the mould or formed secondarily from the remains of the pouring cup's channel and then hammered into shape after casting. Among the moulds used to produce socketed, barbed arrowheads of either 4A or 4C variants, the one found at Gävernitz from a disturbed grave, should be highlighted. This casting mould features negatives of two sickles and two arrowheads, with their pouring cups oriented in opposite directions. It was designed to cast either the sickles or the arrowheads in a single pouring operation. The two arrowhead negatives are linked by a pouring cup via two channels. The negatives of the spurs were either deliberately carved or functioned as risers when filled with molten metal.²¹² Another casting mould worthy of mention comes from Pit K528/2007 at Olšany u Prostějova, dated to the Rei. Br B2–Br C1 phase. Its negatives depict two arrowheads cast from the socket, one of which has a large spur along the socket, which can be interpreted similarly to the mould from Gävernitz.²¹³

Only a limited number of 4C arrowheads were available for use-wear analysis. They displayed technological and wear traces largely identical to those observed on 4A specimens. These include mismatch and incomplete casting defects, as well as post-casting treatments, such as hammering along the edges and sharpening. The arrowheads from Pécs (Fig. 18.4) and Kölesd (Fig. 23.20) show potential use-wear traces, particularly the former, which appears to have a heavily re-worked tip, resulting in a noticeable reduction in size in this area (Fig. 8.4).

4A or 4C

Studied finds: Balatonmagyaród 15 (Fig. 23.15); Celldömölk-Ság-hegy 10/3 (Fig. 18.10/3); Somló 12/4–6, 8–10, 12 (Fig. 20.12/4–6, 8–10, 12); Velem 14/11, 16, 29–30, 32–33, 64–68, 72–73, 76 (Fig. 21.14/11, 16, Fig. 22.14/29–30, 32–33, Fig. 23.14/64–68, 72–73, 76); Románd 6 (Fig. 18.6).

Numerous arrowheads cannot be classified with greater precision than Type 4.²¹⁴ These include specimens bearing atypically small spurs or only the broken remains of a spur (or of a casting jet) on their socket rim or shaft. Such missing parts may be attributed to the removal of the casting jet, intentional breakage, or damage sustained during use.

Among these artefacts, only the arrowhead from the eponymous Románd hoard is datable, which Hungarian research associates with the Ha B2 phase.²¹⁵ Use-wear analysis has revealed technological and usage traces consistent with those observed on well-identified type 4A and 4C arrowheads. In this regard, the Románd arrowhead is distinctive, having been thoroughly hammered along its barbs. This suggests that the object may have undergone reworking after prolonged use, possibly as part of a maintenance process.

210 ECKHARDT 1996, 29.

211 SZABÓ 1993, 170, Pl. 1.6, Pl. 8.1; ŘÍHOVSKÝ 1996, 129, Pl. 27.439; SZABÓ 2013, Pl. 1.6, Pl. 8.1.

212 BIERBAUM 1956, 176–180, Figs 1–2.

213 FOJTÍK 2015, 202–205, Pl. 65.4.

214 The archaeological literature includes numerous similarly atypical arrowheads, for which a clear differentiation between type 4A and 4C remains difficult. see TARBAY 2025b, 4AC.

215 MOZSOLICS 2000, 70–73.

4E (Eckhardt's Type 4, Variant E)

Studied finds, Subvariant A: Celldömök-Ság-hegy 29 (Fig. 25.29).

Studied finds, Subvariant B: Gôr 28 (Fig. 24.28); Velem-Szent Vid 30/1–30/2 (Fig. 25.30/1–2).

Dat: Ha B1 – Subvariant A; Ha B1(Ha B2) – Subvariant B.

The socketed, barbed harpoon arrowheads with a loop are classified as Type 4, Variant E according to Eckhardt.²¹⁶ This variant can be further divided, based on the presence or absence of a spur, into Subvariant A (with spur) (Fig. 2.4E/A) and Subvariant B (without spur) (Fig. 2.4E/B). Variant 4E harpoon arrowheads are distributed across Germany,²¹⁷ Austria,²¹⁸ Hungary,²¹⁹ and the Czech Republic (Fig. 14).²²⁰ Subvariant A appears to be more common, with associated casting moulds and finished artefacts discovered throughout the entire known distribution of the 4E variant. However, its dating remains challenging, as many Subvariant A examples are either stray finds or originate from Ha A–Ha B and Ha B phase settlements lacking secure archaeological context. A casting mould from Pit 3/72 on Špičák Mountain in Mikulovice hold importance for dating this variant, as it has been associated with the Ha B1 phase based on ceramics recovered from the same context.²²¹ Subvariant B is considered rare and has been documented at only a handful of sites: Gôr-Kápolnadomb pit “a”, Höglberg in Landshut, Mainz-Rhein (Petersaue-Ingelheimer Aue), Velem-Szent Vid, Waschenberg bei Bad Wimsbach/Neydharting.²²² Its dating is supported by radiocarbon results from the Gôr-Kápolnadomb settlement, where pit “a” was dated to the 1032–928 cal BC, corresponding to Sperber's LBA IIIa1 (Ha B1b) – LBA IIIa2 (Ha B2).²²³

Many variant 4E arrowheads are known from casting moulds, offering a unique opportunity to study their production technology. Examples include local Transdanubian finds from Celldömök-Ság-hegy,²²⁴ Gôr-Kápolnadomb,²²⁵ and Velem-Szent Vid,²²⁶ as well as finds from Goldberg bei Riesbürg,²²⁷ Heidenstatt bei Limberg,²²⁸ Höglberg in Landshut,²²⁹ Mikulovice-Špičák Mountain Pit 3/72,²³⁰ Prague-Vokovice,²³¹ and Zlín-Malenovice.²³² 4E harpoon arrowheads were cast using two-piece moulds with a casting core. Fixing holes, designed to ensure the precise matching of the mould's halves are

216 See ZU ERBACH 1989, 92; HANSEN 1994a, 83, Fig. 48; HANSEN 1994b, 599, Fig. 48; ECKHARDT 1996, 30, 414–415, Map 10; TARBAJ 2023a; TARBAJ 2025a, 4E.

217 BAUER – DOPPELBAUR 1975, 146; ECKHARDT 1996, Pl. 20.8–9, Pl. 21.4; OVERBECK 2018, Pl. 24.40.

218 COUTIL 1912, 132–133, Fig. 1.8, Fig. 2.14; PERTLWIESER 1971, Pl. 19.9 (uncertain); ECKHARDT 1996, Pl. 57.9, Pl. 60.1

219 TOMPA 1927, 46, Fig. 5a–b; ILON 1992, 244, Fig. 6.3; TARBAJ 2023a, 347, Fig. 1, Fig. 3.1.

220 ŘÍHOVSKÝ 1996, No. 433; BLAŽEK *et al.* 1998, Pl. 16A.31, Pl. 27.119.

221 BLAŽEK *et al.* 1998, 54–55, 145, Pl. 16A.31.

222 TOMPA 1927, Fig. 5.a–b; PERTLWIESER 1971, Pl. 19.9; ILON 1992, Fig. 6.3; ECKHARDT 1996, Pl. 20.8; OVERBECK 2018, Pl. 24.40.

223 ILON 1992, 244, Fig. 6.3; SPERBER 2017.

224 TARBAJ 2023a, 347, Fig. 1

225 ILON 1992, 244, Fig. 6.3.

226 TOMPA 1927, 46, Fig. 5a–b.

227 OVERBECK 2018, 128, Pl. 24.42.

228 ECKHARDT 1996, Fig. 35.1; ŘÍHOVSKÝ 1996, 128; ZU ERBACH 1989, 92, fn. 35; ADAMETZ – LOCHNER 2021, 67, Fig. 2.29.

229 OVERBECK 2018, 127–128, Pl. 24.40.

230 BLAŽEK *et al.* 1998, 54–55, 145, Pl. 16A.31.

231 BLAŽEK *et al.* 1998, 55, 173, Pl. 27.119.

232 ŘÍHOVSKÝ 1996, 128, Pl. 27.433.

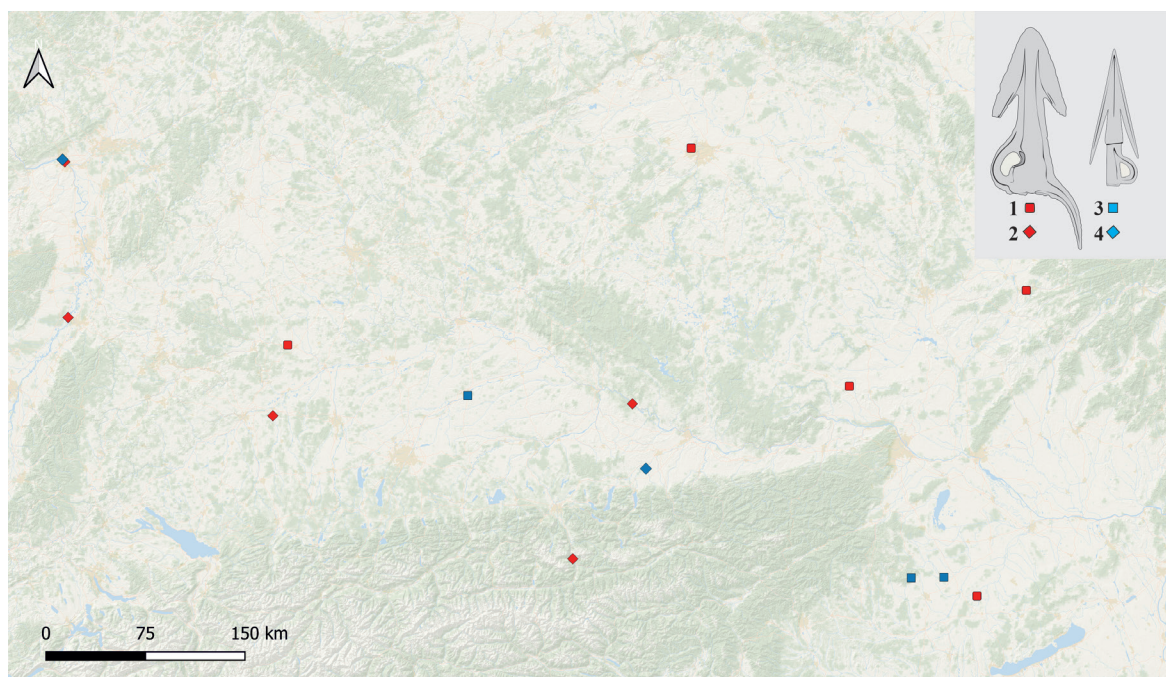


Fig. 14. Distribution of 4E arrowheads (TARBAY 2025a).

observable on the Mikulovice, Goldberg and Höglberg finds.²³³ The mould negatives reveal that one, two or three harpoon arrowheads could be cast simultaneously, indicating an incipient tendency towards serial production within this variant. Craftsmen also designed highly individualised gating systems. In the Celldömölk-Ság-hegy mould, casting occurred from the socket direction,²³⁴ whereas the Zlín-Malenovice and Heidenstatt bei Limberg moulds likely employed casting from the tip direction.²³⁵ On the Mikulovice mould, the pouring cup negative includes two channels—one leading to the spur and another to one of the barbs.²³⁶ This system appears, with slight modifications, in the Velem²³⁷ and Goldberg casting moulds.²³⁸ The Prague-Vokovice specimen repeats the concept but without a channel connecting to the bars.²³⁹ Another distinct design is observable on the Górá²⁴⁰ and Höglberg moulds,²⁴¹ where the arrowhead tips are joined via channels into a single pouring cup.

In Transdanubia, no finished 4E arrowheads have been discovered; thus, use-wear analysis is limited to the casting moulds. Blackened and burnt traces suggest that at least two local moulds (Gór-Kápolnadomb, Celldömölk-Ság-hegy) were used.²⁴² The post-casting phase of the 4E finished products probably followed procedures similar to those applied to other Type 4 arrowheads.²⁴³ Considering their intended purpose, we elaborate here on their functional interpretation, proposing that these looped arrowheads may have been specialised detachable barbed points, with a loop

233 BLAŽEK *et al.* 1998, Pl. 16A.31; OVERBECK 2018, Pl. 24.40, 42.

234 TARBAY 2023a, Fig. 1

235 ŘÍHOVSKÝ 1996, Pl. 27.433; ADAMETZ – LOCHNER 2021, 67, Fig. 2.29.

236 BLAŽEK *et al.* 1998, Pl. 16A.31.

237 TOMPA 1927, Fig. 5.a–b.

238 OVERBECK 2018, Pl. 24.42.

239 BLAŽEK *et al.* 1998, Pl. 27.119.

240 ILON 1992, Fig. 6.3.

241 OVERBECK 2018, Pl. 24.40.

242 T. BIRÓ 1995, 53; TARBAY 2023a, 336.

243 See TARBAY 2023a.

serving to hold the harpoon lines instead of a line hole. If this hypothesis holds, such weapons were primarily employed for hunting and fishing.²⁴⁴

5A (Eckhardt's Type 5, Variant A)

Studied finds: Tihany-Óvár 8 (Fig. 18.8); Velem 14/35, 82²⁴⁵ (Fig. 22.14/35, Fig. 23.14/82). Non-Transdanubian find: Unprovenanced 33/3 (Fig. 26C.33/3)

Small, socketed arrowheads without a spur, having characterised by a leaf-shaped blade, are classified as 5A according to Eckhardt's typology (Fig. 2.5A).²⁴⁶ A leaf-shaped blade may be intentionally carved into a casting mould or may result from a casting defect. Flash defects and mould shifts can cause metal to overflow into the area surrounding the barbs' negatives, filling their outlines. Such casting defects are evident on one of the arrowheads from Behringersdorf,²⁴⁷ and on a previously mentioned arrowhead from Somló Hill (Fig. 20.12/10).

Like other arrowhead variants from Transdanubia, 5A represents a supra-regional form, distributed across an extensive geographical range.²⁴⁸ Finds have been recorded in Austria (Br D–Ha A1 – Ha B),²⁴⁹ Britain,²⁵⁰ Czech Republic (Br B–Ha B3),²⁵¹ East Hungary (Br D–Ha A1),²⁵² France,²⁵³ Germany (Br B–Ha B),²⁵⁴ Greece (EIA),²⁵⁵ Georgia (Ko B–Ko C),²⁵⁶ Poland (Period III–V, EIA),²⁵⁷ Romania (Ha A1),²⁵⁸ Russia/Caucasus (Ko A–Ko D),²⁵⁹ Serbia,²⁶⁰ and Slovakia.²⁶¹ When all analogues view altogether, these arrowheads exhibits concentrations in Mecklenburg, Saxony-Anhalt, Bavaria,

244 See [TARBAY 2023a](#), 339–341.

245 The elongated shape of the object also shows similarities with the 5B variant. See [ECKHARDT 1996](#), 31.

246 [ECKHARDT 1996](#), 30, 418–419, Map. 11.

247 [HUNDT 1975](#), Figs 7–9

248 [ECKHARDT 1996](#), 418–419, Map. 11; [INSELMANN et al. 2024](#), 8, Fig. 6, Suppl. Mat.; [TARBAY 2025a](#), 5A.

249 [PITTIONI 1941](#), Pl. 12.17; [ECKHARDT 1996](#), Pl. 54.13; [ŘÍHOVSKÝ 1996](#), 102.

250 [MESSINA 2017](#).

251 [ČUJANOVÁ-JÍLKOVÁ 1970](#), Pl. 15D.16, Pl. 82A.5–6; [ŘÍHOVSKÝ 1996](#), 100–102, Nos 240, 242–253, 259; [HRALA 2000](#), Fig. VII.105, 108, 123; [SICHERL 2004](#), Pl. 11.19–20.

252 [KEMENCZEI 1968](#), Pl. 12.6; [KOVÁCS 1975a](#), 16, Pl. 9.99/1; [CZUKOR et al. 2013](#), 14.

253 [DE MORTILLET – DE MORTILLET 1903](#), Pl. 88.1090; [BLANCHET 1984](#), Fig. 215.14.

254 [BUCHHOLZ 1896](#), 73, No. 18450; [BUSSE 1896](#), 127, Fig. 2.d; [GROSSE 1919](#), Pl. I.9; [BOHM 1935](#), 125, Pl. 19.5; [GRÜNBERG 1943](#), Pl. 38.10; [COBLENTZ 1952](#), Pl. 8.2, Pl. 32.4; [TORBRÜGGE 1959](#), Pl. 14.12, Pl. 30.13, Pl. 35.13, Pl. 43.49, Pl. 66.6; [JUST 1967](#), Fig. 138a; [JUST 1970](#), Fig. 143c; [MERCER 1970](#), 176; [LAUX 1971](#), Pl. 77.7; [SCHUBART 1972](#), Pl. 40.A2; [BMV 1979](#), 404; [PRÜSSING 1982](#), Pl. 27K.2; [FRÖHLICH 1983](#), Pl. 62.25–27, 29, 36, Pl. 79B.9, Pl. 83B.3, Pl. 93B.1–8; [BERGER 1984](#), Pl. 30.13–14, Pl. 70.7; [RÖSLER 1984](#), Pl. 12.g; [ABELS et al. 1992](#), Fig. 9.21; [FEUSTEL 1993](#), Pl. 31.9; [PAULI 1994](#), Pl. 92.13; [ZEHM 1995](#), Fig. 39; [ECKHARDT 1996](#), Pl. 1.9, Pl. 2.4, Pl. 5.7, Pl. 8.4, Pl. 15.2, Pl. 16.2–4, 6, Pl. 24.6, Pl. 26.4–5, Pl. 36.1; [ŘÍHOVSKÝ 1996](#), 102; [KAYSER 1998](#), Fig. 21.1–4; [PFAUTH 1998](#), Pl. 212.13–14; [EBNER 2001](#), Pl. 28.11; [ORLIŇSKA 2001](#), Pl. 109.25.8; [CLAUSING 2005](#), Pl. 71B1, Pl. 74C.1, Pl. 75E.3, Pl. 79A.1; [KREUTLE 2007a](#), 117; [KREUTLE 2007b](#), Pl. 177D.2; [BUCK – BUCK 2010](#), 31–32, fn. 96; [OSTERMEIER 2012](#), Pl. 86.15, 19, Fig. 179.29–30, Fig. 234.7; [DOMBROWSKY 2014](#), 139–141; [DOMBROWSKY 2017](#), No. 62; [BMV 2018a](#), Fig. 30.2; [BMV 2018b](#), 200–201; [BLITTE et al. 2019](#), Fig. 3; [CIESIELESKI 2021](#), Fig. 60; [INSELMANN et al. 2024](#), Fig. 4.31–39, 43–44, 46–47, 51, Suppl. Mat.

255 [BUCHHOLZ 1963](#), 27, Fig. 7.VIIIa, Fig. 15h; [AVILA 1983](#), Pl. 54.1088.

256 [MIKELADZE 1985](#), 102–104, Pl. 12.28; [REINHOLD 2007](#), 522, List 169 Pfa2.GUR25.

257 [GEDL 2014](#), 46–47, Nos 267–271, 277–284, 288, 296–297; [HRYNKIEWICZ-BOGENRYTER – BARON 2022](#), Fig. 4.1.

258 [PETRESCU-DÎMBOVIȚA 1977](#), Pl. 165.3, Pl. 251.17–18; [ŘÍHOVSKÝ 1996](#), 102; [GOGĂLTAN et al. 2019](#), Fig. 26.

259 [KOZENKOVA 1982](#), Pl. 11.3; [REINHOLD 2007](#), 429, List 173 Pfb1.CEC150.

260 [VASIĆ 2015](#), No. 356.

261 [FURMÁNEK 1977](#), Pl. 1.1; [ŘÍHOVSKÝ 1996](#), 102.

and Moravia (Fig. 15).²⁶² However, spatial patterns based on datable examples reveal less coherence and present divergent trends (Fig. 16). The type spans the Middle (Br B) to the end of the Late Bronze Age (Ha B3).²⁶³ The earliest known 5A arrowheads are located near the modern Czech–German border, including finds from the Burglengenfelder Forst (Br B)²⁶⁴ and Biřkov (Br B).²⁶⁵ The arrowhead recovered from Mound 2 at Tihany-Óvár may also belong to this early phase, dated to the Br B based on associated ceramics (see [Catalogue A](#)). From the Br D–Ha A1 onwards, 5A arrowheads appear to radiate northwest- and south-westwards from their presumed core zone. This expansion appears to have culminate between the Ha A2 and Ha B phases. Within the Carpathian Basin, 5A arrowheads occur only sporadically and are more typical of its eastern territories. In Transdanubia, the type remains rare, with confirmed examples limited to finds from Tihany-Óvár and Velem.

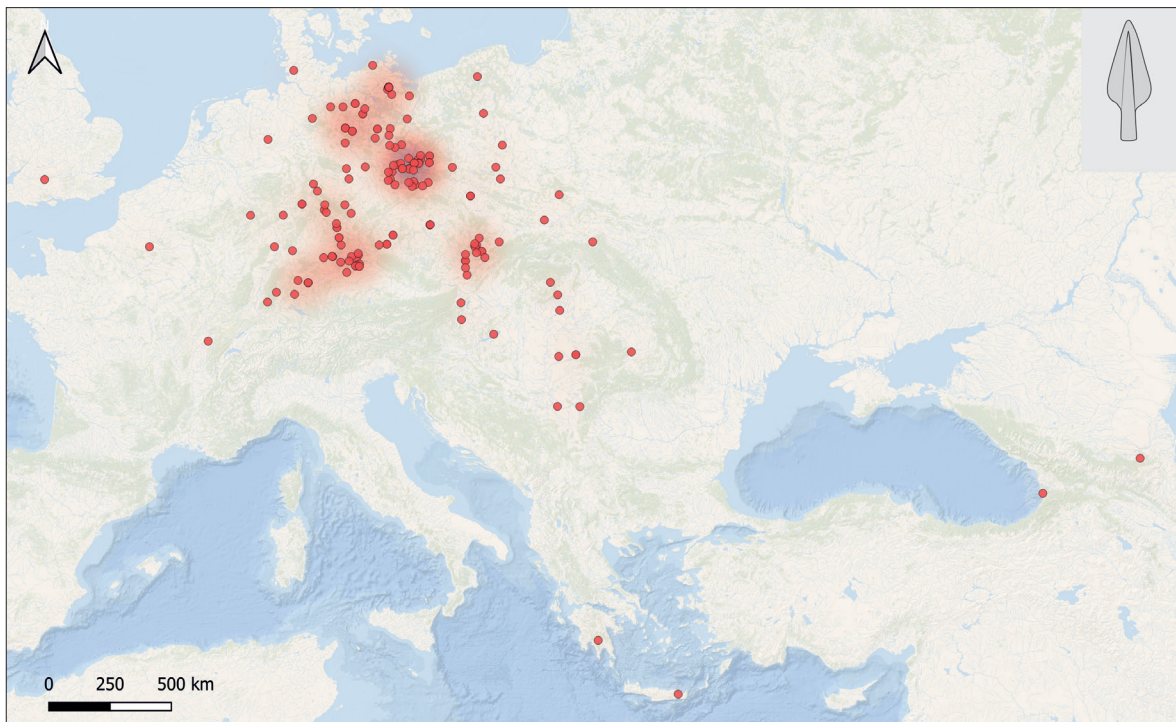


Fig. 15. Distribution of 5A arrowheads (INSELMANN *et al.* 2024; TARBAY 2025a).

The production of type 5A arrowheads is consistent with that of types 4A and 4C. These arrowheads were cast using two-part moulds with two negatives and a casting core. In the case of the Tihany-Óvár arrowhead, it is likely that a fixing rod was employed to secure the core during the casting process—a technical solution also discussed in connection with the Velem 14/6 specimen, classified as 4A. Variant 5A arrowheads underwent similar post-casting treatments similar to the those applied to the aforementioned variants, with their cutting edges and tip hammered and sharpened (Fig. 8.1). No use-wear traces have been observed on the studied Transdanubian finds.

262 INSELMANN *et al.* 2024, 8, Fig. 6.

263 Gedl notes that the arrowhead from Trepcza was found around an Early Bronze Age settlement, see GEDL 2014, 46, Pl. 4.283A.

264 TORBRÜGGE 1959, 119, No. 47, Pl. 14.12.

265 SICHERL 2004, 257, No. 187, Pl. 11.19–20.

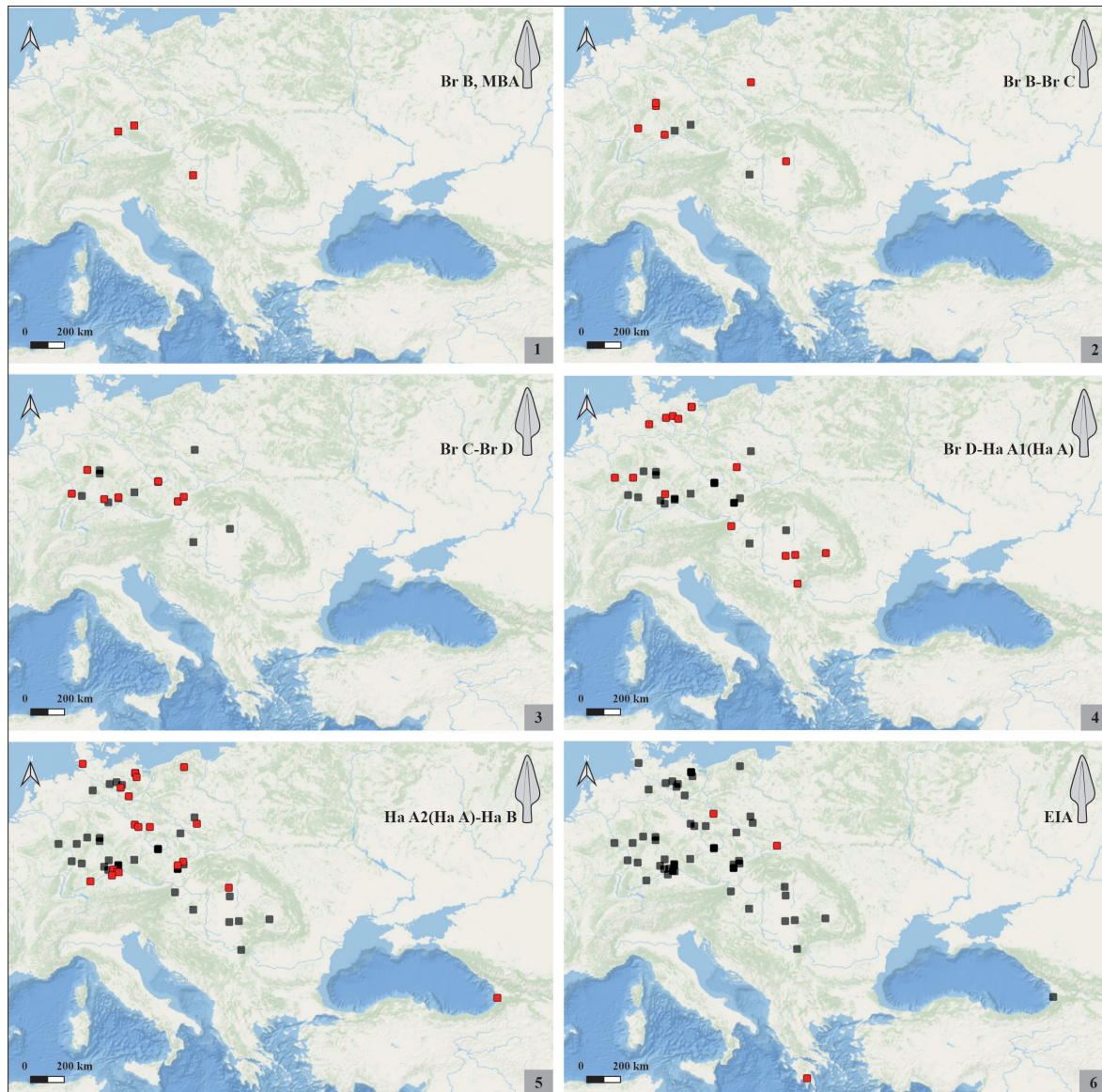


Fig. 16. Distribution of 5A arrowheads through time. Black squares represent older finds, red dots indicate the younger ones (INSELMANN *et al.* 2024; TARBAY 2025a).

Transdanubian arrowheads

Bronze arrowheads from Transdanubia can be classified within Eckhardt's scheme (Variants 1A, 1C, 3A, 4A, 4C, 4E, and 5A). With certain variants, it is possible to distinguish subvariants, including 1A (Subvariants A–C) and 4E (Subvariants A–B). Most Transdanubian arrowheads have been recovered from settlements, some of which may have held central roles, such as Velem, Somló and Ság-hegy. However, aside from the Somló Hill and Bakonyszentlászló, the findspots for many arrowheads remain unknown, rendering much of the studied objects stray finds. Between the Ha A1 and Ha B1 phases, arrowheads were rarely selected for metal hoards, in whole or fragmented. This pattern suggests that arrowhead hoarding, unlike the deposition of swords and spearheads, was not customary in Transdanubia and, with a few exceptions, it does not appear to have been a dominant practice elsewhere in Europe either. Thus, the selection of an arrowhead for a hoard may have represented a personal, perhaps ritual decision, rather than a broader cultural norm.

In contrast to many graves from the Tumulus, Urnfield, and Lusatian cultures across Central Europe, arrowheads are absent from local graves in Transdanubia, with the possible exceptions of

the much earlier-dated Tihany-Óvár mound and Grave 6 from Balatonfűzfő. The latter example, possibly intended to symbolise the archery skills of the deceased, has no clear parallel in the region and may reflect West-Central European burial customs within the local Transdanubian Urnfield culture.²⁶⁶ Arrowheads do not appear to have been deliberately manipulated. The studied specimens are generally intact, significantly outnumbering the fragmented examples, especially when modern damages are considered. Breakages observed on the barbs and spurs, if combat-related, were likely caused by impact with solid targets or difficulties encountered during retrieval. Additionally, a small number of arrowheads exhibit broken tangs or sockets or survive only as tip fragments. In burial context, the deposition of a deliberately fragmented arrowhead may have held ritual significance, analogous to the intentional destruction of other weapon types and components. Grave 6 at Balatonfűzfő contained a set of arrowheads, including two blade fragments, which may reflect such symbolic treatment.

Except for the leaf-shaped-blade variant 5A, all arrowheads possess sharpened barbs that broaden the blade and contribute to deeper penetration and embedding in the target, thereby increasing the lethality of the wound.²⁶⁷ In certain variants, such as 1C, 4C and 4E (Subvariant A), an additional spur is present. Like the barbs, it served to hinder removal once the arrow became embedded in flesh, intensifying bleeding and slowing the victim. Junkmanns has further argued that these small, thin spurs may have fractured during extraction, causing additional pain and internal damage.²⁶⁸ Although untested experimentally, this may explain the frequent occurrence of arrowheads exhibiting broken spurs.²⁶⁹ The barbs and the spurs therefore possessed clear functional significance, and were not mere typological feature.

Barbs first appeared in flint arrowheads and were subsequently adapted in bronze during the Early and Middle Bronze Age across various regions of Europe. Spurs on arrowheads, like those found in Transdanubia, emerged in Central Europe towards the end of the Middle Bronze Age and became widespread during the Late Bronze Age. Their development was likely influenced by bone and later metal harpoon heads, in which the toggle function of the spur had already been refined. 4E arrowheads may have served as *detachable barbed points*, with the loop functioning to secure harpoon lines. In the case of perforated sheet-metal arrowheads, such as the 1A (Subvariant D) example from the Somló Hill, a similar function may be inferred from ethnographic analogues. These examples could have been hafted as end blades in detachable bone harpoon heads and replaced when damaged.²⁷⁰ However, compound arrows with a foreshaft, documented in both ethnographic and Near Eastern contexts, could render any metal arrowhead suitable for harpoon use. Such arrows would likely leave no archaeologically visible traces, particularly in the Carpathian Basin, where no complete arrow shafts have yet been recovered. Nonetheless, it is plausible that compound arrow technology was already known during the Late Bronze Age, given its practical advantages.²⁷¹

Late Bronze Age Transdanubian arrowheads may have been produced either by the archers themselves or by metalsmiths, tailored to individual preferences. Variations in length, width, and the shape of the barbs, even within rigid typological groups, suggest the existence of personalised approaches to design. At the same time, evidence points to the emergence of early forms of serial production, both in Transdanubia and beyond. This is clearly demonstrated by preserved casting

266 ILON 2015a.

267 ECKHARDT 1996, 66.

268 MERCER 1970, 186; JUNKMANNS 2013, 326.

269 TARBAY 2025a, 4AC.

270 PARK – STENTON 1998, 16–17.

271 See MASON 1902, 217–219, Pl. 3; CLARK *et al.* 1974, 333–334; PARK – STENTON 1998, 4; ALLELY 2000, 180–182.

moulds capable of producing multiple arrowheads in a single casting event. Notably, in Transdanubia such moulds tend to originate from central settlements that show clear evidence of metallurgical activity. Although, it was technologically possible to cast multiple arrowheads at once, each was finished individually. This is illustrated by all the studied specimens, which except for two as-cast examples, show a consistent pattern: all are finished products exhibiting characteristic traces of post-casting treatment, including hammering and sharpening (Fig. 9.2–3).

In the Bronze Age Carpathian Basin, no complete bows, arrows, or other organic components of archery equipment have been preserved, which limits our understanding of local bow types and capabilities. European bows dated between the Mesolithic and Bronze Age were generally crafted from a single piece of wood and measured approximately the height of an adult human. Only a handful of complete bows or fragments dating to the Bronze Age have survived in Europe. According to Junkmanns, Bronze Age bows were made of yew, dogwood and elm were also occasionally used. He differentiated two types: those retaining technological features of Mesolithic (De Zilk type) and Neolithic (Onstwedde type) bows, and the Löttschenpass type, which representing Early and Middle Bronze Age innovations. The latter is characterised by wider and flatter moving limbs, a reinforced face with keeled or lenticular cross-sections resistant to breakage, and narrow, high handles that contribute to the stability and accuracy of arrow flight. Junkmanns *et al.* estimate a draw weight of approximately 45–55 lb for these weapons.²⁷² Additional bow fragments have been recovered across Eurasia, most of them dating to the Early and Middle Bronze Age. Late Bronze Age examples are rare and geographically distant from Carpathian Basin, offering little direct insight into the region's potential bow-making traditions.²⁷³

In Transdanubia, even the tips of wooden shafts have perished, with the exception of a lost arrowhead from Velem-Szent Vid (Fig. 23.14/82), which appears to have retained traces of a wooden shaft according to Baron Miske's illustrations.²⁷⁴ Another instance of wooden arrow shaft remains is preserved inside the socket of an arrowhead from Győr-Ménfőcsanak, Feature 133 (Fig. 19.11/1), which will require future radiocarbon dating, archaeobotanical analysis, and tomography to obtain absolute dating, identify the species, and characterise the production technology of the wooden component. As the surviving bronze arrowheads represent only a small fraction of the complete weapon, the absence of organic shafts and other components severely limits our capacity to reconstruct the functional capabilities of this weapon type. Arrows generally follow two main construction principles: either as simple, solid-hafted arrow or a compound one with a foreshaft. Preferences for wood type, shaft dimensions (diameter and length), raw material for parts—particularly for arrowheads (whether stone, bone, or metal)—as well as fletching feathers, glue, and binding materials were likely shaped by regional traditions or personal preferences, given that archers often crafted their own arrows.²⁷⁵ To envisage Late Bronze Age wooden arrow shafts, one must currently rely on extra-Carpathian analogues and Early and Middle Bronze Age examples, such as those from Schnidejoch, dated to the EBA–MBA. These shafts were made from guelder rose (*Viburnum* sp.), honeysuckle (*Lonicera* sp.), and hazel (*Corylus avellana*).²⁷⁶ A shaft fragment from Tollense has been identified as dogwood (*Cornus* sp.).²⁷⁷ Preserved Bronze Age arrows feature nocks, but no traces have been observed that provide insight into the fletching feathers or additional construction details. The

272 See ECKHARDT 1996, 55–65; SICHERL 2004, 165, fn. 1–2; JUNKMANN 2013, 38–39, 305–327, Maps 5–6, Tab. 15, Fig. 25; STRAMBOWSKI 2015, 131–132, Figs 1–2; JUNKMANN *et al.* 2019, 283–290, 303–304, Fig. 4.

273 COMSTOCK 2000, 98–99; MILLS 2008; JUNKMANN 2013, 38–39, 305–327; SEMYAN – BAKAS 2021, 3–6.

274 MISKE 1907, Pl. 31.16.

275 ECKHARDT 1996, 41, 70–76; ALLELY 2000, 180–189.

276 JUNKMANN *et al.* 2019, 292–293, Tab. 2.

277 INSELMANN *et al.* 2024, 3.

hafting of the metal arrowheads can be deduced from eponymous finds, such as the aforementioned arrowheads from Behringsdorf Grave 5, which illustrate the hafting of variants 1A and 4A.²⁷⁸ Depending on the shape of the arrowhead and the presence of either a tang or a socket, various hafting techniques and material would have been employed to secure the head firmly to the slender wooden shaft, including different types of binding fibres and adhesive substances.

How, and for what purpose, bows and arrows were used in Transdanubia during the Late Bronze Age remains difficult to determine, mainly because archaeological conclusions rely almost entirely on the preserved metal arrowheads. Production technological and use-wear traces observed on the Transdanubian arrowhead material confirm that these arrowheads formed parts of fully functional projectiles (Figs 7–9). Bows and arrows may have been employed for both hunting and warfare. These functions are not exclusive but rather complementary within the social framework we would expect in the Late Bronze Age. Hunting during peaceful periods was an effective means of refining ranged-combat skills, such as accurately striking moving targets at a distance. It also enhanced the physical and mental abilities required to be an effective warrior, such as endurance, stealth. Hunting also offered opportunity for practicing individual and cooperative attack. Through shared experience, hunting also strengthened group cohesion, which was essential when warriors had to fight side by side. Hunting also conferred prestige, providing access to high-nutrition food raw materials (antler), trophies (tusks) and pelts that were otherwise unattainable.²⁷⁹ It also tended to be an activity associated with social elites. Cultraro, in the context of Mycenaeans and Hittites, also notes that wild boar hunting was a prominent activity linked to the ruling class and related to male initiation.²⁸⁰ In Transdanubia, key prey animals included wild boar, red and roe deer, European hare, aurochs, and rabbit. Aurochs, wild goat, fox, wolf, different bird species also appear in the archaeozoological material of the Tumulus and Urnfield cultures.²⁸¹ Vörös also emphasised the importance of dogs as indicators of hunting in the Late Bronze Age archaeozoological material.²⁸² Arrowheads, and harpoon arrows could have been used to hunt these animals, as well as aquatic fish species such as carp and pike, which identified at the Ménfőcsanak site. The same site also yielded remains of beaver and European pond turtle.²⁸³ However, there is no osteological evidence in this region for animals wounded by arrowheads; so the consumed fauna therefore provides only indirect indications of bow and possibly spear-hunting activities in the area.

During prehistory, bows and arrows were, of course, an essential part of the equipment of Bronze Age warriors and were used in act of violence across both smaller and potentially larger-scale conflicts. Evidence for the participation of archers in violent encounters has accumulated since the Mesolithic. By the Late Bronze Age, the range of such evidence had expanded, including osteological material, use-wear traces, and finds from battlefields and siege sites, all clear indicators of the employment of bows and arrows in warfare.²⁸⁴ Since the discovery of the Tollense battlefield, there can be little doubt that warrior equipped with bows and arrows participated in larger-scale combat and were capable of inflicting serious injury. The wounds observed on human remains from this site demonstrate that these projectiles could penetrate skin, flesh, and bones alike, and be embed-

278 HUNDT 1975, 10–12, Figs 6–9; CLAUSING 2005, 72, Pl. 9B.2–3. See Iron Age example: ECKHARDT 1996, 282–283, Pl. 55.2–3.

279 MERCER 1970, 186; SCHAUER 1983, 217; HARDING 1999, 161; CULTRARO 2004, 127; CLAUSING 2005, 71–72; VANDKILDE 2011, 366; ILON 2015a, 39–40.

280 CULTRARO 2004.

281 VÖRÖS 1996, 212–213, Tab. 1; VÖRÖS 1999, 293; ILON 2024a, 79–80, Tab. 3.2.1.

282 VÖRÖS 1996, 210–211, Tab. 1; VÖRÖS 1999, 293; ILON 2024a, 82.

283 ILON *et al.* 2016; ILON 2024a, 80, Tab. 3.2.1.

284 JUNKMANN 2013, 40, 88–89; BARON *et al.* 2020; INSELMANN *et al.* 2024, 11.

ded deeply within the body. Tollense is of particular importance, as some of the arrowhead types known from Transdanubia (4A, 4C, 5A) were also recovered there. Embedded arrowheads within human bones, together with osteological analyses of the deceased, confirm that injuries caused by such projectiles occurred in this violent conflict.²⁸⁵

Tollense is not the only Central European site to yield osteological evidence for arrow-related injuries. Falkenstein notes vertebrae with embedded 4A arrowheads, one from Klings and the other from Saalfeld. Both appear to have been shot from behind: the Klings example likely caused rapid death, while the Saalfeld vertebra shows signs of healing.²⁸⁶ Many the arrowheads discussed throughout this study originate from settlements, hillforts, and hilltop sites. Their presence as stray finds, even if used, does not necessarily indicate siege. However, certain well-researched sites do provide compelling evidence. At Heunischenburg near Kronach (Ha B2–Ha B3), traces of siege activity have been identified, where 107 arrowheads were discovered in various locations: in front of the fortification, within the inner and the outer gate alley.²⁸⁷ The presence of bronze arrowheads at hillforts such as Velim, which shows clear signs of destruction and siege, likewise supports their use in combat.²⁸⁸ As Sava and Gogâltan have observed, arrowheads (1A, 5A) appear at southeastern Carpathian mega-sites in Hungary and Romania, including Csanádpalota-Földvár, Cornești-Iacuri, and Sântana-Cetatea Veche. At the latter site, arrowheads form part of a broader suite of evidence that included burnt palisades and walls, scorched clay projectiles, spearheads, and osteological remains associated with a siege episode.²⁸⁹ The appearance of arrowheads at battle and siege sites not only reflects the violent nature of Bronze Age societies but also demonstrates a transformation in warfare. Sacking a fortified settlement required strategic planning, organisation, and logistical support. Arrowheads, often in large quantities, were likely a key component of such operations. It is perhaps no coincidence that casting moulds capable of producing multiple arrowheads began to emerge during the Late Bronze Age, signalling serial production to meet these demands. The Wrocław-Widawa hoard may represent such a stockpile. According to analysis conducted by the Polish research team, the assemblage consists carefully crafted arrowheads, many of which show evidence of use. This assemblage exemplifies the potential life cycle of Bronze Age projectiles: they may have originated from a curated reserve, possibly composed of recycled arrowheads with damaged shafts, which were then prepared for re-hafting. The Wrocław-Widawa hoard provides a realistic picture of the scale and organisation of arrowhead production and use within a Late Bronze Age settlement—phenomena that become archaeologically tangible only under favourable preservation conditions due to recycling.²⁹⁰

In Transdanubia, arrowheads recovered from settlements tend to be concentrated in the northern and northwestern parts of the region. Notable sites include Velem-Szent Vid, Ság Hill, and Somló Hill. However, many of these arrowheads are either stray finds or components of hoards. Except for the stray finds from the Somló Hill—where research is still ongoing—cannot yet be spatially interpreted (Fig. 17). Based on our current knowledge, the arrowheads found between 2023 and 2025 are concentrated on the southeastern plateau, where Urnfield and Hallstatt settlements traces have been identified through excavation and field surveys. The relationship between these arrowheads and the settlement traces remains, however, is not yet clear. The discovery of an as-cast 1A arrow-

285 DOMBROWSKY 2014, 139–141; BRINKER *et al.* 2018; INSELMANN *et al.* 2024, 3, 5, Figs 2–3, Fig. 5.

286 FALKENSTEIN 2007, 45, Figs 7–8.

287 ABELS 2002, 34–35; INSELMANN *et al.* 2024, 11–12.

288 See HLÁSEK – CHVOJKA 2022.

289 CZUKOR *et al.* 2013, 14; BĂLĂRIE *et al.* 2016, 53, Fig. 6; GOGÂLTAN *et al.* 2019, 213, Fig. 26; SAVA – GOGÂLTAN 2023, 99, 103, Tab. 1.

290 BARON *et al.* 2020, 16.

head at this site not only supports the local production of this variant but also suggests that the recovered arrowheads may not necessarily relate to warfare. They could instead represent components of stockpiles or hoards. Clear evidence of Bronze Age warfare and violence in Transdanubia that involved arrowheads is uncertain and limited to a single site. The arrowheads from Bakony-szentlászló-Kesellőhegy were found in the vicinity of a rampart, possibly indicating siege activity – a hypothesis that should be tested through future research.

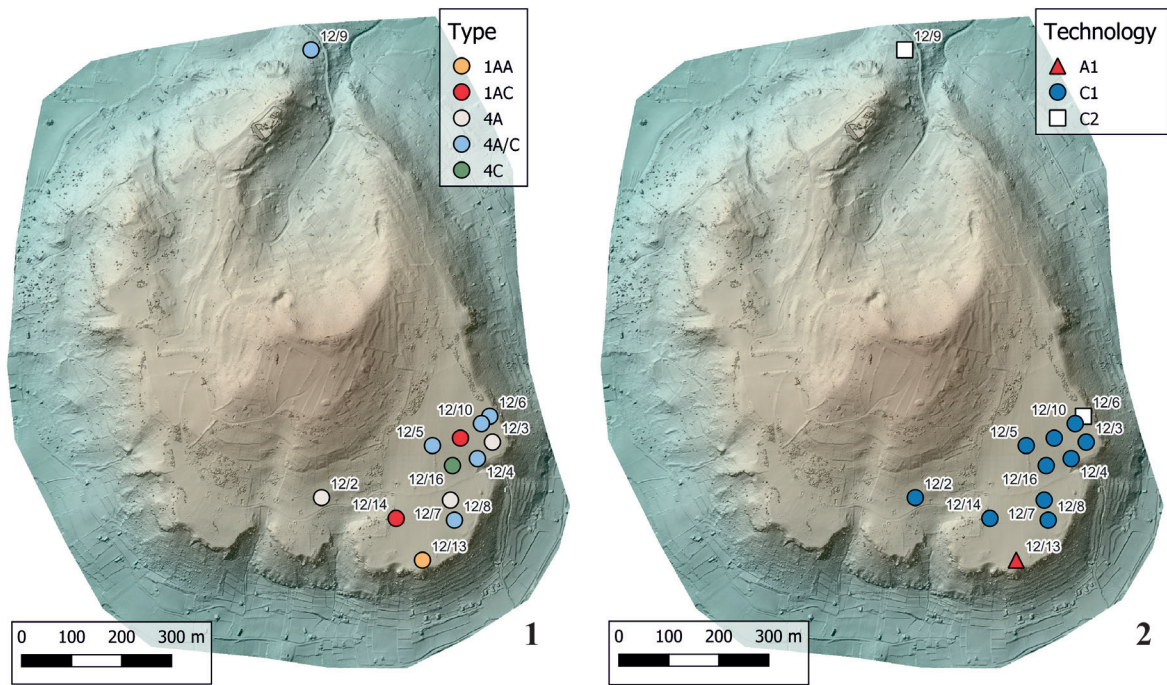


Fig. 17. Distribution of arrowheads on the Somló Hill. 1 – distribution of types, 2 – distribution of technological types (A1 – as-cast, C1 – finished product, C2 – finished used product) (data: [TARBAY 2025b](#); map by Bence Soós).

Without sufficient archaeometric data (such as elemental composition²⁹¹ and lead isotopes analysis), it is not possible to determine which raw materials, and alloying ratio might be considered characteristic of the region and which might not. The manufacturing technology of the individual variants is neither so distinctive nor complex that it could not have been adopted in multiple regions or independently developed by local metalworkers. The similarities observed in mould negatives, gating system design, and the post-casting treatment of arrowheads may be an argument for the latter. In Transdanubia, five casting moulds can be linked to arrowhead production. Three depict variant 4E, one is associated with 4A, and the fifth remains unidentified. The 4E variant moulds originate from sites that are also regarded as metallurgical centres (Gór, Ság, and Velem), making the local production of 4E arrowheads in Transdanubia plausible. The distribution of 4E also indicates that its production was not confined to a single region but extended across other parts of Central Europe. The observed asymmetry and the presence of only a few casting moulds versus a relatively large number of finished products is a pattern noted in other regions as well. Several factors may account for this, including the use of fragile casting moulds (e.g., clay) or casting technologies that leave no

291 Legacy data on Transdanubian arrowheads exist for only a handful of specimens from Velem-Szent Vid. [KÖLTŐ 1996](#), Tabs 1–2 (velem8, 11–12); [SZABÓ 1999](#), 333 (BRVEL81); [KÖLTŐ et al. 2002](#), Tab. 2 (Velem 46); [TARBAY 2023b](#). One arrowhead from the Pázmándfalu III hoard was analysed by PGAA and LA-ICP-MS; which revealed a tin content of around 10 m% and low levels of accompanying elements ([TARBAY et al. 2025](#), Tab. 1.15, Fig. 1.15, Tab. 2.17, Tab. 3.16).

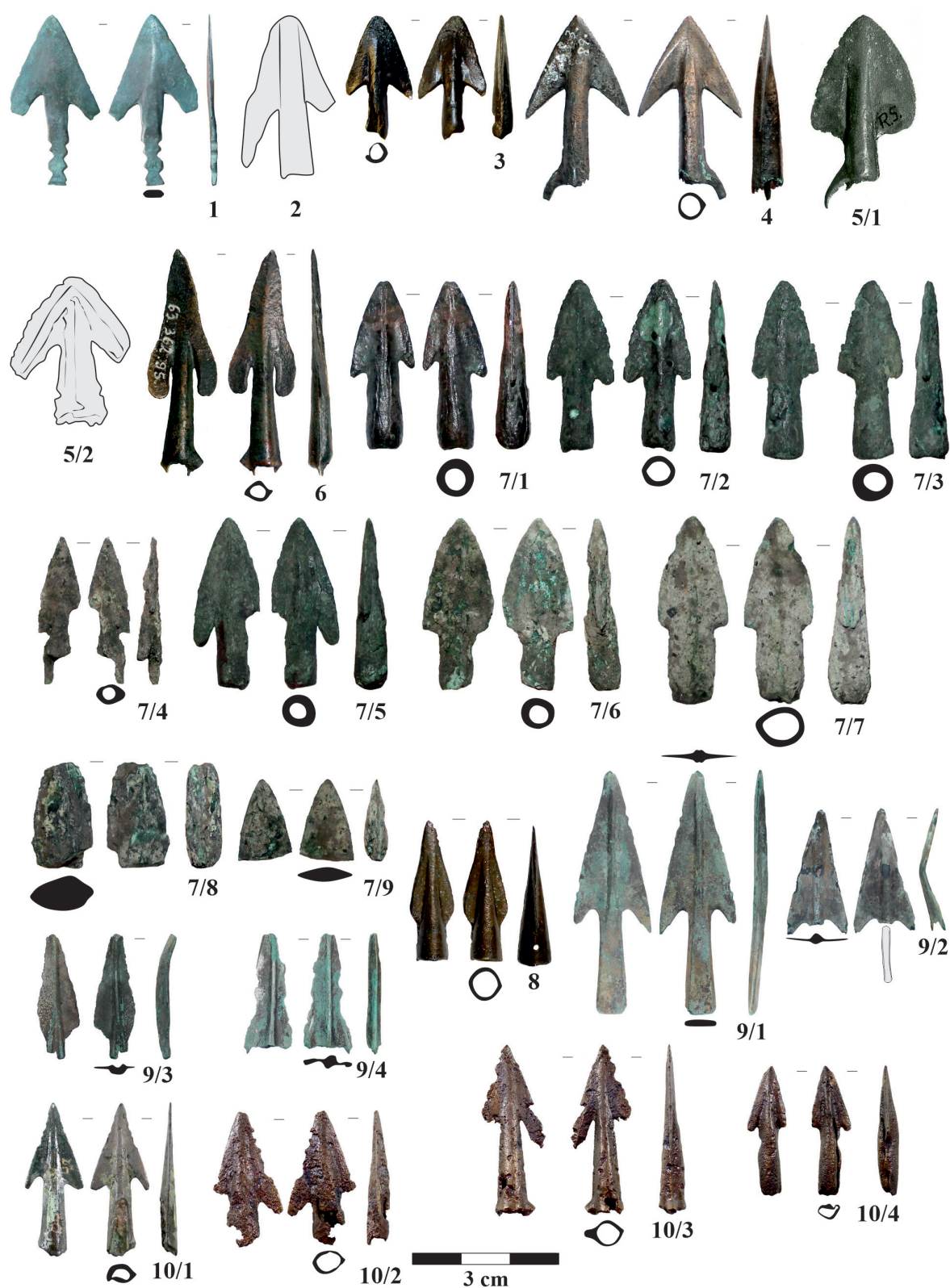


Fig. 18. Arrowheads from Transdanubia. 1 – Bolhás II, 2 – Celldömölk-Ság-hegy, 3 – Pázmándfalu III, 4 – Pécs-Jakab-hegy III, 5/1–2 – Regöly-Veravár, 6 – Románd, 7/1–9 – Balatonfüzfő Grave 6, 8 – Tihany-Óvár, 9/1–4 – Bakonyszentlászló-Kesellőhegy, 10/1–4 – Celldömölk-Ság-hegy (drawings and image after NOVÁKI 1979, Fig. 44.4; MOZSOLICS 2000, Pl. 22.11; SZABÓ 2013, Pl. 1.5–6; see Catalogue A).

archaeologically detectable traces (e.g., sand casting). Therefore, the absence of moulds associated with other arrowhead types does not necessarily preclude their local production.

This study has contributed to updating and refining the distribution of the examined arrowhead types. As previously proposed,²⁹² bronze arrowheads became increasingly more supra-regional artefacts. In certain cases, such as 1A, analogues occur across an enormously wide geographical range, spanning from the Caucasus to the Iberian Peninsula. These bronze arrowheads were not only widely distributed—often produced by culturally distinct groups—but also remained in use over an extended period. When this massive distribution is analysed chronologically, more nuanced regional and temporal patterns emerge, albeit not without certain limitations (Fig. 6, Fig. 11, Fig. 16). Sharing Hansen’s cautionary thoughts,²⁹³ it remains difficult to clearly identify local or regional products across such a vast area. A significant shift in the understanding could be achieved through a systematic metallurgical approach, which would also allow for the identification of arrowheads potentially cast from the same raw materials and thus help to characterise regionally specific raw material, alloying groups. Comparative analysis of casting moulds and finished products may further clarify the connections between the dispersion of arrowheads and their presumed places of manufacture – or indicate the existence of shared production standards, copying of finished products, as hypothesised in the case of one arrowhead from Somló Hill and the River Danube casting mould (Fig. 20.12/11, Fig. 24.27; Fig. 27A). Similarly, comparing finished arrowheads with one another can reveal relationships between objects from different sites that may have been cast in the same mould or derived from an identical model, potentially originating from the same workshop. These are the though what can be formulated for the matching arrowheads from the Velem-Szent Vid and Somló Hill (Fig. 27B), as well as the small set from Balatonfűzfő. Having matching set of arrowheads within the same quiver of one individual like it happened in Balatonfűzfő is less surprising, as it is more likely that a given warrior used arrows originate from the same source. However, the connection observed between the arrowheads from two different northern Transdanubian Urnfield settlements is far more thought-provoking—it may indicate warrior mobility between different elite centres. This could also represent a potential trace of internal conflict between Urnfield communities, a question that calls further investigation at both the object and settlement level in this region.

Source-critical factors must also be considered. The quality of arrowhead publications varies considerably, and key data, such as cross-section, dimensions, weight, elemental composition, and use-wear, are often missing. Moreover, many published illustrations are difficult to interpret, which can lead to uncertainty or typological misidentifications. A crucial next step would be the complete re-documentation of the material using a standardised methodology, thereby enabling more reliable comparative analysis. There is also a research-historical dimension that is rarely addressed. Distribution maps of Bronze Age arrowheads in Central Europe consistently show a concentration of finds in Poland, the Czech Republic, and Germany. This pattern may not (only) reflect historical processes but also the influence of the *Prähistorische Bronzefunde* volumes published by Gedl, Říhovský, generations of meticulous German scholarship. Exceptional assemblages like the Wrocław-Widawa hoard, which contains more artefacts than some countries have uncovered over two centuries of archaeological research—can also distort distribution patterns. Compared with the Carpathian basin, these regions are clearly overrepresented. Hungary is a relevant example, *Prähistorische Bronzefunde* volumes are generally lacking and comprehensive publications of Late Bronze Age cemeteries and settlements that include arrowheads remain relatively scarce. Recent metal-detecting campaigns, however, have significantly increased the number of arrowheads. The sites of Ménfőcsanak and Somló Hill serve as strong examples of this phenomenon. A similar pattern is

292 ECKHARDT 1996; INSELMANN *et al.* 2024.

293 HANSEN 1994a, 52–59.

observable in Britain; while O'Connor originally listed only a few arrowheads from the region,²⁹⁴ the number of known specimens has since grown substantially through new entries in the Portable Antiquities Scheme database.

The occurrence of the various arrowhead types (1A, 1C, 3A, 4A, 4C, 4E, 5A) identified in Transdanubia can best be understood based on their chronological distribution. Bronze arrowheads appear relatively late in this region. Presumed early bronze specimens have uncertain archaeological context, such as the sheet-metal arrowhead (1A, Subvariant D) from Somló Hill (Fig. 19.12/1). Another notable example is a tanged arrowhead, probably corresponding to Eckhardt's 2C variant, whose publication does not clarify its archaeological context. This specimen originates from Palotabozsok-Szérűskertek, an Encrusted Pottery culture site dated to the Middle Bronze Age (Phase III).²⁹⁵ Bronze arrowheads with secure archaeological contexts in the region are primarily known from the Late Bronze Age, specifically the Urnfield period. Among all the identified types, 4E dated to Ha B, can be interpreted as certainly produced locally, based on the presence of preserved casting moulds. However, considering its wider distribution and the existence of analogous moulds in other regions, it should be regarded as part of a broader production network that also included Transdanubia. Based on their frequency and the presence of a casting moulds, 4A and possibly 4C were also likely produced locally. Both occur in Transdanubian assemblages from the Ha A1 phase onwards according to the chronological position of datable finds. This is also the period during which they became widely distributed across Central Europe and beyond. Variants 1A, 1C, 3A, and 5A, by contrast, are unlikely to represent Transdanubian types, given their low numbers and their stronger concentration in other regions. The distribution of 1A, apart from its distant western analogues, is more pronounced in Germany, Austria, the southern Balkans, and the Black Sea area. Nevertheless, the as-cast 1A arrowhead from Somló Hill suggests that local production cannot be excluded, at least on this site. 1C is similarly rare in Transdanubia, with only a few analogues outside the region. The '3A' sheet-metal arrowhead is unique, with only a handful of analogues known from Pitten Grave 155 and Donja Brnjica Grave III.4. It is also possible that the object represents a modified arrowhead originally belonging to variant 1A or 1C. 5A arrowheads reached the Carpathian Basin during Br B2–Br C, yet remain few, particularly in Transdanubia, and are difficult to date precisely. In summary, the dominant presence of bronze arrowheads in Transdanubia becomes apparent only from the second half of the Late Bronze Age onwards. Most of the identified variants—excluding a few specific forms—are of Central European character, displaying supra-regional patterns of through time. For 4A, 1A, and 4E, local production is supported by casting moulds and as-cast objects.

Conclusions

In this study, bronze arrowheads from Transdanubia, dated to the Hungarian Late Bronze Age (Br B2–Ha B3), have been examined regarding their presumed origin, supra-regional connections over time, production technology, and use. Arrowheads from this region can largely be classified according to Eckhardt's (1996) typology, with minor modifications: 1A (Subvariants A–D), 1C, 3A, 4A, 4C, 4E (Subvariants A–B), and 5A. Apart from the sporadic appearance of bronze arrowheads dated to the Middle Bronze Age, the available data suggest that Transdanubia did not play a formative role in the early innovation of this projectile type within the wider European context. Based on current evidence, it is more likely that most of these forms originated in the western regions of Central Europe before spreading eastwards into Transdanubia, where they became an integral component of the local weaponry. This trend corresponds with the broader cultural transformations and shifts in metallurgical traditions observed in Transdanubia, first at the end of the Middle Bronze Age and

²⁹⁴ O'CONNOR 1980, 102–104, Lists 58–59.

²⁹⁵ ECKHARDT 1996, 27; GUTAY – KÁRPÁTI 2010, 19–20; KISS 2012, 130, 292, No. 240, Fig. 34.8.

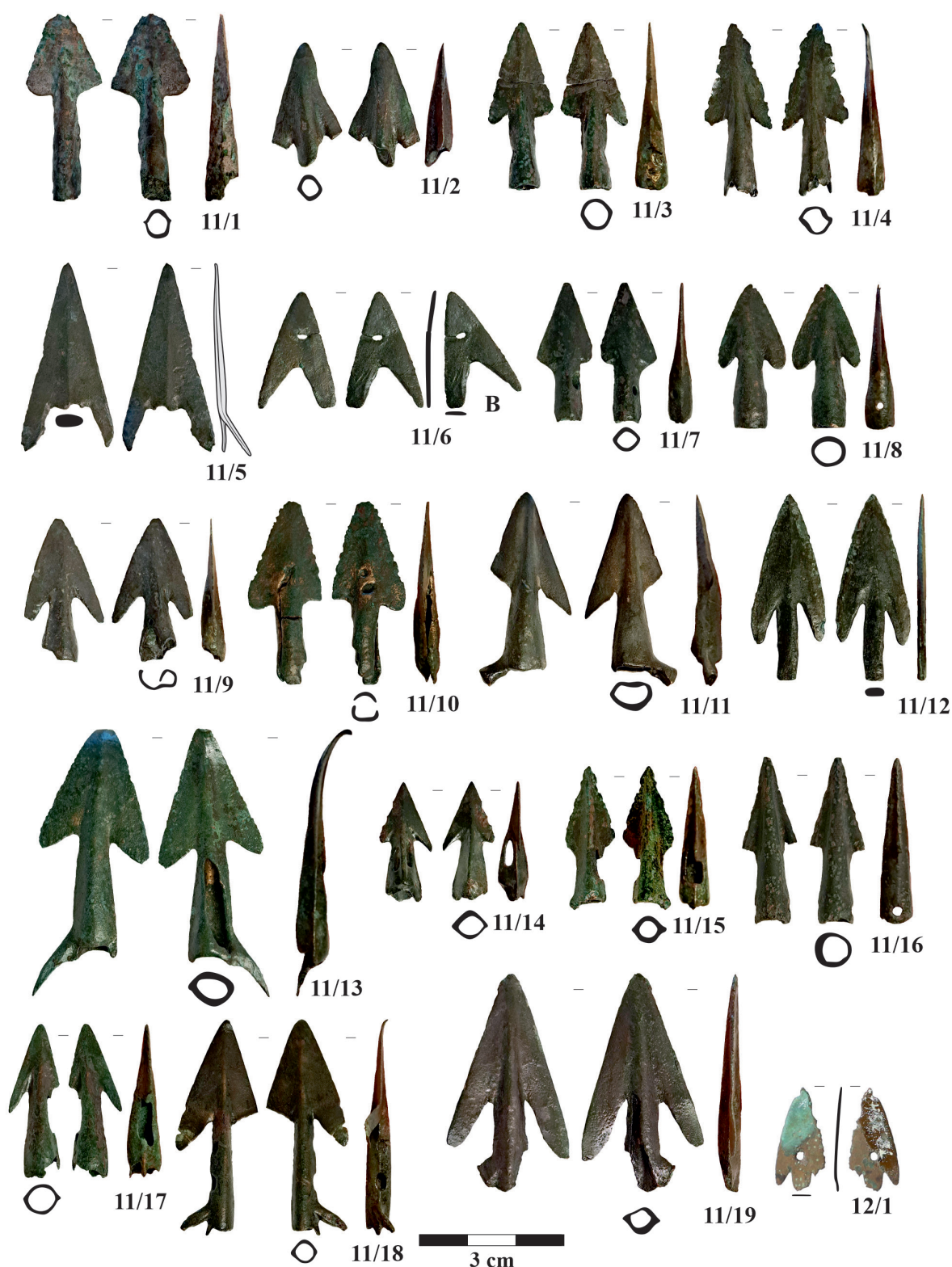


Fig. 19. Arrowheads from Transdanubia. 11/1–19 – Győr-Ménfőcsanak; 12/1 – Somló Hill (see [Catalogue A](#)).

later during the transition to the Urnfield period, when local communities were heavily influenced by western traditions. The use of metal arrowheads in archery in this region appears to have taken place primarily during the Urnfield period, between the Ha A1 and Ha B phases. Evidence for local casting derives from moulds (4A, 4E) and as-cast specimens (4A, 1A) discovered within Transdanubia. Use-wear analysis of the Transdanubian arrowheads indicates that these generally finished

products, with some displaying varying degrees of wear. Regarding the intended function of these weapons, direct evidence remains scarce and largely circumstantial. Available archaeozoological data on wild fauna from Tumulus and Urnfield period sites, together with faint traces of siege activity—such as the findspots of used arrowheads at Bakonyszentlászló-Kesellőhegy, support both hunting and warfare.

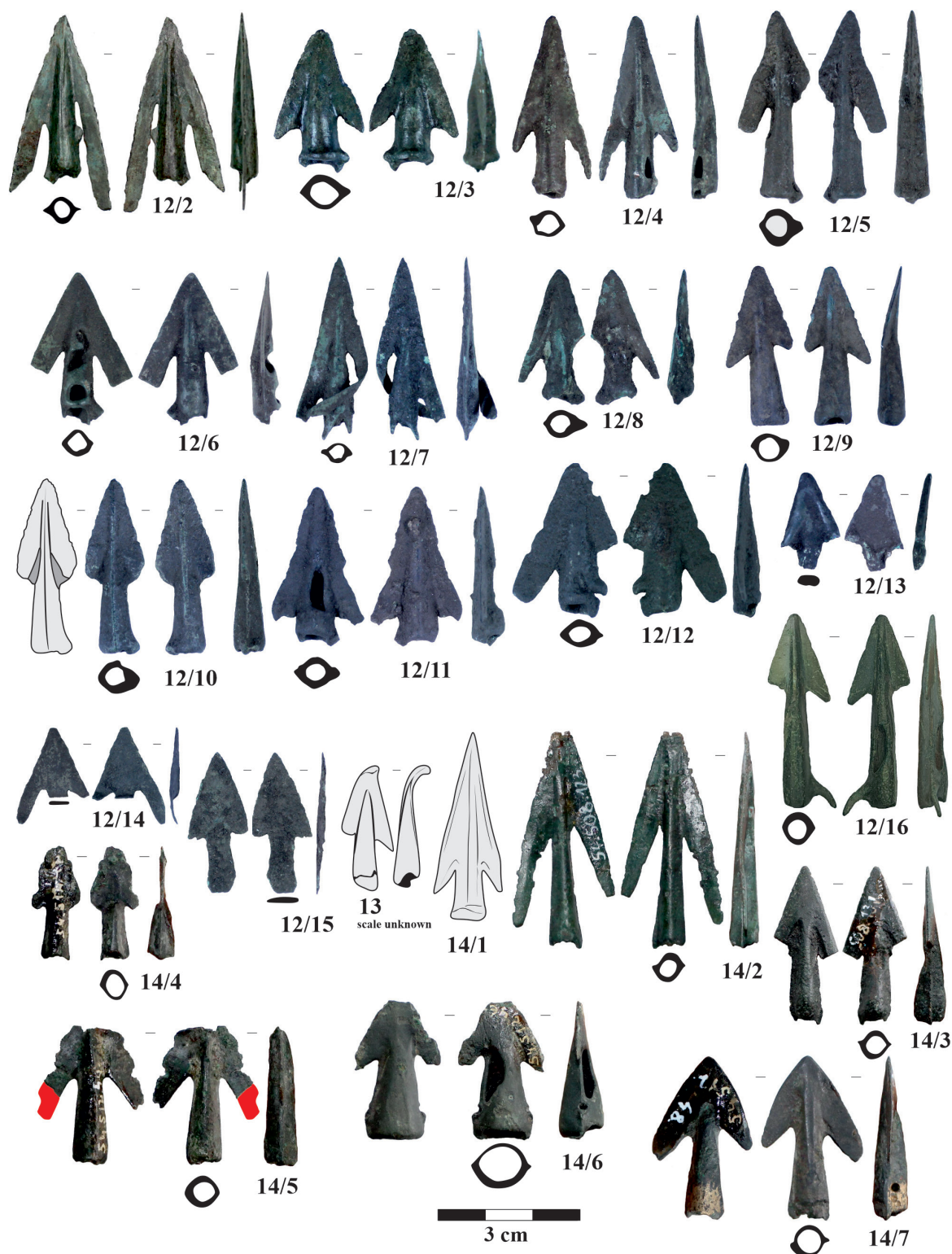


Fig. 20. Arrowheads from Transdanubia. 12/2–16 – Somló Hill, 13 – Tikos-Homokgödrök, 14/1–7 – Velem-Szent Vid (Drawings after: FOLTINY 1958, Pl. 3.4; POLGÁR 2015, Fig. 7; see Catalogue A).

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Catalogue A²⁹⁶

Hoard

1. **Bolhás-Pusztafalusi dűlő II**, Somogy County. In the second, unpublished dual hoard from Bolhás-Pusztafalusi dűlő, salvaged by Szilvia Honti, one arrowhead was recovered. Date: Ha B1. RRM non-inventoried (A1, Subvariant A, individual): Barbed, tanged arrowhead with a notched tang. L. 37.48 mm, w. 18.86 mm, diam. (socket) 4.29 mm, wt. 1.9 g (Fig. 18.1).
2. **Celldömölk-Ság-hegy IV**, Vas County. Jenő Lázár referred to “Hoard IV” as a *Schreibtischfund*, which he reportedly having discovered inside his desk. In our opinion, the interpretation of these objects as a single hoard remains uncertain. The arrowhead was lost prior to the 2021 museum inventory revision. Date: “Ha B2”. HNM 1949.26.7, lost (4A): A small socketed, barbed arrowhead (Fig. 18.2).²⁹⁷
3. **Pázmándfalu III**, Győr-Moson-Sopron County. The hoard was discovered on 22 December 2011, by the hoard research team from ELTE IAS. It was located approximately 8–10 metres from the first and second hoards and had been disturbed by ploughing activity. Date: Ha A1. ELTE IAS non-inventoried (4A): A socketed, barbed arrowhead. L. 26.98 mm, w. 14.73 mm, diam. (socket) 4.96 mm, wt. 2 g (Fig. 18.3).²⁹⁸
4. **Pécs-Jakab-hegy III**, Baranya County. The hoard was discovered at the LBA/EIA Jakab-hegy site in 1976, during an excavation led by Borbála Maráz, located outside the fortification ramparts. Date: Ha A1. JPM ő.1978.3.89 (4C): A socketed, barbed arrowhead with a broken spur. L. 40.46 mm, w. 23.01 mm, diam. (socket) 5.9 mm, wt. 4.5 g (Fig. 18.4).²⁹⁹
5. **Regöly-Veravár**, Tolna County. The hoard was discovered in 1960 during the construction of a house, in burnt, reddish-coloured loess soil. The artefacts were later acquired by Viktor Cziráki, a private collector who permitted Géza Szabó to publish and analyse the finds. Date: Ha A1. 5/1. Private Collection of Viktor Cziráki (4B/C): An arrowhead with a leaf-shaped blade, a spur, and a conical socket. According to Géza Szabó, the

296 Abbreviations: BM – Balaton Museum (Keszthely), ELTE IAS – ELTE Institute of Archaeological Sciences (Budapest), JPM – Janus Pannonius Museum (Pécs), HNM – Department of Archaeology, Hungarian National Museum (Budapest), HNM NIA – National Institute of Archaeology, Hungarian National Museum, NH – Naturhistorisches Museum (Vienna), LDM – Laczkó Dezső Museum (Veszprém), RRM – Rippl-Rónai Museum (Kaposvár), RFMTM – Rómer Flóris Museum of Art and History (Győr), SM – Savaria Museum (Szombathely), TGYM – Thúry György Museum (Nagykanizsa). L.: Length; Diam.: Diameter; W.: Width; Wt.: Weight.

297 *MOZSOLICS* 1979, 87, Pl. 12.10; *MOZSOLICS* 2000, 39, Pl. 22.11.

298 V. SZABÓ 2019a, 60–71, Fig. 48; V. SZABÓ 2019b, 174–178, Fig. 17; *TARBAY et al.* 2025, Tab. 1.15, Fig. 1.15, Tab. 2.17, Tab. 3.16.

299 *PATEK* 1968, 62; *MARÁZ* 1977, 10–11; *MOZSOLICS* 1985, 171; *KŐSZEGI* 1988, 171, No. 894.

blades are asymmetrical due to use, with a misrun defect visible near the tip. Casting seams are also present on the object. L. 42 mm, w. 24 mm (Fig. 18.5/1).³⁰⁰ 5/2. Private Collection of Viktor Cziráki (4A): A barbed arrowhead with broken blades and a possible misrun defect. Casting seams are visible on the object. L. 32 mm, w. 29 mm (Fig. 18.5/2).³⁰¹

6. Románd-Horog út dúlő, Győr-Moson-Sopron County. The eponymous hoard was discovered at Horog út dúlő in Románd, on the roadside in front of the so-called Szauber House, in the spring of 1938. The hoard was recollected from various sources by the colleagues of the local museum, together with potsherds. Date: Ha B2. LDM 63.362.95 (4A/C): A small, barbed arrowhead with a spur and a slightly triangular-sectioned blade. L. 49.38 mm, w. 15.03 mm, diam. (socket) 4.86 mm, wt. 4.1 g (Fig. 18.6).³⁰²

Burials

7. Balatonfűzfő, Grave 6, Veszprém County. Between 1991 and 1994, Szilvia K. Palágyi K. conducted excavations that resulted in the discovery of a Late Tumulus–Early Urnfield period (Br D2–Ha A1) cemetery. Grave No. 6 belonged to an adult male aged between 25 and 35 years. The cremated human remains were contained in a vessel, accompanied by a ceramic vessel set, animal bones, and bronze objects. According to Gábor Ilon, the point of the sword and the edge of the winged axe were oriented to northwards, while the point of the knife faced south. These three artefacts were laid parallel to each other, with the knife and sword possibly encased in their wooden or leather sheaths. The grave goods included one sword, one winged axe, one knife, nine arrowheads, one pin, bronze rivets, and a set of ceramic vessels. Date: Br D–Ha A1.³⁰³ 7/1. LDM 2016.4.64 (4A): A socketed barbed arrowhead with its socket filled with unidentifiable material. L. 37.28 mm, w. 13.98 mm, diam. (socket) 8.11 mm, wt. 6.4 g (Fig. 18.7/1). 7/2. LDM 2016.4.64 (4A): A socketed barbed arrowhead with a filled socket. L. 38.48 mm, w. 5.77 mm, diam. (socket) 7.65 mm, wt. 5 g (Fig. 18.7/2). 7/3. LDM 2016.4.64 (4A): A socketed, barbed arrowhead. L. 39.18 mm, w. 14.59 mm, diam. (socket) 9.14 mm, wt. 6.9 g (Fig. 18.7/3). 7/4. LDM 2016.4.64 (4C): A socketed, barbed arrowhead with a spur. L. 35.70 mm, w. 10.48 mm, diam. (socket) 6.85 mm, wt. 1.5 g (Fig. 18.7/4). 7/5. LDM 2016.4.64 (4A): A socketed, barbed arrowhead. L. 39.59 mm, w. 15.43 mm, diam. (socket) 7.94 mm, wt. 5.4 g (Fig. 18.7/5). 7/6. LDM 2016.4.64 (4A): A socketed, barbed arrowhead. L. 39.48 mm, w. 16.50 mm, diam. (socket) 8.06 mm, wt. 5.5 g (Fig. 18.7/6). 7/7. LDM 2016.4.64 (4A): A socketed, barbed arrowhead. L. 40.75 mm, w. 14.95 mm, diam. (socket) 9.53 mm, wt. 7.6 g (Fig. 18.7/7). 7/8. LDM 2016.4.64 (U): A blade fragment from an arrowhead. L. 23.08 mm, w. 12.86 mm, wt. 4.3 g (Fig. 18.7/8). 7/9. LDM 2016.4.64 (U): A tip fragment from an arrowhead. L. 17.93 mm, w. 11.99 mm, wt. 1.4 g (Fig. 18.7/9).

8. Tihany-Óvár alja, Mound 2, Grave 2, Veszprém County. The arrowhead was discovered during a rescue excavation conducted by András Uzsoki in February 1972, inside Mound 2. Grave 2 was a beehive-shaped pit with a skeleton placed in a south-west to north-east orientation. The arrowhead was found beneath the deceased. The ceramic material from this excavation can be associated with the Tumulus culture. Among the recovered ceramics, three cups have recognisable shapes. One has a biconical body and a curved, funnel-shaped neck, as well as a large strap handle connecting the rim and the shoulder. The second cup repeats these formal characteristics but has a spheroid body. The third cup is preserved up to the neck; it has a biconical, flattened body, and a decoration consisting of an incised line and a row of dots. These vessels are characteristic of the Br B1 and Br B2 phases, signing the earlier phase of the Tumulus culture of Tihany-Óvár.³⁰⁴ LDM 72.5.1 (5A): A socketed arrowhead with a leaf-shaped blade, two peg holes, and a short conical socket. L. 30.85 mm, w. 9.83 mm, diam. (socket) 7.54 mm, wt. 2.7 g (Fig. 18.8).

Settlements

9. Bakonyszentlászló-Kesellőhegy, Veszprém County. Three arrowheads (66.173.3–5) were excavated by Gyula Nováki on 15 July 1962, in the fortified settlement, specifically in trench V ('1. munkahely'), in front of the stone wall on the western slope of the site. Another arrowhead (66.176.4) was found in front of the first

300 KŐSZEGI 1993; SZABÓ 1993, 170, Pl. 1.1–10, Pl. 8.1–3, Pl. 4.4; SZABÓ 2013, 27–29, Pl. 1.6, Pl. 8.1.

301 SZABÓ 1993, 170, Pl. 1.5; SZABÓ 2013, Pl. 1.5.

302 NÉMETH – TORMA 1965, 59–62, Pl. 1–1a, Pl. 2.1b, Pl. 3, Pl. 4.4b–5b; KEMENCZEI 1991, 63, Pl. 60.258; MOZSOLICS 2000, 70–73, Pl. 84.1–5, 8–9, 13; STOCKHAMMER 2004, 308.

303 ILON 2012; ILON 2015a, 33–38, 42, Fig. 8.3–12.

304 UZSOKI 1972; BÓNA 1975, 198, Pl. 51.8, Pl. 69.7, Pl. 175.13, Pl. 208.6; UZSOKI 1986, 246; REGENYE 2004, 190; KISS 2012, 304, No. 350; SOÓS 2017, 159, fn. 345. I am grateful to Nóra Szabó and Kristóf Fülöp for discussing the dating of the ceramics from Tihany-Óvár, and to Bence Soós for providing me with archival data on this site.

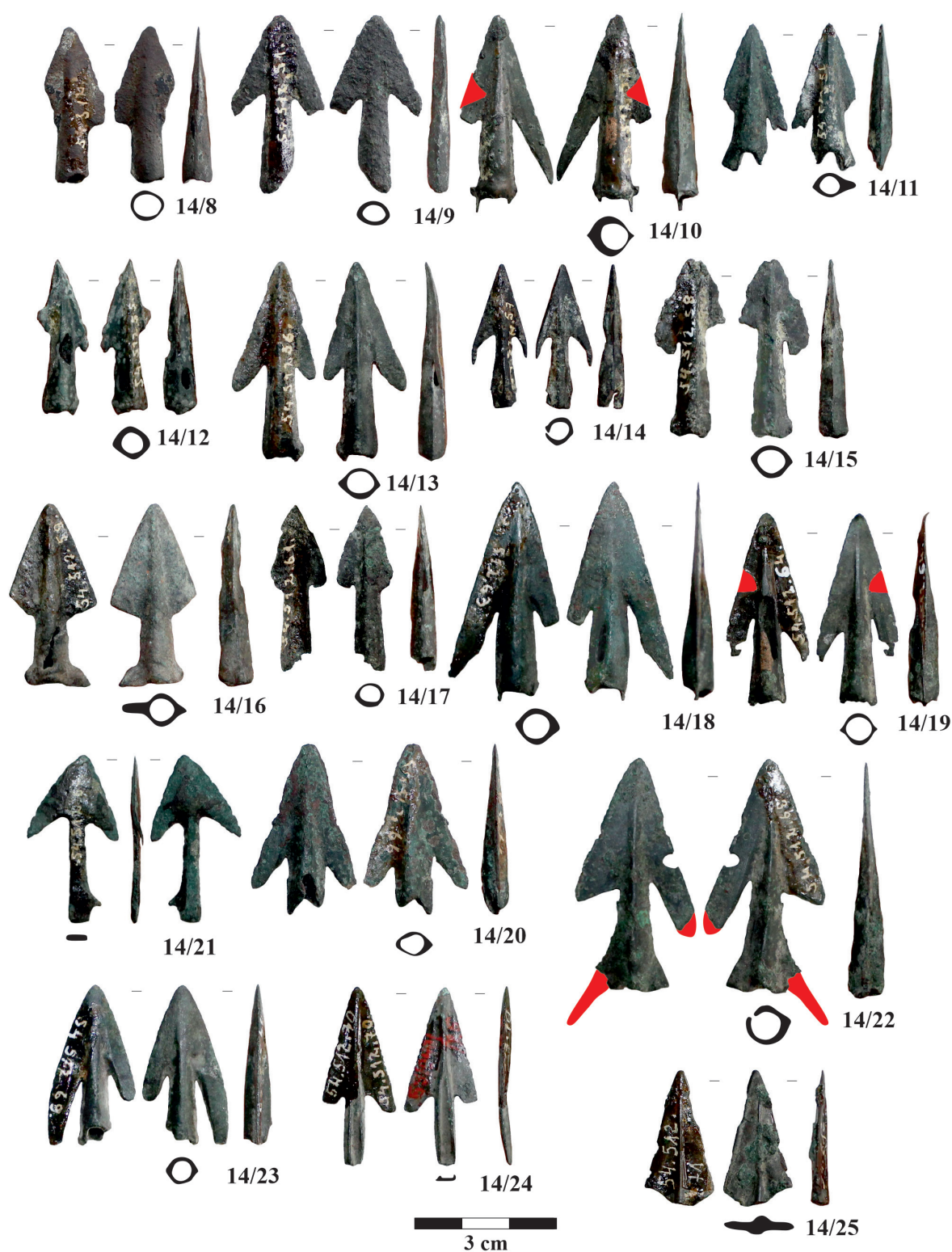


Fig. 21. Arrowheads from Transdanubia. 14/8–25 – Velem-Szent Vid (see [Catalogue A](#)).

gate, approximately 2.5 metres from the wall, at a depth of about 25 cm, in front of the western wing. Nováki dated Kesellőhegy to the Ha A2–Ha B1 period. Traces of burning were also observed in the rampart.³⁰⁵ 9/1. LDM 66.173.3 (1A, Subvariant A): A barbed arrowhead with a midrib and a hammered tang. L. 50.07 mm,

305 [Dax et al. 1972](#), 51–52, No. 12/12; [Nováki 1969](#), 135; [Nováki 1979](#), 85–89, 102–105, 135, Fig. 44.1–4; [Kőszegi 1988](#), 121, No. 82; [Nováki et al. 2006](#), 130–132; [Ilon 2024b](#), 227, Fig. 6.2.2.1.

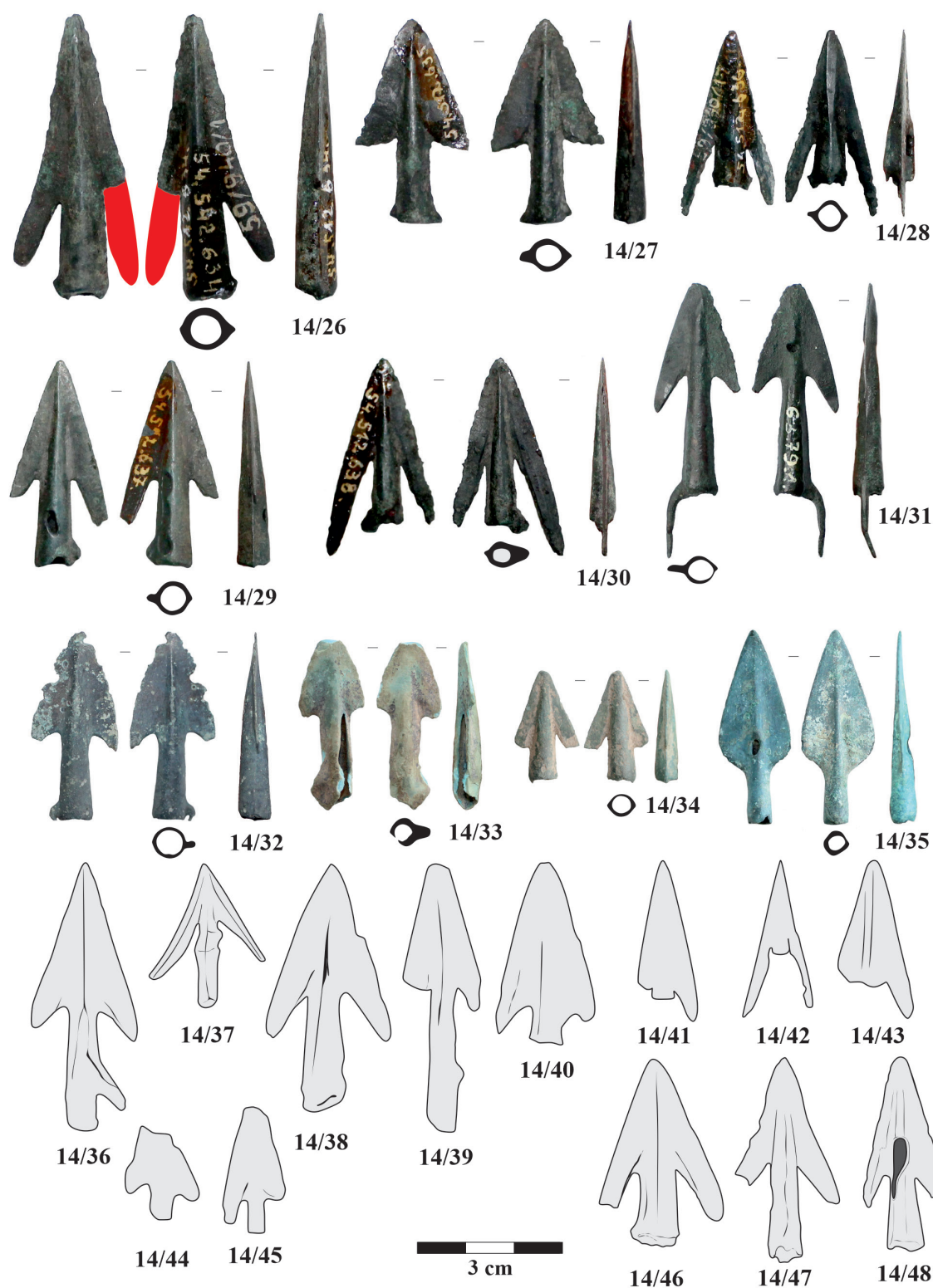


Fig. 22. Arrowheads from Transdanubia. 14/26–48 – Velem-Szent Vid (Drawings after: MISKE 1907, Pl. 31.3–10, 18, Pl. 37.6–7, 10, 37; see Catalogue A).

w. 15.89 mm, diam. (tang) 1.05 mm, wt. 2.9 g (Fig. 18.9/1). 9/2. LDM 66.173.4 (1A, Subvariant A): Tanged, barbed arrowhead with a midrib. Its tang is broken and missing. L. 25.91 mm, w. 12.81 mm, wt. 0.9 g (Fig. 18.9/2).³⁰⁶ 9/3. LDM 66.173.5 (1A, Subvariant B): A broken barbed arrowhead with a midrib. L. 28.26 mm, w. 9.44 mm, wt.

306 NOVÁKI 1979, Fig. 44.4.

1.1 g (Fig. 18.9/3). 9/4. LDM 66.176.4 ("1A"): A tanged, barbed arrowhead with a broken tang. L. 24.57 mm, w. 9.70 mm, wt. 1 g (Fig. 18.9/4).

10. Celldömölk-Ság-hegy, Vas County. A handful of stray arrowheads are known from the settlement at Celldömölk-Ság-hegy.³⁰⁷ 10/1. HNM 1949.27.60 (4A): A socketed, barbed arrowhead, broken. L. 31.74 mm, w. 12.15 mm, diam. (socket) 6.07 mm, wt. 0.9 g (Fig. 18.10/1). 10/2. HNM 1949.27.60 (4A): A socketed, barbed arrowhead, fragmented and containing soil within the socket. L. 27.91 mm, w. 14.53 mm, diam. (socket) 6.94 mm, wt. 1.9 g (Fig. 18.10/2). 10/3. HNM 1949.27.60 (4A/C): A socketed, barbed arrowhead with a broken spur. L. 37.90 mm, w. 14.14 mm, diam. (socket) 8.81 mm, wt. 2.5 g (Fig. 18.10/3). 10/4. HNM 1949.27.62 (4A): A socketed, barbed arrowhead with either a break or an incomplete casting defect. L. 29.20 mm, w. 8.81 mm, diam. (socket) 4.83 mm, wt. 2.1 g (Fig. 18.10/4).

11. Győr-Ménfőcsanak, Győr-Moson-Sopron County. In Feature 133 of the Ménfőcsanak settlement, an arrowhead was discovered alongside Late Tumulus-Early Urnfield ceramics. Several additional arrowheads were also found during metal-detecting surveys. 11/1. Feature 133, HNM NRI 1.34305.133.58 (4A): A small, socketed arrowhead with broken barbs. Remains of a wooden shaft are preserved inside the socket. L. 39.02 mm, w. 15.34 mm, diam. (socket) 5.58 mm, wt. 2.7 g (including wooden remains) (Fig. 19.11/1).³⁰⁸ 11/2. HNM NRI 1.34305.1.89 (4A): A barbed arrowhead with a broken socket, and broken barbs. L. 25.79 mm, w. 14.45 mm, diam. (socket) 5.07 mm, wt. 2.7 g (Fig. 19.11/2).³⁰⁹ 11/3. HNM NRI 1.34305.1.92 (4A): A socketed, barbed arrowhead with a broken barb, preserved in two modern fragments. L. 34.96 mm, w. 14.61 mm, diam. (socket) 6.67 mm, wt. 2.7 g (Fig. 19.11/3).³¹⁰ 11/4. HNM NRI non-inventoried (6218 identifier) (4A): A socketed, barbed arrowhead. L. 35.99 mm, w. 13.89 mm, diam. (socket) 6.66 mm, wt. 2.4 g (Fig. 19.11/4).³¹¹ 11/5. HNM NRI 1.34305.1.225 ("1A", Subvariant A): Tanged, barbed arrowhead. The tang is broken off. L. 39.51 mm, w. 18.61 mm, diam. (tang) 3.75 mm, wt. 2.3 g (Fig. 19.11/5).³¹² 11/6. HNM NRI 1.34305.1.224(3A, individual): A triangle-shaped, barbed sheet metal arrowhead with a hole. L. 24.17 mm, w. 15.96 mm, wt. 0.9 g (Fig. 19.11/6).³¹³ 11/7. HNM NRI non-inventoried (1334 identifier) (4A): A socketed arrowhead with broken and solidly cast barbs. L. 29.12 mm, w. 11.57 mm, diam. (socket) 5.84 mm, wt. 2 g (Fig. 19.11/7). 11/8. HNM NRI non-inventoried (1325 identifier) (4A): A socketed, barbed arrowhead with two peg holes. L. 30.05 mm, w. 14.20 mm, diam. (socket) 7.09 mm, wt. 3 g (Fig. 19.11/8). 11/9. HNM NRI 1.34305.1.148 (4A): A socketed, barbed arrowhead with a fragmented socket. L. 29.77 mm, w. 16.75 mm, diam. (socket) 7.76 mm, wt. 2.1 g (Fig. 19.11/9). 11/10. HNM NRI 1.34305.1.253 (4A): A socketed, barbed arrowhead broken into two fragments. L. 38.03 mm, w. 15.60 mm, diam. (socket) 5.59 mm, wt. 3.3 g (Fig. 19.11/10). 11/11. HNM NRI 1.34305.1.178 (4A): A socketed, barbed arrowhead with a casting jet and a broken blade. L. 40.03 mm, w. 17.34 mm, diam. (socket) 8.74 mm, wt. 4.5 g (Fig. 19.11/11). 11/12. HNM NRI 1.34305.1.279 (1A, Subvariant A): A tanged, barbed arrowhead. L. 38.67 mm, w. 15.57 mm, diam. (tang) 4.03 mm, wt. 2.5 g (Fig. 19.11/12). 11/13. HNM NRI non-inventoried (2533 identifier) (4C): A socketed, barbed arrowhead with a spur. L. 55.52 mm, w. 21.75 mm, diam. (socket) 8.68 mm, wt. 5 g (Fig. 19.11/13). 11/14. HNM NRI 1.34305.1.2 (4A): A socketed, barbed arrowhead with a lozenge-shaped socket. L. 24.82 mm, w. 10.66 mm, diam. (socket) 7.45 mm, wt. 1.6 g (Fig. 19.11/14). 11/15. HNM NRI 1.34305.2.1 (4A): A socketed arrowhead with broken barbs. L. 29.78 mm, w. 10.28 mm, diam. (socket) 6.58 mm, wt. 1.7 g (Fig. 19.11/15). 11/16. HNM NRI 1.34305.1.68 (4A): A socketed arrowhead with broken barbs. L. 34.66 mm, w. 11.08 mm, diam. (socket) 7.46 mm, wt. 3.1 g (Fig. 19.11/16). 11/17. HNM NRI 1.34305.1.10 (4A): A socketed arrowhead with barbs, one of which is broken. L. 31.96 mm, w. 10.38 mm, diam. (socket) 7.63 mm, wt. 2.6 g (Fig. 19.11/17). 11/18. HNM NRI 1.34305.1.80 (4C): A socketed barbed arrowhead with a spur. L. 44.85 mm, w. 18.14 mm, diam. (socket) 5.59 mm, wt. 4.4 g (including soil) (Fig. 19.11/18). 11/19. HNM NRI 1.34305.7951.151 (4A): A socketed barbed arrowhead with a broken jet. L. 45.33 mm, w. 25.31 mm, diam. (socket) 7.32 mm, wt. 5.3 g (Fig. 19.11/19).

12. Somló Hill, Veszprém County. The BM holds a stray find sheet-metal barbed arrowhead from the Somló Hill, originating from the collection of Kálmán Darnay. Additional finds were discovered during 2023–2025

307 PATEK 1968, 36–37, 145, Pl. 27.14A–C, Pl. 35.1–3; KŐSZEGI 1988, 130, No. 230; ILON 2013, 94, Pl. 44.165, Pl. 45.165.

308 ILON 2015b, 237, Pl. 4.C2; ILON 2024b, 226, Fig. 6.2.1.8.

309 ILON 2019, Fig. 3.3; ILON 2024b, 72, Fig. 3.E1.4.3.

310 ILON 2019, Fig. 3.4; ILON 2024b, 72, Fig. 3.E1.4.4.

311 ILON 2024b, 226, Fig. 6.2.1.9.

312 ILON 2017, Fig. 8.16; ILON 2019, Fig. 3.7; ILON 2024b, 72, Fig. 3.E1.4.7.

313 ILON 2017, Fig. 8.17; ILON 2019, Fig. 3.6; ILON 2024b, 72, Fig. 3.E1.4.6.

metaldetecting survey at Somló.³¹⁴ 12/1. BM 1978.36.42 (1A, Subvariant D): A sheet metal barbed arrowhead with one loop, fragmented. L. 22.11 mm, w. 9.59 mm, diam. (tang) 4.16 mm, wt. 0.5 g (Fig. 19.12/1). 12/2. HNM 2023.14.6 (4A): A socketed, barbed arrowhead with a hammered cutting edge. L. 41.26 mm, w. 21.84 mm, di. (socket) 7.52 mm, diam. (socket) 10.31 mm, wt. 3.2 g (Fig. 20.12/2). 12/3. HNM 2025.7.1 (4A, individual): A socketed, barbed arrowhead with a thick collar. L. 29.13 mm, w. 18.39 mm, diam. (socket) 7.28 mm, wt. 3.2 g (Fig. 20.12/3). 12/4. HNM 2025.7.2 (4A/C): A socketed, barbed arrowhead with a misrun defect. L. 38.71 mm, w. 17.12 mm, diam. (socket) 9.30 mm, wt. 3.4 g (with soil) (Fig. 20.12/4). 12/5. HNM 2025.7.3 (4A/C): A socketed, barbed arrowhead with a casting jet trace. L. 40.75 mm, w. 15.88 mm, diam. (socket) 9.27 mm, wt. 4.1 g (with soil) (Fig. 20.12/5). 12/6. HNM 2025.7.4 (4A/C): A socketed, barbed arrowhead with a misrun defect, and a broken casting jet. L. 32.11 mm, w. 21.16 mm, diam. (socket) 8.73 mm, wt. 2.6 g (with soil) (Fig. 20.12/6). 12/7. HNM 2025.7.5 (4A): A socketed, barbed arrowhead. L. 38.67 mm, w. 14.72 mm, diam. (socket) 5.85 mm, wt. 2.7 g (with soil) (Fig. 20.12/7). 12/8. HNM 2025.7.6 (4A/C): A socketed, barbed arrowhead with a jet trace. L. 28.67 mm, w. 14.47 mm, diam. (socket) 8.84 mm, wt. 2.2 g (with soil) (Fig. 20.12/8). 12/9. HNM 2025.7.7 (4A/C): A socketed, barbed arrowhead. L. 33.19 mm, w. 14.10 mm, diam. (socket) 8.11 mm, wt. 3.1 g (Fig. 20.12/9). 12/10. HNM 2025.7.8 (4A/C): A socketed, barbed arrowhead with broken jet and solid cast barbs. L. 36.90 mm, w. 12.51 mm, diam. (socket) 8.21 mm, wt. 3.4 g (with soil) (Fig. 20.12/10). 12/11. HNM 2025.7.9 (4A): A socketed, barbed arrowhead with misrun defect and a broken jet. L. 33.42 mm, w. 19.32 mm, diam. (socket) 8.51 mm, wt. 3.4 g (with soil) (Fig. 20.12/11). 12/12. HNM 2025.7.10 (4A/C): A socketed, barbed arrowhead with a broken jet. L. 32.58 mm, w. 22.61 mm, diam. (socket) 8.26 mm, wt. 4.3 g (with soil) (Fig. 20.12/12). 12/13. HNM 2025.7.11 (1A, Subvariant A): A tanged, barbed, sheet metal arrowhead, as-cast. L. 20.43 mm, w. 12.58 mm, diam. (tang) 4.31 mm, wt. 1.2 g (with soil) (Fig. 20.12/13). 12/14. HNM 2025.7.12 (1A, Subvariant C): A tanged, barbed, sheet metal arrowhead. L. 22.61 mm, w. 17.85 mm, diam. (tang) 4.69 mm, wt. 0.6 g (with soil) (Fig. 20.12/14). 12/15. HNM 2025.7.13 (1A, Subvariant C): A tanged, barbed, sheet metal arrowhead. L. 29.58 mm, w. 12.72 mm, diam. (tang) 5.73 mm, wt. 2.3 g (with soil) (Fig. 20.12/15). 12/16. HNM 2025.7.14 (4C): A socketed, barbed arrowhead. L. 42.81 mm, w. 15.21 mm, diam. (socket) 6.09 mm, wt. 4.4 g (Fig. 20.12/16).

13. **Tikos-Homokgödrök**, Somogy County. Polgár published a bronze arrowhead from the Urnfield settlement at Tikos-Homokgödrök. Whether the object was a stray find or recovered from a specific settlement feature is not mentioned in his paper. Based on the published figure, it appears to be a socketed, barbed arrowhead with a slightly bent tip (4A) (Fig. 20.13). The Tikos-Homokgödrök settlement is dated between the Br D2 and Ha A1 phases, based on the analysis of ceramic and metal finds.³¹⁵

14. **Velem-Szent Vid**, Vas County. Several stray arrowheads are known from the fortified, multi-period settlement at Velem-Szent Vid. These objects are kept in different collections: NM (Vienna), SM (Szombathely), and BM (Keszthely). The NM acquired the objects between 1897 and 1898. The rest either originate from the Kálmán Darnay collection, were found during the Bándi-Fekete excavations or were discovered during new metal-detecting surveys led by László Kolonits in 2019.³¹⁶ 4/1. NHMW 32.407 (4A): A socketed, barbed arrowhead. L. 40 mm, w. 15 mm (Fig. 20.14/1).³¹⁷ 14/2. SM 54.508.123 (4A): A large, socketed, barbed arrowhead. L. 46.34 mm, w. 21.86 mm, diam. (socket) 7.10 mm, wt. 4.1 g (Fig. 20.14/2).³¹⁸ 14/3. SM 54.508.131 (4A): A small, socketed, barbed arrowhead. L. 33.85 mm, w. 13.87 mm, diam. (socket) 7.21 mm, wt. 3.4 g (Fig. 20.14/3).³¹⁹ 14/4. SM 54.512.42 (4A): A barbed arrowhead with a slightly triangular blade and a short conical socket. L. 24.47 mm, w. 10.33 mm, diam. (socket) 6.16 mm, wt. 1.2 g (Fig. 20.14/4).³²⁰ 14/5. SM 54.512.44 (4A): A barbed arrowhead with a long, conical socket. L. 29.39 mm, w. 21 mm, diam. (socket) 7.51 mm, wt. 3.2 g (Fig. 20.14/5).³²¹ 14/6. SM 54.512.46 (4A): A socketed, barbed arrowhead with a spur. L. 29.61 mm, w. 18.43 mm, diam. (socket) 12.97 mm, wt. 4.5 g (Fig. 20.14/6).³²² 14/7. SM 54.512.48 (4A): A socketed, barbed arrowhead. L. 34.65 mm, w. 21.17 mm, diam. (socket) 8.87 mm, wt. 4.7 g (Fig. 20.14/7).³²³ 14/8. SM 54.512.49 (4A): A socketed arrowhead with a

314 DARNAY 1899, 50, 56–57, Pl. 20.1; TARBAY *et al.* 2023, Fig. 2.6; TARBAY *et al.* 2024, Tab. 1.4, Fig. 13.

315 SERLEGI 2004; POLGÁR 2015, 144, 149, Fig. 7.

316 MISKE 1907; FOLTINY 1958; PATEK 1968 (see individual citations below).

317 FOLTINY 1958, 9, Pl. 3.4.

318 ILON 2024b, 227, Fig. 6.2.2.2.

319 SZABÓ 1999, 333, Fig. 6.3, BRVEL 81.

320 MISKE 1907, Pl. 37.11; PATEK 1968, 164, No. 529.

321 MISKE 1907, Pl. 37.8; PATEK 1968, 164, No. 527.

322 MISKE 1907, Pl. 31.24; PATEK 1968, 164, No. 516.

323 MISKE 1907, Pl. 31.27; PATEK 1968, 164, No. 519; KÖLTŐ *et al.* 2002, Tab. 2.Velem46.

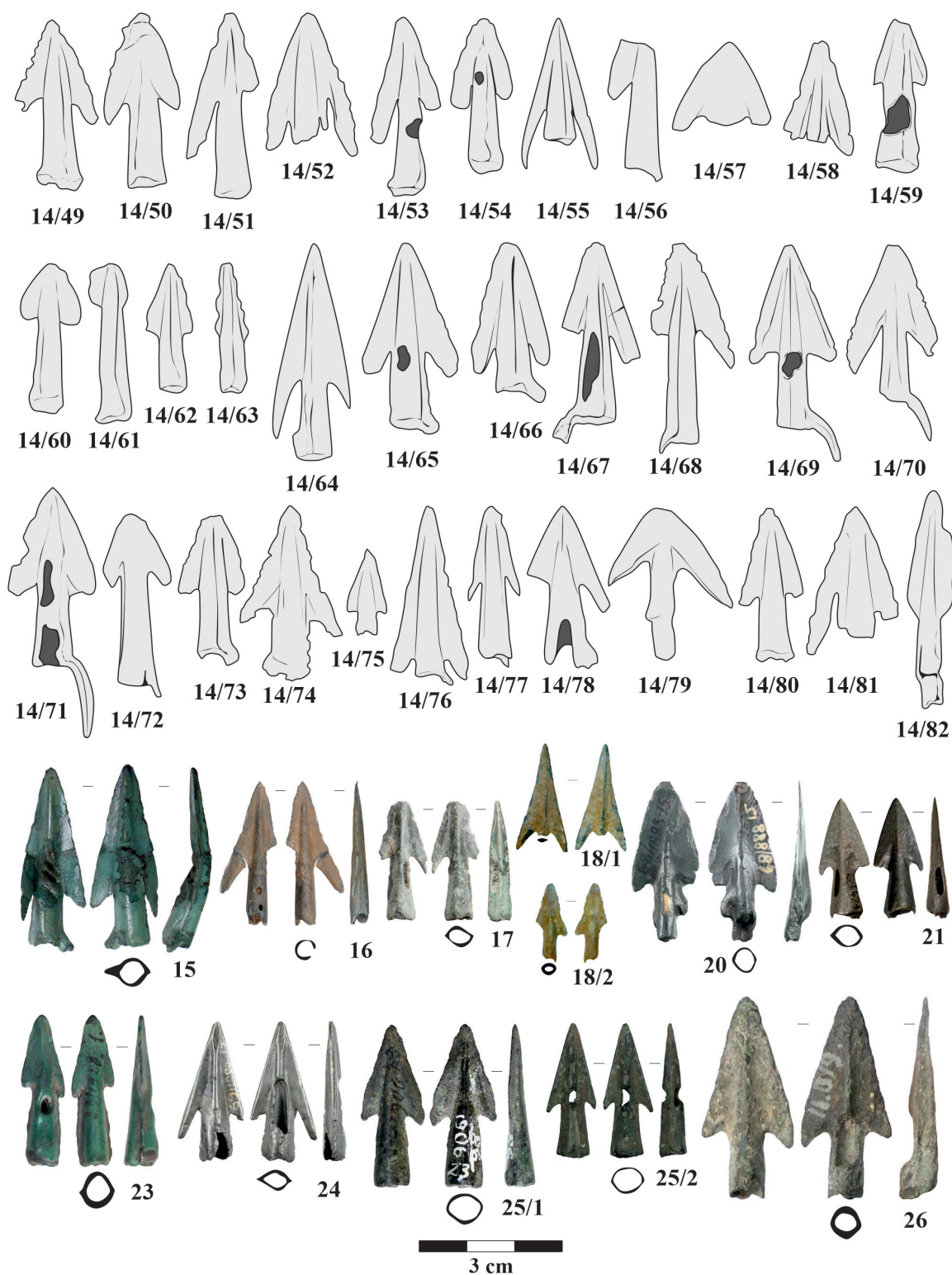


Fig. 23. Arrowheads from Transdanubia. 14/49–81 – Velem-Szent Vid, 15 – Balatonmagyaród-Kiskányavár B, 16 – Barnag-Vadalmi dűlő, 17 – Doba-Török-dombok, 18 – Kapospula-Határárok, 20 – Kölesd-Hangospuszt, 21 – Pusztaszemes, 23 – ‘Transdanubia’, 24 – Udvari-Alsópépuszta, 25 – HNM, 26 – BM (Drawings after MISKE 1907, Pl. 13.13, Pl. 31.16–17, 19, 21, 28–30, 34, 36, 39, 42–43, 45–46, 48, 50, 52–53, 55, Pl. 32.12, Pl. 37.2–3, 5, 13; ILON 2024b, Fig. 6.2.2.3.124–125, 128–129, 132, 134, 143, 146; see Catalogue A).

triangle blade. L. 33.53 mm, w. 12.57 mm, diam. (socket) 7.27 mm, wt. 2.9 g (Fig. 21.14/8).³²⁴ 14/9. SM 54.512.51 (4A): A socketed, barbed arrowhead. L. 37.85 mm, w. 19.83 mm, diam. (socket) 7.13 mm, wt. 4.2 g (soil) (Fig. 21.14/9).³²⁵ 14/10. SM 54.512.52 (4A): A socketed, barbed arrowhead. L. 41.86 mm, w. 20.49 mm, diam. (socket) 10.04 mm, wt. 4.5 g (Fig. 21.14/10).³²⁶ 14/11. SM 54.512.54 (4A/C): A socketed, barbed arrowhead with a broken spur. L. 31.36 mm, w. 12.68 mm, diam. (socket) 9.15 mm, wt. 2.7 g (Fig. 21.14/11).³²⁷ 14/12. SM 54.512.55 (4A): A socketed, barbed arrowhead. L. 33.21 mm, w. 11.09 mm, diam. (socket) 8.06 mm, wt. 2.8 g (Fig. 21.14/12).³²⁸ 14/13. SM 54.512.56 (4A): A socketed, barbed arrowhead. L. 42.36 mm, w. 17.88 mm, diam. (socket) 8.91 mm, wt. 3.8 g (Fig. 21.14/13).³²⁹ 14/14. SM 54.512.57 (4A): A socketed barbed arrowhead. L. 30.68 mm, w. 11.86 mm, diam. (socket) 5.70 mm, wt. 2 g (Fig. 21.14/14).³³⁰ 14/15. SM 54.512.58 (4A): A socketed, barbed arrowhead with a broken spur. L. 38.16 mm, w. 15.78 mm, diam. (socket) 9.10 mm, wt. 3.9 g (Fig. 21.14/15).³³¹ 14/16. SM 54.512.59 (4A/C): A socketed, barbed arrowhead with a broken spur. Its barbs are broken. L. 38.82 mm, w. 18.19 mm, diam. (socket) 14.05 mm, wt. 4.4 g (Fig. 21.14/16).³³² 14/17. SM 54.512.61 (4A): A socketed, barbed arrowhead. L. 35.41 mm, w. 12.20 mm, diam. (socket) 6.67 mm, wt. 2.1 g (Fig. 21.14/17).³³³ 14/18. SM 54.512.63 (4A): A socketed, barbed arrowhead. L. 46.70 mm, w. 23.50 mm, diam. (socket) 9.17 mm, wt. 5.5 g (Fig. 21.14/18).³³⁴ 14/19. SM 54.512.64 (4A): A socketed, barbed arrowhead. L. 40.17 mm, w. 17.01 mm, di. (socket) 7.97 mm, wt. 3.7 g (Fig. 21.14/19).³³⁵ 14/20. SM 54.512.66 (4A): A socketed, barbed arrowhead. L. 35.64 mm, w. 21.87 mm, diam. (socket) 7.59 mm, wt. 3.7 g (Fig. 21.14/20).³³⁶ 14/21. SM 54.512.67 (1C): A barbed, tanged arrowhead with a spur or a casting jet trace. L. 34.83 mm, w. 19.16 mm, diam. (socket) 4.74 mm, wt. 1.9 g (Fig. 21.14/21).³³⁷ 14/22. SM 54.512.68 (4C): A large, socketed barbed arrowhead with a broken spur (modern). L. 49.34 mm, w. 25.62 mm, diam. (socket) 15.74 mm, wt. 5.6 g (Fig. 21.14/22).³³⁸ 14/23. SM 54.512.69 (4A): A socketed, barbed arrowhead. L. 33.72 mm, w. 17.97 mm, diam. (socket) 6.41 mm, wt. 4.1 g (Fig. 21.14/23).³³⁹ 14/24. SM 54.512.70 (1A, Subvariant B): A barbed arrowhead with a ribbed tang. L. 37.60 mm, w. 15.44 mm, diam. (socket) 4.15 mm, wt. 2 g (Fig. 21.14/24).³⁴⁰ 14/25. SM 54.512.71 (U): A barbed arrowhead tip fragment with a modern break. L. 28.71 mm, w. 14.54 mm, wt. 2.4 g (Fig. 21.14/25).³⁴¹ 14/26. SM 54.512.634 (4A): A fragment of a socketed, barbed arrowhead. L. 59.67 mm, w. 20.14 mm, diam. (socket) 9.69 mm, wt. 7.8 g (Fig. 22.14/26).³⁴² 14/27. SM 54.512.635 (4A): A fragment of a socketed, barbed arrowhead with a slightly triangle-shaped blade. L. 41.77 mm, w. 23.06 mm, diam. (socket) 10.80 mm, wt. 5.5 g (Fig. 22.14/27).³⁴³ 14/28. SM 54.512.636 (4A): A socketed, barbed arrowhead with a short socket. L. 38.13 mm, w. 18.75 mm, diam. (socket) 7.63 mm, wt. 2.8 g (Fig. 22.14/28).³⁴⁴ 14/29. SM 54.512.637 (4A/C): A socketed, barbed arrowhead with a spur. L. 42.64 mm, w. 20.07 mm, diam. (socket) 9.50 mm, wt. 4.4 g (Fig. 22.14/29).³⁴⁵ 14/30. SM 54.512.638 4A/C): A socketed, barbed arrowhead with a spur. L. 40.60 mm,

- 324 MISKE 1907, Pl. 37.1; PATEK 1968, 164, No. 518.
- 325 MISKE 1907, Pl. 31.23; PATEK 1968, 164, No. 515.
- 326 MISKE 1907, Pl. 37.12; PATEK 1968, 164, No. 525.
- 327 MISKE 1907, Pl. 31.31; PATEK 1968, 164, No. 520.
- 328 MISKE 1907, Pl. 31.22; PATEK 1968, 164, No. 535.
- 329 MISKE 1907, Pl. 37.4; PATEK 1968, 164, No. 514.
- 330 MISKE 1907, Pl. 31.26; PATEK 1968, 164, No. 526.
- 331 MISKE 1907, Pl. 37.9; PATEK 1968, 164, No. 523.
- 332 MISKE 1907, Pl. 31.47; PATEK 1968, 164, No. 528.
- 333 MISKE 1907, Pl. 31.20; PATEK 1968, 164, No. 524.
- 334 MISKE 1907, Pl. 31.41; PATEK 1968, 164, No. 512.
- 335 PATEK 1968, 164, No. 513.
- 336 MISKE 1907, Pl. 31.14; PATEK 1968, 164, No. 522.
- 337 MISKE 1907, Pl. 31.2; PATEK 1968, 164, No. 537.
- 338 MISKE 1907, Pl. 31.54; PATEK 1968, 164, No. 517.
- 339 MISKE 1907, Pl. 31.51; PATEK 1968, 164, No. 521.
- 340 MISKE 1907, Pl. 31.1; PATEK 1968, 164, No. 542.
- 341 PATEK 1968, 164, No. 543.
- 342 MISKE 1907, Pl. 31.38; PATEK 1968, 164, No. 545.
- 343 MISKE 1907, Pl. 31.49; PATEK 1968, 164, No. 546.
- 344 MISKE 1907, Pl. 31.33; PATEK 1968, 164, No. 547.
- 345 MISKE 1907, Pl. 31.32; PATEK 1968, 164, No. 548.



Fig. 24. Arrowhead casting moulds from Transdanubia (▼ direction of casting). 27 – Danube River, 28 – Górkápolnadomb (see [Catalogue B](#)).

w. 22.79 mm, diam. (socket) 9.03 mm, wt. 3.6 g ([Fig. 22.14/30](#)).³⁴⁶ 14/31. BM 1963.79.1 (4C): A large socketed barbed arrowhead with a spur. L. 56.80/44.07 mm, w. 17.93 mm, diam. (socket) 10.05 mm, wt. 4.6 g ([Fig. 22.14/31](#)). 14/32. SM ō.2014.1.71 Bándi–Fekete excavation (11.08.1976, western part of trench C29, c. 60–90 cm deep) (4A/C): A socketed barbed arrowhead with a small spur. L. 38.70 mm, w. 18.05 mm, diam. (socket) 9.01

346 MISKE 1907, Pl. 31.40; PATEK 1968, 164, No. 549.

mm, wt. 4.2 g (soil or wood) (Fig. 22.14/32). 14/33. SM metal detector survey on 30.03.2019 (non-inventoried) (4A/C): A socketed, barbed arrowhead with a long socket and a broken spur. L. 34.32 mm, w. 13.34 mm, diam. (socket) 8.44 mm, wt. 2.5 g (Fig. 22.14/33). 14/34. SM metal detector survey on 27.04.2019 (non-inventoried) (4A): A socketed, barbed arrowhead. L. 23.44 mm, w. 18.43 mm, diam. (socket) 8.32 mm, wt. 3 g (Fig. 22.14/34). 14/35. SM metal detector survey on 30.03.2019 (non-inventoried) (5A): A socketed arrowhead with a leaf-shaped blade. L. 39.98 mm, w. 15.19 mm, diam. (socket) 5.53 mm, wt. 3.2 g (Fig. 22.14/35).

Lost:³⁴⁷ 14/36. lost (1C): A tanged, barbed arrowhead with a spur or casting jet trace (Fig. 22.14/36).³⁴⁸ 14/37. lost ("1A or 2A"): A tanged, barbed arrowhead. Small knobs appear to be visible on its tang (Fig. 22.14/37).³⁴⁹ 14/38. lost (1A, Subvariant A): A tanged, barbed arrowhead (Fig. 22.14/38).³⁵⁰ 14/39. lost (1A, Subvariant A): A tanged, barbed arrowhead (Fig. 22.14/39).³⁵¹ 14/40. lost (1A, Subvariant A): A barbed arrowhead with a broken tang (Fig. 22.14/40).³⁵² 14/41. lost (1A, Subvariant C): A barbed arrowhead with a broken tang (Fig. 22.14/41).³⁵³ 14/42. lost (1A, Subvariant C): A barbed arrowhead with a broken tang (Fig. 22.14/42).³⁵⁴ 14/43. lost (1A, Subvariant C): A barbed arrowhead with a missing tang and barb (Fig. 22.14/43).³⁵⁵ 14/44. lost (1A, Subvariant C): A tanged, barbed arrowhead with a broken tip (Fig. 22.14/44).³⁵⁶ 14/45. lost (1A, Subvariant C): A tanged barbed arrowhead with a broken barb (Fig. 22.14/45).³⁵⁷ 14/46. lost (4A): A socketed, barbed arrowhead with a broken barb (Fig. 22.14/46).³⁵⁸ 14/47. lost (4A): A socketed, barbed arrowhead with a broken barb (Fig. 22.14/47).³⁵⁹ 14/48. lost (4A): A socketed, barbed arrowhead with a broken barb and a misrun defect (Fig. 22.14/48).³⁶⁰ 14/49. lost (4A): A socketed, barbed arrowhead (Fig. 23.14/49).³⁶¹ 14/50. lost (4A): A socketed, barbed arrowhead (Fig. 23.14/50).³⁶² 14/51. lost (4A): A socketed, barbed arrowhead with a broken barb (Fig. 23.14/51).³⁶³ 14/52. lost (4A): A barbed arrowhead with a broken socket (Fig. 23.14/52).³⁶⁴ 14/53. lost (4A): A socketed, barbed arrowhead with a broken barb and a misrun defect (Fig. 23.14/53).³⁶⁵ 14/54. lost (4A): A socketed, barbed arrowhead with a misrun defect (Fig. 23.14/53).³⁶⁶ 14/55. lost (4A): A barbed arrowhead with a broken socket (Fig. 23.14/55).³⁶⁷ 14/56. lost (4A): A socketed, barbed arrowhead. Fragmented (Fig. 23.14/56).³⁶⁸ 14/57. lost

347 Erzsébet Patek notes further arrowheads from the collection of the SM (54.512.40–41, 43, 45, 47, 53, 60, 62, 633) which were lost in the museum's collection when I visited them. Some of them are likely to be identical with the ones published by baron Kálmán Miske, but their description is too schematic to find their matching figures in the baron's plates. MISKE 1907; PATEK 1968, 164, No. 530–533, 538–541, 544. Miske also publish one arrowhead with a leaf-shaped blade. The quality of the published illustrations and not suitable to decide whether this is an Early Iron Age arrowhead or a Late Bronze Age one (e.g. 5A) (MISKE 1907, Pl. 31.25). There is also one barbed arrowhead which appears to be either a heavily corroded bronze or iron arrowhead (MISKE 1907, Pl. 31.44).

348 MISKE 1907, Pl. 37.7.

349 MISKE 1907, Pl. 37.10.

350 MISKE 1907, Pl. 31.3.

351 MISKE 1907, Pl. 31.5.

352 MISKE 1907, Pl. 31.4.

353 MISKE 1907, Pl. 31.6.

354 MISKE 1907, Pl. 31.7.

355 MISKE 1907, Pl. 31.8.

356 MISKE 1907, Pl. 31.9.

357 MISKE 1907, Pl. 31.10.

358 MISKE 1907, Pl. 31.37.

359 MISKE 1907, Pl. 31.18.

360 MISKE 1907, Pl. 37.6.

361 MISKE 1907, Pl. 37.5.

362 MISKE 1907, Pl. 31.15.

363 MISKE 1907, Pl. 13.13.

364 MISKE 1907, Pl. 31.19.

365 MISKE 1907, Pl. 31.39.

366 MISKE 1907, Pl. 31.36.

367 MISKE 1907, Pl. 32.12.

368 MISKE 1907, Pl. 31.17.



Fig. 25. Arrowhead casting moulds from Transdanubia. 29 – Celldömölk-Ság-hegy, 30 – Velem-Szent Vid (Photo after: TOMPA 1927, 47, 5b; see Catalogue B).

(4A): A barbed arrowhead with a broken socket (Fig. 23.14/57).³⁶⁹ 14/58. lost (4A): A barbed arrowhead with a broken barb and socket (Fig. 23.14/58).³⁷⁰ 14/59. lost (4A): A socketed, barbed arrowhead with a misrun defect

369 MISKE 1907, Pl. 31.21.

370 MISKE 1907, Pl. 31.30.

and a broken tip (Fig. 23.14/59).³⁷¹ 14/60. lost (4A): A socketed, barbed arrowhead (Fig. 23.14/60).³⁷² 14/61. lost (U): A socketed arrowhead with a broken blade (Fig. 23.14/61).³⁷³ 14/62. lost (4A/U): A socketed arrowhead. Its blade is either triangular or barbed (Fig. 23.14/62).³⁷⁴ 14/63. lost (U): A socketed arrowhead with a broken blade (Fig. 23.14/63).³⁷⁵ 14/64. lost (4A/C): A socketed, barbed arrowhead with a broken spur or casting jet (Fig. 23.14/64).³⁷⁶ 14/65. lost (4A/C): A socketed, barbed arrowhead with a misrun defect, and a broken spur or casting jet (Fig. 23.14/65).³⁷⁷ 14/66. lost (4A/C): A socketed, barbed arrowhead with a broken casting jet or spur (Fig. 23.14/66).³⁷⁸ 14/67. lost (4A/C): A socketed, barbed arrowhead with a misrun defect, broken barbs and broken casting jet or spur (Fig. 23.14/67).³⁷⁹ 14/68. lost (4A/C): A socketed, barbed arrowhead with a spur (Fig. 23.14/68).³⁸⁰ 14/69. lost (4C): A socketed, barbed arrowhead with a misrun defect and a spur (Fig. 23.14/69).³⁸¹ 14/70. lost (4C): A socketed, barbed arrowhead with a spur and a fragmented barb (Fig. 23.14/70).³⁸² 14/71. lost (4C): A socketed, barbed arrowhead with a misrun defect, a broken barb and a spur (Fig. 23.14/71).³⁸³ 14/72. lost (4A/C): A socketed, barbed arrowhead with a broken barb and a spur (Fig. 23.14/72).³⁸⁴ 14/73. lost (4A/C): A socketed, barbed arrowhead with a broken spur or casting jet (Fig. 23.14/73).³⁸⁵ 14/74. lost (4A): A socketed, barbed arrowhead (Fig. 23.14/74).³⁸⁶ 14/75. lost (4A): A socketed, barbed arrowhead (Fig. 23.14/75).³⁸⁷ 14/76. lost (4A/C): A socketed, barbed arrowhead with a broken casting jet or spur (Fig. 23.14/76).³⁸⁸ 14/77. lost (4A): A socketed, barbed arrowhead (Fig. 23.14/77).³⁸⁹ 14/78. lost (4A): A socketed, barbed arrowhead with an incomplete casting defect, and a broken barb (Fig. 23.14/78).³⁹⁰ 14/79. lost ("1A or 2A"): A tanged, barbed arrowhead (Fig. 23.14/79).³⁹¹ 14/80. lost (4A): A socketed, barbed arrowhead (Fig. 23.14/80).³⁹² 14/81. lost (4A): A socketed, barbed arrowhead with a broken barb (Fig. 23.14/81).³⁹³ 14/82. lost (5A/B): A socketed, barbed arrowhead with a leaf-shaped blade, and a likely preserved wooden shaft inside (Fig. 23.14/82).³⁹⁴

15. Balatonmagyaród-Kiskányavár B, Feature 2, Zala County. In 1981, László Horváth excavated a barbed arrowhead in Feature 2 at the Kiskányavár B site near Balatonmagyaród. The settlement is dated between the Br D and Ha A phases. TGYM 1982.38.1 (4A/C): A socketed, barbed arrowhead with a broken spur. L. 38.91 mm, w. 11.73 mm, diam. (socket) 9.93 mm, wt. 3 g (Fig. 23.15).³⁹⁵

16. Barnag-Vadalmi-dűlő, Veszprém County. At the Vadalmi-dűlő in Barnag, on both sides of the creek crossing the village, a bronze barbed arrowhead and Urnfield potsherds were found. LDM 65.81.1 (4A): A small

371 MISKE 1907, Pl. 37.3.

372 MISKE 1907, Pl. 37.2.

373 MISKE 1907, Pl. 31.52.

374 MISKE 1907, Pl. 31.28.

375 MISKE 1907, Pl. 31.29.

376 MISKE 1907, Pl. 31.34.

377 MISKE 1907, Pl. 37.13.

378 MISKE 1907, Pl. 31.43.

379 MISKE 1907, Pl. 31.42.

380 MISKE 1907, Pl. 31.45.

381 MISKE 1907, Pl. 31.55.

382 MISKE 1907, Pl. 31.46.

383 MISKE 1907, Pl. 31.53.

384 MISKE 1907, Pl. 31.48.

385 MISKE 1907, Pl. 31.50.

386 ILON 2024b, 227, Fig. 6.2.2.3.132.

387 ILON 2024b, 227, Fig. 6.2.2.3.143.

388 ILON 2024b, 227, Fig. 6.2.2.3.124.

389 ILON 2024b, 227, Fig. 6.2.2.3.128.

390 ILON 2024b, 227, Fig. 6.2.2.3.134.

391 ILON 2024b, 227, Fig. 6.2.2.3.146.

392 ILON 2024b, 227, Fig. 6.2.2.3.125.

393 ILON 2024b, 227, Fig. 6.2.2.3.129.

394 MISKE 1907, Pl. 31.16.

395 HORVÁTH 1996, 60, 66, 72; SZÁRAZ 2020, 14, 28.

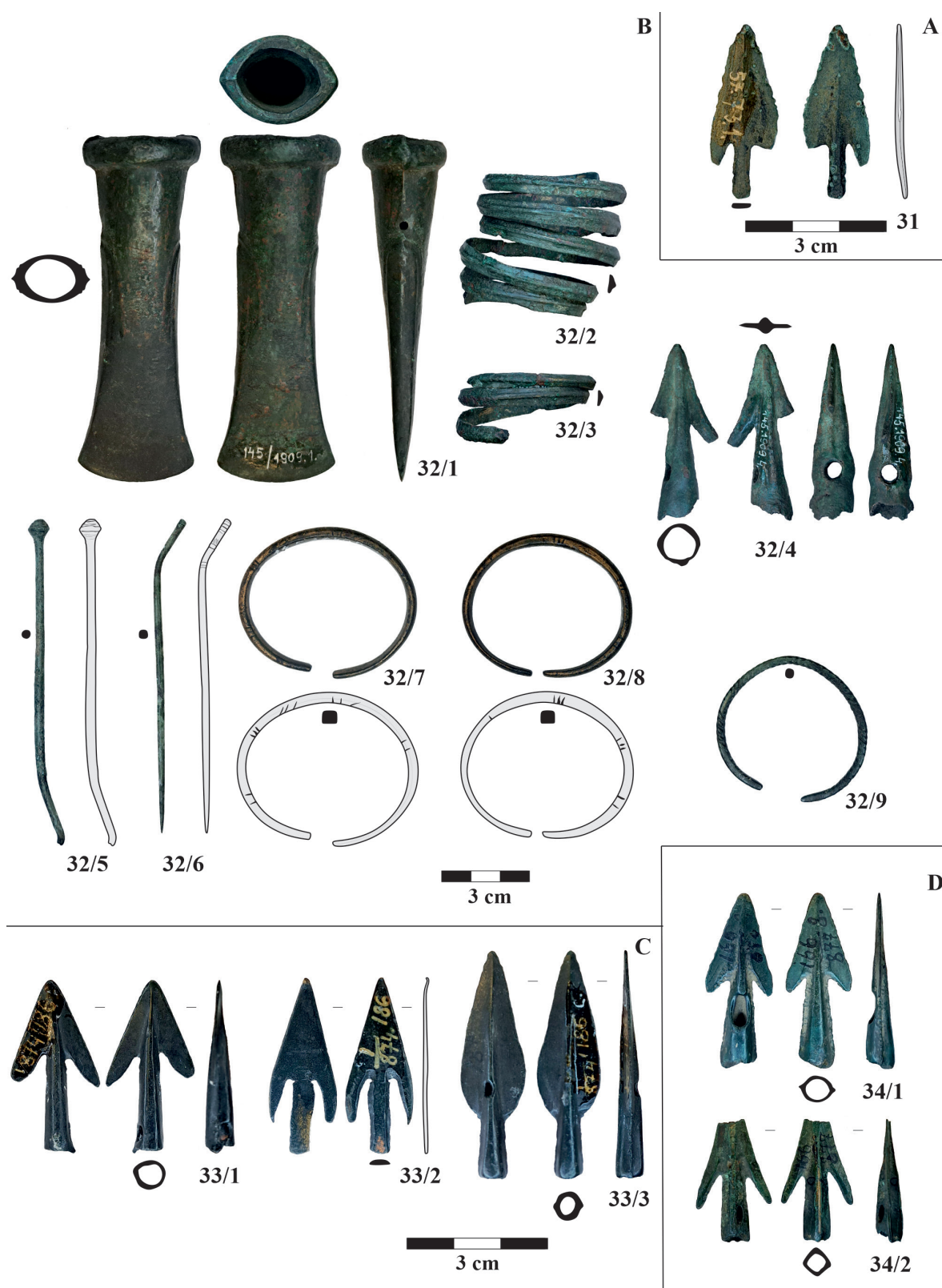


Fig. 26. Finds from the Hungarian National Museum (see [Catalogue C](#)). A31 – Gödöllő-Domonyvölgy; B32/1–9 – Vukovar, Croatia, C33/1–3 – Unprovenanced (Ráth Collection), D34/1–2 Unprovenanced (objects from Remig Sztachovich).

barbed, socketed arrowhead with a broken blade. L. 30.29 mm, w. 11.67 mm, diam. (socket) 4.52 mm, wt. 1.2 g (Fig. 23.16).³⁹⁶

Stray finds

17. **Doba-Török-dombok**, Veszprém County. A stray arrowhead is known from the Doba-Török-dombok site, discovered during a metal-detecting survey led by Bence Soós on 14 August 2021. HNM 2023.8.1 (4A): A socketed, barbed arrowhead with a misrun defect along its shaft. L. 25.27 mm, w. 10.08 mm, diam. (socket) 5.76 mm, wt. 1.5 g (with soil inside) (Fig. 23.17).

18. **Kapospula-Határárok (Halastavak)**, Tolna County. Around 2014, a private collector, Dr Zoltán Repkényi, deposited numerous objects at ELTE IAS for scientific study. The dating of these finds is varied, but most can be attributed to the Ha A1 phase. The collection contained two arrowheads.³⁹⁷ 18/1. Private Coll. of Dr. Zoltán Repkényi ("1A or 2A"): A barbed arrowhead with a broken tang. L. 38 mm, w. 18 mm, wt. 2 g (Fig. 23.18/1). 18/2. Private Coll. of Dr. Zoltán Repkényi (4A): A barbed, socketed arrowhead with a damaged blade. L. 28 mm, w. 11 mm, diam. (socket) 5.3 mm, wt. 1.5 g (Fig. 23.18/2).

19. **Keszthely-Fenékpusztá**, Zala County. Several finds from Fenékpusztá, originating from the private collection of Árpád Csák, were donated to the BM (Keszthely). According to Bálint Kuzsinszky, these objects came either from the Balaton or from the surrounding drylands. Among the several bronze objects, he mentioned an arrowhead. Some of the finds were later reconstructed as a hoard by the authors of the *MRT 1* and Amália Mozsolics; however, in this study, they are treated as stray finds.³⁹⁸

20. **Kölesd-Hangos-pusztá-Posta-dűlő**, Tolna County. The HNM acquired several objects from various periods and sites from Bódog Szelenovits. Among them is an arrowhead, which originating from the "hangosdi határ, Posta dűlő," now known as Kölesd-Hangos-pusztá-Posta-dűlő. HNM 1888.68.15 (4C): A socketed, barbed arrowhead with an incomplete cast spur and a broken socket. L. 33.92 mm, w. 14.42 mm, diam. (socket) 5.1 mm, wt. 2.1 g (Fig. 23.20).

21. **Pusztaszemes**, Somogy County. An unpublished arrowhead was found between the Kereki-dűlő and Bálványosi-dűlő. RRM 63.42.1 (4A): A small, barbed arrowhead with a short conical socket. L. 25.36 mm, w. 10.93 mm, diam. (socket) 7.44 mm, wt. 1.3 g (Fig. 23.21).

22. **Tényő** (Tényőfalu), Győr-Moson-Sopron County. The *Győri Főgymnasiumi Értesítő* records that a socketed, barbed arrowhead was found together with a spearhead at Tényő. The finds were added to the collection through Jerómos Lóskay, a Benedictine monk, facilitated by Pintér. Lost ("4A"): A socketed arrowhead with 8 mm-long barbs. L. 45 mm.³⁹⁹

23. **"Transdanubia"**. The arrowhead was purchased from Gyula Kiss, a retired teacher, together with additional finds dated to other periods. The provenance provided was simply "Dunántúl" (Transdanubia). HNM 1928.33.1 (4A): A small, barbed, socketed arrowhead. L. 31.79 mm, w. 9.21 mm, diam. (socket) 7.15 mm, wt. 2.9 g (Fig. 23.23).

24. **Udvari-Alsópélpusztá-Donáth-dűlő**, Tolna County. Mór Wosinsky mentions an arrowhead from the Donáth-dűlő at Alsópélpusztá, which is likely identical to an arrowhead preserved in the Prehistoric Collection of the HNM. The dimensions and description of the find in the inventory book match Wosinsky's text. The object was purchased from Bódog Szelenovits among many finds from different periods and sites. HNM 1888.68.16 (4A): A socketed, barbed arrowhead with a misrun defect and a broken barb. L. 29.53 mm, w. 14.06 mm, diam. (socket) 7.20 mm, wt. 1.6 g (Fig. 23.24).⁴⁰⁰

25. HNM, "Csákberény, Fejér County" (25/1) and Unprovenanced (25/2). In 1906, the HNM inventoried objects originating from the Merán counts' collection in their castle at Csákberény. The objects, including an arrowhead (1906.86.23), were donated to the National Museum by the wife of Count János Meráni (*Countess Ladislaja Lamberg*) during the official visit of Ede Mahler. In the literature, these finds have been mispublished as

396 ÉRI *et al.* 1969, 63, No. 12/6; KŐSZEGI 1988, 125, No. 149.

397 TARBAY 2021, 39–45, Fig. 3.5–6.

398 LIPP 1886, 23; KUZSINSZKY 1920, 48; BAKAY *et al.* 1966, 88, No. 34; MOZSOLICS 1985, 119; KŐSZEGI 1988, 150, No. 556.

399 GYŐRI FŐGYMNASIUMI ÉRTESÍTŐ 1877, 102; MITHAY 1942, 32, Pl. 13.7.

400 WOSINSKY 1896, 375 (Alsó-Pél-Donáth-dűlő); MOZSOLICS 1985, 86 (Alsópél, Udvari); KŐSZEGI 1988, 191, No. 1218 (Udvari-Alsópél).

originating from Csákberény.⁴⁰¹ More recently, the HNM acquired an arrowhead and a rod ingot, along with several objects dating to different periods. These finds were confiscated from a metal-detectorist, who had participated in the community archaeology programme of the Szent István Király Museum. The provenance of the find is uncertain. 25/1. HNM 1906.86.23 (4A): A barbed arrowhead with a long conical socket. L. 34.81 mm, w. 13.76 mm, diam. (socket) 7.83 mm, wt. 3.1 g (Fig. 23.25/1). 25/2. HNM 2023.9.1 (4A): A socketed, barbed arrowhead with a misrun defect. L. 28.75 mm, w. 10.71 mm, diam. (socket) 7.03 mm, wt. 1.8 g (Fig. 23.25/2).

26. BM, Zala County. The BM holds a stray-find arrowhead, which possibly originates from Zala County. BM 63.71.1 (4A): A socketed, barbed arrowhead with a misrun defect. L. 42.9 mm, w. 19.42 mm, diam. (socket) 6.5 mm, wt. 22.2 g (Fig. 23.26).

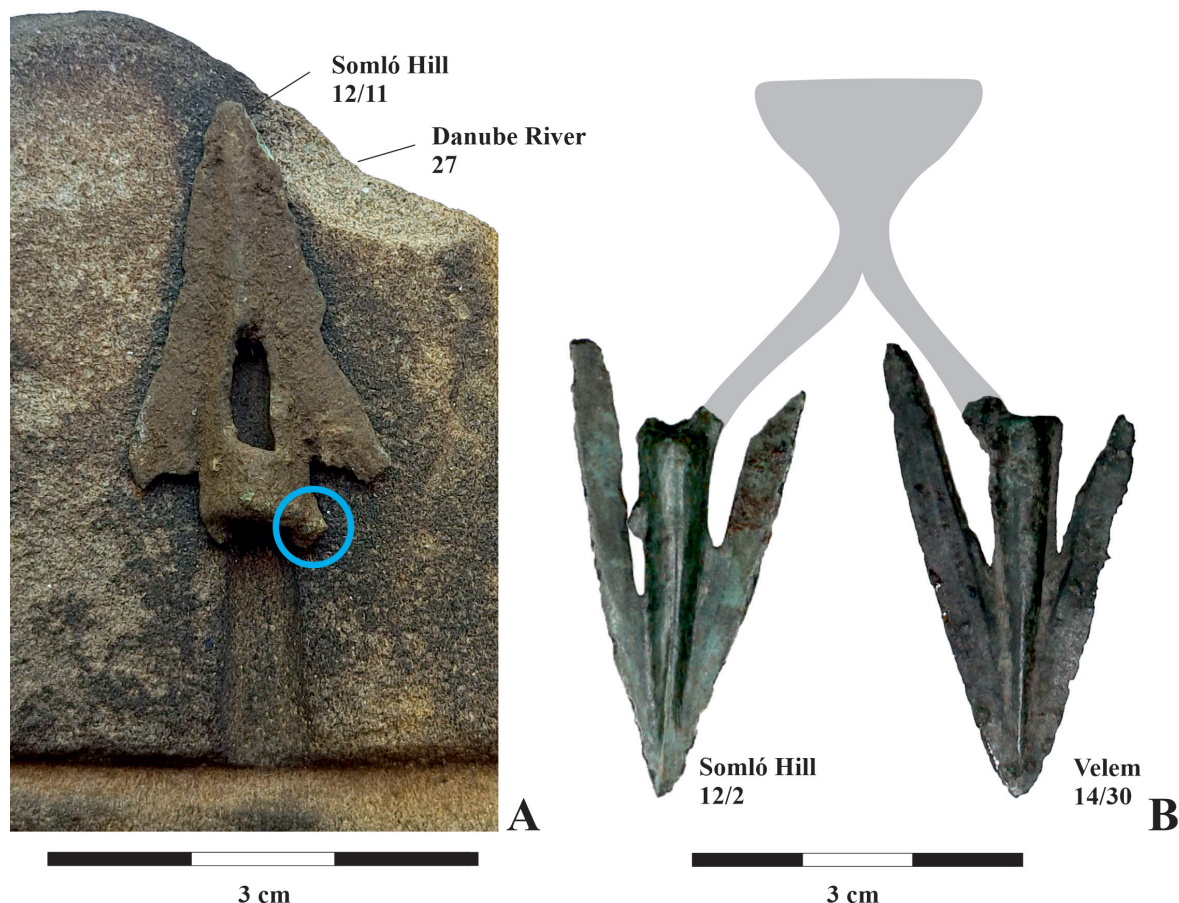


Fig. 27. A – An arrowhead from Somló Hill and the casting mould from the Danube River follow the same casting model. However, the arrowhead was cast in a different mould, as indicated by the casting jet traces (highlighted in red), B – Similar arrowheads from Somló Hill and Velem-Szent Vid appear to have been made in the same mould, connected by a channel, or their negatives were carved after the same model.

Catalogue B– Casting moulds

27. **Danube River** (between Almásneszmély and Győr), Komárom-Esztergom or Győr-Moson-Sopron Counties. Gábor Ilon published an unprovenanced arrowhead casting mould originating from the Danube River. The object was part of András Marton's (Mesterháza) collection, who purchased it from his friend from Győr in September 2022. The mould reportedly comes from gravel that had been loaded onto the truck of his friend's father. HNM (2025.12.1) (4A): The object is a two-faced mould: one negative bears three arrowhead negatives with a pouring cup on their tips, and a line that connecting their bases. A casting core was possibly inserted into this part. The reverse side of the mould depicts a three-pronged core joined at the base (see

401 The second arrowhead fragment (1906.86.24) was not catalogued, as this fragment may belong to an Early Iron Age arrowhead due to its rectangle shape.

detailed description in the text under 4A, *Eckhardt's Type 4, Variant A*). Dimensions: 98.05 × 70.77 mm, th. 23.84–23.97–25.64–23.50 mm, arrowheads l. 34.96–33.11 mm, wt. 257.2 g (Fig. 24.27).⁴⁰²

28. Gőr-Kápolnadomb, Vas County. During the excavations of the Gőr-Kápolnadomb Urnfield settlement, in Quadrant K-6, pit “a”, a two-faced spearhead-arrowhead mould was found, along with other moulds, ceramics, animal bones, and slag. The feature is dated to 1032–928 Cal BC. SM 6.90.18.4 (4E, Subvariant B): Two-faced mould. 1) Central fragment of a spearhead mould with assembly marks. The negative depicts a spearhead with a leaf-shaped blade. 2) Mould for three barbed harpoon arrowheads with loops. It has one pouring cup with three canals. Unused (spearhead); used and burnt (harpoon arrowheads). Micaceous sandstone. 73.64 × 72.27 mm, th. 24.91–20.77–19.68–15.36 mm, wt. 179.3 g; harpoon arrowheads L. 46.57 mm, 49.30 mm, 51.78 mm (Fig. 24.28).⁴⁰³

29. Celldömölk-Ság-hegy, Vas County. From the collection of Jenő Lázár, several casting moulds from Celldömölk-Ság-hegy were purchased by the HNM. One of them depicts a harpoon arrowhead. HNM 1949.23.14 (4E, Subvariant A): Casting mould of a large, barbed harpoon arrowhead with a loop and a spur. The mould is rectangular in shape and has a slightly conical pouring coup. Burning traces are visible on its surface. 63.59 × 93.10 mm, th. 27.41 mm, wt. 247.2 g (Fig. 25.29).⁴⁰⁴

30. Velem-Szent Vid, Vas County. At the fortified, multi-period settlement of Velem-Szent Vid, several casting moulds are known. Among the casting moulds from the collection of Baron Kálmán Miske, two can be linked to arrowhead manufacture. Unfortunately, only one part of 30/1 has been known. 30/1–2. SM 54.517.274.2 (4E, Subvariant B): Rectangular casting mould for two barbed arrowheads with loops. Its surface is polished. Assembly marks visible along its narrow sides. 78.14 × 49.41 mm, Th. 32.06–25.38 mm, Wt. 199.1 g. According to Tompa and Miske, this mould originally had another part, now lost. On that mould half, the same gating system was visible, but the negative lacks loops. The object is now lost (Fig. 25.30/1).⁴⁰⁵ 30/3. SM 54.518.53 (U): Patek notes a fragmented arrowhead casting mould made of sandstone (Length 4.8 cm, Width 5.3 cm), the other negative showing a pin. The object is now lost (Fig. 25.30/2).⁴⁰⁶

Catalogue C – Arrow and harpoon heads from the collection of the Hungarian National Museum

31. Domonyvölgy, Pest County. In 1957, Bronze Age pots dated to the period of the Tumulus culture and an arrowhead was inventoried. The context of the objects is unclear. They were collected by Ágnes Salamon in 1956.⁴⁰⁷ HNM 1957.73.1 (1A): Tanged, barbed arrowhead. Hammering traces visible on its blade and tang. Its cutting edge is fragmentary and one of its barbs is broken. L. 37.70 mm, w. 14.80 mm, diam. (tang) 3.90 mm, wt. 2.1 g (Fig. 26A.31).

32. Vukovar, Croatia, Vukovar-Syrmia County. Patek published three bracelets, one club-headed pin, an “arrowhead” and a conical-headed pin from the collection of the HNM. According to her, the objects originated from Buda Castle Hill in Budapest (*Budapest-Burggegend, Budaer Burghügels*).⁴⁰⁸ The inventory book, however, reveals that the Bronze Age objects were purchased together with Late Iron Age, Roman, and Medieval period finds from Regina Vogel for 39 crowns. The provenance of the finds is not the Buda Castle Hill, but “Bukovár vidéke” (area of Bukovár), an alternative form of Vukovar, Croatia. The purchase also included additional Bronze Age artefacts, and based on typological features, the “arrowhead” can instead be identified as

402 ILON 2022, 150, No. 31, Fig. 3.5; ILON 2024a, 291–292, 299, Tab. 6.1.4.E1. No. 31; ILON 2024b, 220, Fig. 6.1.4.E1.3.1.

403 ILON 1992, 244, Fig. 6.3; T. BIRÓ 1995, 52–53, 55, Fig. 6–7; ILON 1996, 177, 184, Pl. 2.9; ILON 2024a, 216, Fig. 6.1.1.14.2, 300, Tab. 6.1.4.E1. No. 38.

404 LÁZÁR 1943, 282, Pl. 4.24; TARBAJ 2023a, 336–337, Fig. 1; ILON 2024a, 215, Fig. 6.1.4.13.3, 298, Tab. 6.1.4.E1. No. 22.

405 TOMPA 1927, 46, Fig. 5a–b; MISKE 1929, 85, Fig. 7.2a–b; PATEK 1968, 160, No. 250; ILON 2024a, 307, Tab. 6.1.4.E1. No. 100; ILON 2024b, 212, 220, Fig. 6.1.4.10.1, Fig. 6.1.4.E1.3.1.

406 PATEK 1968, 160, No. 251.

407 Inventory Book of the Hungarian National Museum 1957.73; SALAMON 1956, 33; DINNYÉS *et al.* 2012, 142–144.

408 PATEK 1968, 74, 122–123, Pl. 68.7–12; KŐSZEGI 1988, 128, No. 200.

a harpoon.⁴⁰⁹ 32/1. HNM 1909.145.1. Socketed axe: pseudo-winged socketed axe with four inner ribs, a thick collar, and two cast holes along the narrow sides. Its cutting edge is curved. The surface of the axe is worn, and the cutting edge is hammered. L. 117.99 mm, w. (rim) 38.55 × 28.65 mm, w. (blade) 40.62 mm, wt. 179.4 g (Fig. 26B.32/1). 32/2. HNM 1909.145.2. Spiral armlet: spiral armlet with a ribbed back and rounded terminals. Di. 59.59 × 51.25 mm, th. 6.37 mm, h. 49.32 mm, wt. 57.2 g (Fig. 26B.32/2). 32/3. HNM 1909.145.4. Spiral armlet: spiral armlet with a ribbed back and rounded terminals. Di. 52.33 × 49.23 mm, th. 6.91 mm, h. 24.30 mm, wt. 19.6 g (Fig. 26B.32/3). 32/4. HNM 1909.145.4. Harpoon head: Socketed, barbed harpoon head with a line hole. The breakage of the barbs and the socket is modern. L. 60.12 mm, w. 24.19 mm, wt. 21.3 g (Fig. 26B.32/4). 32/5. HNM 1909.145.5. Pin: Bronze pin with a conical head and a broken shaft. The head is decorated with bundles of lines. The breakage of the shaft is modern. L. 111.15 mm, th. 2.96 mm, wt. 7 g (Fig. 26B.32/5). 32/6. HNM 1909.145.6. Pin: Club-headed pin. Its head is decorated with hatched and bundles of lines motifs. L. 106.85 mm, th. 2.72 mm, wt. 3.7 g (Fig. 26B.32/6). 32/7. HNM 1909.145.7. Bracelet: Rectangular-sectioned bracelet with blunt terminals. The surface is heavily worn, showing traces of a line pattern. 60.77 × 51.86 mm, th. 4.99 × 4.19 mm, wt. 19.4 g (Fig. 26B.32/7). 32/8. HNM 1909.145.8. Bracelet: Rectangular-sectioned bracelet with blunt terminals. The surface is heavily worn, showing traces of a line pattern. 57.89 × 49.05 mm, th. 4.67 × 4.12 mm, wt. 18.6 g (Fig. 26B.32/8). 32/9. HNM 1909.145.9. Bracelet: Circular-sectioned bracelet, decorated with torsion. 50 × 47.17 mm, th. 2.65 × 3.01 mm, wt. 7 g (Fig. 26B.32/9).

33. Unprovenanced, Ráth Collection. The HNM purchased numerous objects from the Ráth Collection, including three unprovenanced arrowheads can be dated to the Bronze Age. 33/1. HNM 1874.1.186 (4A): Socketed barbed arrowhead. The object shows mismatch defect and a misrun. Its cutting edge is hammered. L. 37.23 mm, w. 19.16 mm, diam. (socket) 6.75 mm, wt. 3.6 g (Fig. 26C.33/1). 33/2. HNM 1874.1.186 (1A): Tanged, barbed arrowhead. The arrowhead was likely made in two-part casting mould with a single negative. L. 37.86 mm, w. 14.76 mm, diam. (tang) 4.25 mm, wt. 1.8 g (Fig. 26C.33/2). 33/3. HNM 1874.1.186 (5A): Socketed arrowhead with a leaf-shaped blade. It shows a misrun and mismatch. L. 49.16 mm, w. 14.02 mm, diam. (socket) 6.37 mm, wt. 4.8 g (Fig. 26C.33/3).

34. Unprovenanced. Two arrowheads were purchased from “Remig Sztachovich” [presumably Remig Alajos Stachovich]. The provenance of the objects is unknown. 34/1. HNM 1877.166.8 (4A): Socketed, barbed arrowhead. The object has a misrun defect and a mismatch. The cutting edge is hammered. L. 37.40 mm, w. 14.35 mm, diam. (socket) 7.44 mm, wt. 3.2 g (Fig. 26D.34/1). 34/2. HNM 1877.166.9 (4A): Socketed, barbed arrowhead with a broken tip (modern breakage). The object has a misrun and a mismatch defect. L. 26.67 mm, w. 16.73 mm, diam. (socket) 6.35 mm, wt. 2 g (Fig. 26D.34/2).

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409 Inventory Book of the Hungarian National Museum 1909.145.1–23. From the same acquisition, a Medieval signet ring was also published under the provenance of ‘Vukovar’ (GERGELYES 1998, 53, No. F/29).

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