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LATE BRONZE AGE BRONZE DETACHABLE BARBED HARPOONS WITH LINE HOLE AND A SPUR FROM HUNGARY

The Hungarian National Museum (HNM) in Budapest holds two unpublished metal finds[1]. One was found in Budapest-Buda/H (**fig. 1, 1**), and the other is an unprovenanced find from the Ráth Collection (**figs 1, 3; 2, 2**). They have the appearance of bronze arrowheads, but their dimensions and shapes differ completely from those types of Bronze Age weapons. To illustrate their differences, a typical Late Bronze Age (Ha A1) barbed arrowhead with a spur from the 3rd hoard from Pécs-Jakabhegy (Baranya County/H)[2] is shown in **figure 2, 1**. The two heads from Budapest-Buda and the Ráth Collection have short sockets and cast horizontal line holes right above the mentioned part. They have hammered barbed blades and single asymmetrical spurs (**fig. 1, 1. 3**).

Since the 1880 discovery of the Szentes-Magyartés find (Csongrád-Csanád County/H) (**fig. 1, 2**), research has been aware of their Southeast European Late Bronze Age counterparts[3]. In 1973, Amália Mozsolics classified objects like the one from Kisvarsány-Hidéri (Szabolcs-Szatmár-Bereg County/H) as harpoon-like tools or socketed arrowheads. She sorted them into the group of Late Bronze Age fishing and hunting tools[4]. In her later works, she reinterpreted the Kisvarsány-Hidéri find and the Karcag-Zádor (Jász-Nagykun-Szolnok County/H) specimens as bronze arrowheads[5]. In 1984, Tibor Kemenczei classified the Viss-Török-ér (Borsod-Abaúj-Zemplén County/H) and Szentes-Magyartés items as arrowheads without further comments[6].

The most formative impact on the interpretation of these objects was left by Serbian scholars. Dušan Borić recognized that the Futog specimen (South Bačka District/SRB) can be identified as a harpoon used for fishing, but suitable for hunting and combat as well[7]. Ildiko Medović noted several important observations in her brief study on the stray find from Borjaš/Borđos (Central Banat District/SRB). She primarily classified the instrument in question as a fishing harpoon. Her proposal is further strengthened by the close proximity of the Tisza River to the presumed findspot, and the abundance of ichthyoarchaeological material in the nearby Mošorin-Feudvar site (South Bačka District/SRB)[8]. A comprehensive typo-chronological synthesis has been provided by Rastko Vasić. He identified these objects as »Pfeilspitzen mit dreieckigem Blatt, Flügelwiderhaken, kräftiger Schafttülle und Dornfortsatz« (*Type Karaburma*). Rastko Vasić also summarized previously known Hungarian parallels to the Serbian ones from Szentes-Magyartés, Viss-Török-ér, Kisvarsány-Hidéri, Karcag-Zádor. He dated them between the Br C/Br D and the Ha B1 period. Although he primarily classified these objects as arrowheads, he also noted that their construction derived from antler harpoons[9]. Vojislav Filipović also recognized this barbed head type and classified it as a Br D/Ha A1 arrowhead[10].

Thus, there is no consensus among local researchers on the functional and typological interpretation of metal heads similar to the ones from Budapest-Buda and the Ráth Collection. Most scholars interpret them as arrowheads, while some assign them to the group of »harpoons«, a specialized fishing tool. In our study, we propose that these finds are detachable barbed harpoon heads with a spur, based on ethnographic analogies[11].

The emergence of these weapons represents a new and important line of development after the different types of harpoon heads used for hunting and fishing since the Paleolithic. In this work, I assess barbed metal harpoon heads with a line hole and a spur from the Late Bronze Age of Southeast Europe, specifically in

Fig. 1 **1** Stray find bronze harpoon head from Budapest-Buda. – **2** harpoon head from Szentes-Magyartés. – **3** stray find harpoon head from the Ráth Collection. – (Hungarian National Museum, photos J. G. Tarbay). – Scale 2:3.

Fig. 2 **1** A barbed arrowhead with a spur from the 3rd hoard from Pécs-Jakabhegy. – **2** the harpoon head from the Ráth Collection. – (1 Janus Pannonius Museum; 2 Hungarian National Museum; photos J. G. Tarbay). – Scale 2:3.

the territory of Hungary. My goal is to examine the context of these specialized weapons and to understand their manufacturing technology and myriad hafting techniques. Based on the currently limited archaeological and archaeozoological data from the Carpathian Basin, I investigate which species this type of weapon may have been used for, and why the emergence of a weapon capable of killing such presumably large animals may have been important in the food supply of local Late Bronze Age communities.

ARCHAEOLOGICAL BACKGROUND

To interpret what was a barbed bronze harpoon with a spur in the Late Bronze Age, all available archaeological data must be revised. In Southeastern Europe, similar barbed bronze harpoons were found in the territory of three countries: Hungary, Serbia, and Bulgaria (cf. **figs 14-15**). It cannot be ruled out that there are similar metal harpoon heads in Transylvania, Romania. Examples are the objects from the Şpălnaca 2 (Alba County/RO) and Frâncenii de Piatră hoards (Sălaj County/RO). Based on the available illustrations, the functions of these artifacts are not identifiable[12].

Late Bronze Age Metal Harpoons from Hungary

In the territory of Hungary, a total of five bronze barbed harpoons with a spur are known: 1. Budapest-Buda (**fig. 1, 1**), 2. Karcag-Zádor (**fig. 14, 8**), 3. Kisvarsány-Hidéri (Belsőgát/Körgát) (**fig. 14, 1**), 4. Szentes-Magyartés (Teés/Teés puszta) (**fig. 1, 2**), 5. Viss-Török-ér (**fig. 14, 13**).

The Budapest-Buda harpoon head is a stray find. The HNM acquired this specimen from »Buda« in 1910 for 5 Austro-Hungarian kroner from Lipót Fischer[13]. No further information is known about the find's circumstances of discovery. Buda is the third main part of the Hungarian capital, Budapest, with an extensive shoreline along the Danube River. Urnfield period habitation is intense in this area (**Appendix I, 1; fig. 1, 1**)[14].

The bronze harpoon head from Karcag-Zádor (**fig. 14, 8**) was part of a bronze hoard dated to the Ha B1 (Hajdúböszörmény horizon). The circumstances of discovery were noted by István Hild: »[...] Donation of Imre L. Sántha Esq. Prehistoric bronze objects 12.5 kilograms with the dirt in them. Found by his tanyás [farmworker] while plowing in the newly divided paddock within the »Zádor«, when the plow turned some pieces, on the 22nd of October, 1906. The others have been found after some digging and searching«[15]. Based on the 19th-century Cadastral Map of the Habsburg Empire, the area described by István Hild as »paddock within the ›Zádor‹« could be located northeast from the present-day town Karcag. It is probably the southeastern part of the so-called Nagy legelő [Great Pasture] between the Zádor and the Nagy-Zádor-ér [Great Zádor brook][16]. Unfortunately, the assemblage has been lost completely in the museum's collection during the Second World War. Based on the description of Amália Mozsolics, this assemblage is a common representative of Ha B1 hoards with heterogeneous composition. Besides the presumed harpoon head, it consists of 163 bronze objects, e. g., swords, spearheads, socketed axes, socketed chisels, different type of sickles, knives, saws, a cauldron fragment, a plate fibula, a spiral anklet, spiral fragments, torques fragments, bracelets, and three plano-convex ingot fragments[17].

Kisvarsány-Hidéri (Belsőgát/Körgát) is a hoard from the Br D period (Ópályi horizon). It was found in 1962 and acquired incomplete by the Jósa András Museum in Nyíregyháza. The assemblage consists of a disc-butted axe, three knobbed sickles, one sickle blade fragment, two flanged sickles, one socketed axe, a tweezer, a bronze wire, four bracelets, one harpoon (**fig. 14, 1**), two plano-convex ingot fragments, and a slag piece[18]. The presumed topographical position of the site is the Tisza River floodplain.

Fig. 3 Metal finds from Szentes-Magyartés: **1** spearhead. – **2** socketed axe. – **3** chain of a bracelet, and three cast-in-one annular rings. – (Hungarian National Museum, photos J. G. Tarbay). – Scale 2:3.

Szentes-Magyartés (Teés, Teés puszta) is the fourth site where a bronze harpoon was found (**Appendix I, 3; figs 1, 2**). According to Tibor Kemenczei, who relied on the Hungarian National Museum inventory book from the 1880s, a socketed axe with a beaked mouth, an »arrowhead«, a spearhead, and three annular rings with a chained bracelet were recovered in Magyartés (**Appendix II, 1-3; fig. 3**). He noted that these

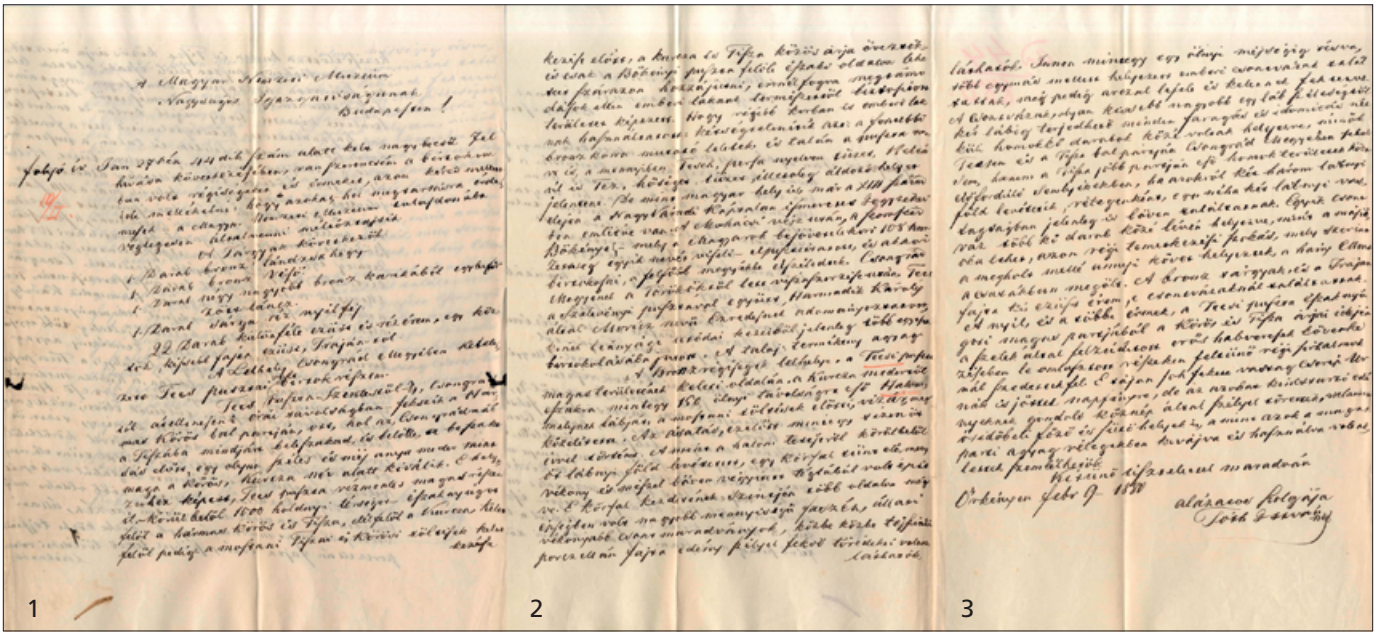

Fig. 4 The letter of István Tóth from Örkény. – (Archive Document no. 44/880, Central Database, Hungarian National Museum).

finds were found »beside a skeleton«, but he was highly suspicious about the reliability of this context[19]. The topographical position of Teés puszta, which is the former name of Magyartés, can be in the north-eastern direction from the town Szentes, right beside the Körös brook, in the floodplain of the Tisza River. Based on the letter of István Tóth from Örkény (Archive Document no. 44/880 of the HNM), who donated the finds to the HNM[20], the context can be further clarified. First, the metal finds were not found together. The socketed axe, the rings, and the spearhead were recovered from »[...] a Mound, circa 150 fathoms to the North from the Kurcza channel, on the Eastern side in the Hungarian part of the Teesi puszta [a type of hamlet and farmlands], the foot of which has been approached by the floods before the new ramparts«[21]. According to István Tóth, these finds were »excavated« around 1865. He describes the mound as follows: »Just after five feet of dirt had been excavated from the top of the mound, a brick enclosure wall appeared, with thin bricks joined by a lot of mortar. At the base level of this enclosure wall, on more sides, much intact charcoal, slender animal bone fragments, some buff-colored porcelain-like vessel sherds scattered around, could be seen […]. From here, digging almost five fathoms more deep, human skeletons placed next to each other have been found, namely laid face down and head to the East. The skeletons were placed between some smaller and bigger, from one to two feet wide sandstone blocks, without any sculpting or training, those of which can be found abundantly even today, [unintelligible] in Tees or at the left bank of the Tisza in Csongrád County, but at the right bank of the Tisza, in the wetlands among the sandy areas, if two or three feet of dirt is removed, in the form of layers in one, sometimes two feet thick. The reason of why one skeleton was placed among more stones than the other is, that according to an old burial custom, they placed as many stones beside the dead as the number of enemies he killed in battle. The bronze objects, and the small coin of Trajan, were found beside these skeletons« (**figs 4-5, 1**)[22]. The harpoon was found in a completely different area in the northwestern part of Magyartés, in the vicinity of burial mounds right beside the Körös brook and the floodplain of the Tisza River. For the location of the site of recovery, it is again important to cite István Tóth's letter: »The arrow and the other coins were discovered at graves that appeared in the high banks of the Körös Stream in the North-Western Tees puszta as strong surfs, raised by winds during the floods of the Tisza, crushed those banks. Many thick, black pottery urns also came to light

Fig. 5 The topographical position of **1** Szentes-Magyartés (1st Military Survey of the Habsburg Empire, 1782-1785). – **2** Futog (2nd Military Survey of the Habsburg Empire, 1819-1869). – (Maps https://maps.arcanum.com [31.8.2022]).

in this landscape, but those are thought to be treasure vessels by the common people and were smashed by them; besides, ancient old cooking places, as they were carved and used in those high bank clay layers, became visible« (**fig. 4**)[23].

Based on modern satellite images, cadastral maps, and the 1st and 2nd Military Survey maps of the Habsburg Empire, it was not possible to locate these mounds, only the larger area beside the Török brook where this harpoon head was found. The harpoon head was assigned to the »period of the Gáva culture« in the literature[24]. This periodization can no longer be supported because the harpoon head originates from a different

findspot than the rest of the finds, and the fact that the rest of the finds can be dated earlier (Br D/Ha A1) than the current relative starting dates (Ha A2/Ha B1) of the Gáva ceramic style.
According to Tibor Kemenczei, the last harpoon from the territory of Hungary was found in 1972, during the construction of the Török-ér dam. This area lies northeast of Viss according to the cadastral map of the Austro-Hungarian Empire[25]. The bronze hoard was acquired incomplete. The known specimens include a socketed axe, a dagger, two spearheads, one legspiral, a funnel-shaped pendant, and a bronze harpoon (**fig. 14, 13**). The relative chronological position of these finds can be dated to the Br D period (Ópályi horizon)[26].

Bronze Harpoons from the Territory of Serbia

The bronze harpoon heads from Serbia were classified by Rastko Vasić under the Karaburma type of arrowheads. This typological group comprises the specimens from Belgrade-Karaburma/SRB (**fig. 14, 9**), Borjaš/Bordos (**fig. 14, 6**), Drmno (Braničevo District/SRB) (**fig. 14, 12**), Futog (**fig. 14, 11**), Koželj (Zaječar District/SRB) (**fig. 14, 4**), Belgrade-Zemun/SRB (**fig. 14, 10. 14**)[27].
Two of the Serbian metal harpoons are stray finds (Belgrade-Karaburma[28]; Koželj[29]) with no further data on their context (**fig. 14, 4. 9**). A completely preserved bronze harpoon was found as a stray find in Borjaš/Bordos (**fig. 14, 6**). The object's circumstances of discovery are unknown. As Ildiko Medović has pointed out, the presumed findspot is situated near the Tisza River, which is visible on the 1726 map of Luigi Ferdinando Marsigli[30].
Two Serbian specimens are wetland finds, from the Danube riverbed at Belgrade-Zemun (**fig. 14, 10. 14**)[31], perhaps due to accidental loss during fishing.
Unlike the harpoons from Hungary, only two Serbian metal harpoon heads originate from hoards. The first was discovered in the spring of 1989 in the Lugovi site at Drmno (**fig. 14, 12**). This assemblage consists of only a few finds: a flange-hilted sword, a flat axe, a flanged sickle, and sickle fragments. The bronzes were found in a brown ceramic vessel buried 1 m deep. Rastko Vasić dated this assemblage to Phase II (Ha A1) according to the Serbian relative chronological frame. Drmno is situated topographically close to the Mlava and the Danube rivers[32].
In 1913, the Hungarian National Museum purchased numerous objects from three sites in the current Vojvodina province, from István Regényi: Futog, Titel (South Bačka District/SRB), and Banatski Karlovac (South Banat District/SRB). The largest purchase was the Futog hoard, which was given to Yugoslavia by Hungary as part of restitution[33]. Unfortunately, no archival data is preserved on the finds' circumstances of discovery. As in the case of the Hungarian sites, it is again observable that the findspot is near a major river, in this case, the Danube (**fig. 5, 2**). This assemblage can be dated to the Phase II (Ha A1) hoards based on the Serbian relative chronological scheme. Considering the selected types (tools, ornaments, weapons, wagon parts, ingots), and the treatment of the artifacts, it is well comparable to the western-Hungarian, Kurd-type scrap hoards belonging to the same period. The Futog hoard is also important as the only assemblage with both fishhooks and a harpoon (**fig. 14, 11**)[34].

A Metal Harpoon Head from Bulgaria

From the territory of Bulgaria, we are aware of one similar metal harpoon. It is a stray find from the Lovech region/BG. It has double spurs similar to the Futog specimen. The presumed findspot is close to the Osam River (**fig. 14, 5**)[35].

The Metal Harpoon Head from the Ráth Collection

The last specimen that belongs to the group of barbed metal harpoons with a line hole and a spur was found in the Ráth Collection (**Appendix I, 2; fig. 1, 3; 2, 2**). This massive specimen lacks precise context and its place of recovery is completely unknown. Based on the specimens discovered thus far, it most likely originated in modern-day Hungary or Serbia, and its relative chronological position is most likely the Br D/Ha A1 period.

Metal Harpoons from Hungary and Serbia

Most bronze barbed harpoons were distributed near the Danube and Tisza Rivers[36]. All sites are either near these two main rivers (within 1-2 hours by foot) or situated close to smaller rivers and brooks (Körös ér, Great-Zádor brook, etc.). The wetland nature of these sites is most visible on the maps of the 1st and 2nd Military Surveys of the Habsburg Empire, which depict the environmental conditions of the Carpathian Basin before the grand regulations of the Danube and Tisza Rivers. The metal harpoons were deposited in hoards and most likely had been used in this environment, which is ideal for harpoon fishing due to its shallow water level. The hoard assemblages containing metal harpoon heads can be generally dated between the Br D and Ha A1 periods. Only in the case of the lost Karcag-Zádor harpoon head is the selection of younger hoards (Ha B1) known. In our opinion, this find was most likely an »out-of-time object«. The inclusion of such finds in Ha B1 assemblages from the territory of Hungary seems to be a common hoarding pattern[37].

THE ORIGIN OF THE METAL HARPOONS

As Rastko Vasić has pointed out, the barbed metal harpoons with a spur evolved from their antler predecessors, which are generally called toggle-head harpoons in the literature[38]. The origin of different harpoon types in organic material can be traced back to the Paleolithic era[39]. The more refined counterparts of the metal harpoon heads appeared much later, around the Copper Age of Southeast Europe. These detachable antler harpoon heads have no barbs, but they are self-bladed and have a circular or oval-shaped cross-section, one spur, a socket part, and a line hole.

Ethnographic and archaeological research quickly revealed that this harpoon design is similar to those found among native Americans, particularly the Inuits of Canada and Greenland[40]. In Hungary, the identification of these objects as harpoon heads can be related to Miklós Gábori's 1950 study, which analyzed and compared the Tószeg (Jász-Nagykun-Szolnok County/H) harpoon and its related finds to the ethnographic examples for harpoon arrows[41]. This harpoon design is common in European prehistory, especially in the Copper Age and Late Bronze Age material (e.g., Bad Buchau »Wasserburg« [Biberach District/D])[42]. The detachable antler harpoon heads appeared in various parts of Europe. Emblematic examples are known from southern Germany, around the area of the Federsee. Moreover, numerous examples in the archaeological material of Swiss lake dwellings have been published[43].

Examples of similar harpoon heads can also be mentioned from Southeast Europe. A harpoon head is known from Ljubljansko barje (Ljubljana/SLO). New finds were recently excavated in the Copper Age site at Pietrele (Giurgiu County/RO), and the Middle Bronze Age (MBA) site at Pecica-Şanțul Mare (Arad County/RO)[44]. In the territory of Hungary, the largest quantity of such harpoons was found in Early Bronze Age (EBA) and MBA settlements, e.g., Békés-Várdomb, MBA (Békés County/H); Deszk, MBA (Csongrád-

Fig. 6 Antler harpoons from Tószeg-Laposhalom. – (Hungarian National Museum, photos J. G. Tarbay). – Scale 2:3.

Csanád County/H); Jászdózsa-Kápolnahalom, MBA (Jász-Nagykun-Szolnok County/H); Kakucs-Turján, MBA (Pest County/H); Mezőcsát-Pástidomb, EBA (Borsod-Abaúj-Zemplén County/H); Szelevény, EBA (Jász-Nagykun-Szolnok County/H); Szihalom, EBA (Heves County/H); Tiszaluc-Dankadomb, EBA (Borsod-Abaúj-Zemplén County/H); Tiszaug, EBA (Bács-Kiskun County/H); Tiszafüred-Ásotthalom, MBA (Jász-Nagykun-Szolnok County/H); Tószeg, EBA (fig. 6); Túrkeve-Terehalom, MBA (Jász-Nagykun-Szolnok County/H)[45]. In the Carpathian Basin, barbed bone harpoons with a spur were used during the Late Bronze Age. Gábor Ilon published two specimens, one from the Gór-Quadrant K-6 (Vas County/H) late Urnfield settlement, and another from the Győr-Ménfőcsanak (Győr-Moson-Sopron County/H) Tumulus culture-Urnfield site[46]. A total of 36 antler harpoons were excavated in the Bronze Age-Early Iron Age phases of Mošorin-Feudvar[47].

The main formal difference between the antler harpoon heads and the studied metal harpoon heads is the absence or presence of barbs. As far as we are aware, the »missing link« between the two kinds of harpoon heads has been discovered in Auvernier (Ct. Neuchâtel/CH). This is a bronze artifact imitating the shape of a harpoon made of organic material[48].

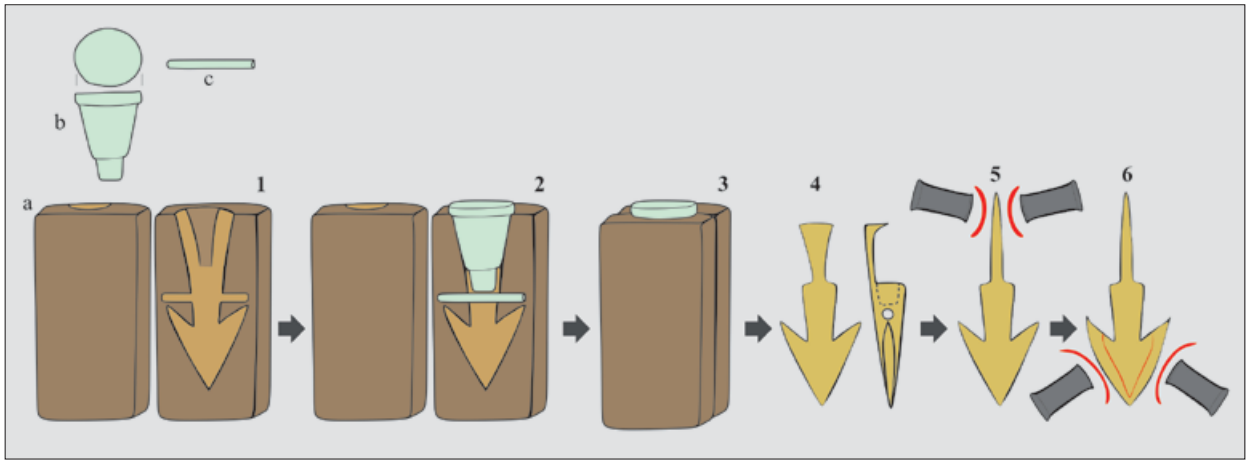

Fig. 7 The metal harpoon heads' schematic steps of production. – (Graphic J. G. Tarbay).

MAKING THE METAL HEADS

Ildiko Medović noted that harpoons like the one from Borjaš/Borđos could be cast in two-piece molds[49]. This is an important observation, but it does not elaborate on how the bronze heads of these fishing instruments could be made. Certainly, as cast objects, metal harpoons can be made by numerous techniques (e. g., two-piece molds, sand casting, lost-wax casting) which would leave identical or nearly identical traces on a completely manufactured finished product. Casting is not a rigid practice. It gives plenty of space for improvisation, individual innovations, and ideas, but essentially strikes for the most economical and effective creation of the desired artifact. Here, one scenario will be given for how these objects could be made (**fig. 7**).

Since no casting mold can be associated with the metal harpoon heads in question, their casting technology can be reconstructed based on casting molds of comparable weapons (spearheads[50], arrowheads)[51] and manufacturing traces[52] observed on the metal harpoons themselves. The easiest way to make these weapons is to cast them into a two-piece mold with two negatives (**fig. 7, a, 1-3**), into which a short casting core (**fig. 7, b**), and a fixing rod (**fig. 7, c**) are inserted. Casting seams referring to two-pieced molds with two negatives and comparable casting techniques are well observable on the narrow sides of the studied Hungarian specimens. The material of the two-piece mold depends on individual choice, and it leaves no characteristic traces on completely manufactured and used objects with significant abrasion marks caused by long use. Based on the petrographic analysis of a significant number of casting molds in the collection of the Hungarian National Museum, the choice of material was diverse in the Carpathian Basin, from specially tempered clay to different types of stones. Metal casting molds were also present in this region. However, it seems that the most common material was sandstone, which is an easily manufacturable material available locally in great quantity[53]. The material of the short casting core can be identical to the molds. The imprint of this mold part is well observable inside the socket and along the inner part of the spike. Thus, these objects were most likely cast from the socket where the core was inserted. On the studied specimens, no traces of casting jets were visible on any part due to the comprehensive post-casting treatment. Spearheads and arrowheads provide fine analogies for the direction of casting. Spearheads were cast from the direction of the socket, and arrowheads from the direction of the tip or socket. In this case, the core was closed inside the molds. After post-casting treatment of the blade part, this technique left no visually observable traces. Another scenario is that the harpoons were cast from the direction of the socket. In this case, the casting jet

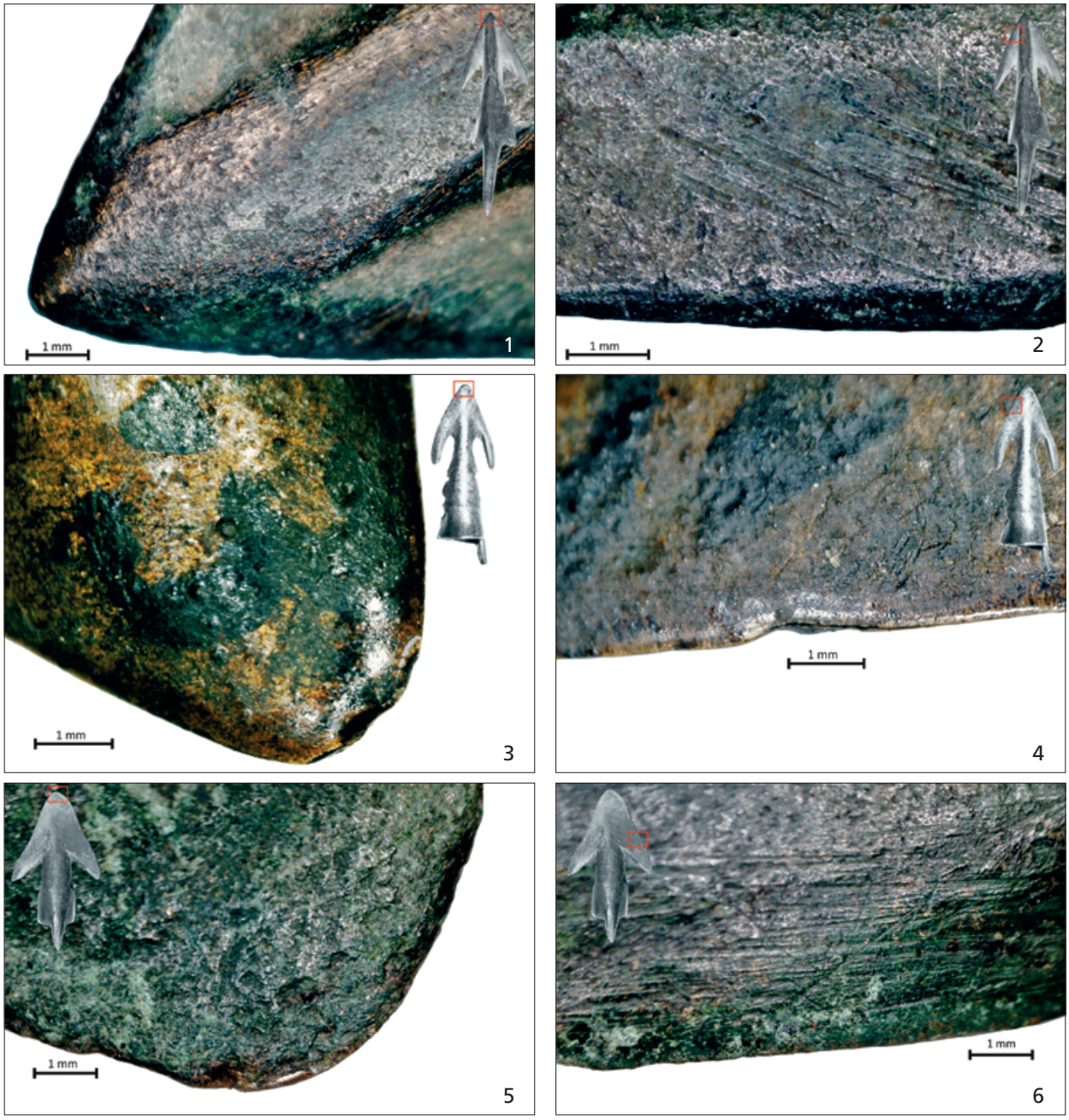

Fig. 8 Metalwork production and use-wear analysis of harpoon heads: **1** re-shaped tip (Budapest-Buda). – **2** hammered and sharpened edge (Budapest-Buda). – **3** dents on a harpoon's tip (Szentes-Magyartés). – **4** dents on the cutting edge, near the tip (Szentes-Magyartés). – **5** modern tip damage (Ráth Collection). – **6** hammered, sharpened edge (Ráth Collection). – (Hungarian National Museum, photos J. G. Tarbay).

was not removed but shaped by cycles of hammering into a spur (**fig. 7, a, 4-5**). Comprehensive hammering traces and the lack of jets on the rim of the studied finds' socket may support this idea. Most harpoons (e. g., Budapest-Buda, Ráth Collection) have one horizontal line hole above the socket[54], inside the solid part. These holes were made by casting, which is the most economical way to form such parts in cast metal artifacts. The making of the line hole by casting is analogous to the manufacture of spearheads' peg holes. In the case of spearheads, a rod is inserted inside the mold across the casting core. This construction design allows us to hold the casting core in place and at the same time create the peg holes. In the case of most

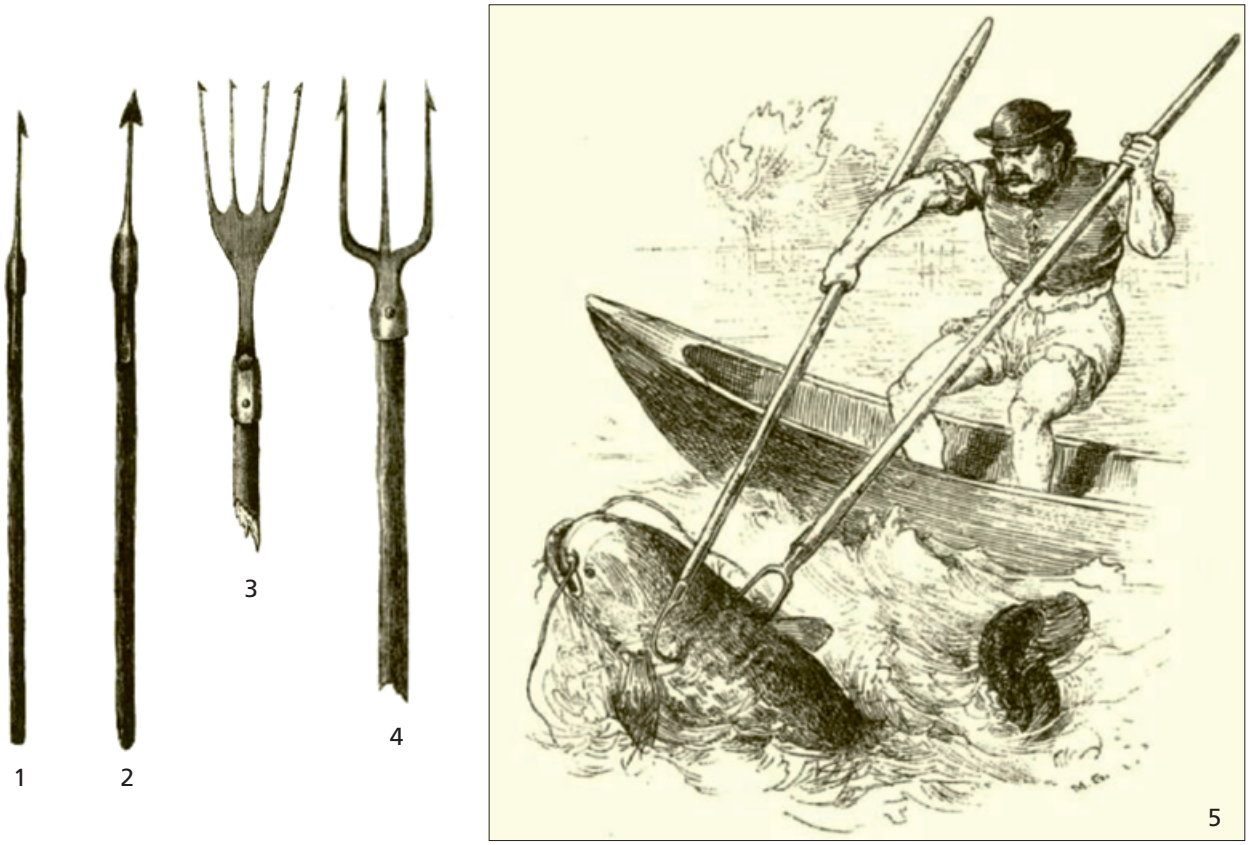

Fig. 9 Ethnographic harpoons and harpoon fishing from the Carpathian Basin: **1** permanently hafted *szekler* thrusting harpoon (Transylvania, Romania). – **2** permanently hafted thrusting harpoon from the Bodva River area (Slovakia). – **3** permanently hafted harpoon from Velence Lake (Hungary). – **4** permanently hafted harpoon from the area of Moftinu Mic near the Crasna River (Romania). – **5** catfish (*Silurus glanis* Linnaeus, 1758) harpooning at Tápé (Hungary). – (After Herman 1880, 342. 345. 347. 489 figs 226. 229. 231).

harpoons, the rod is simply inserted inside the mold right above the casting core. Since only a short mold is required to make these weapons, they do not require secure fastening against core rising defects. An exception is the Szentes-Magyartés harpoon, which is equipped with double line holes (**fig. 1, 2**), similarly to some of the Bronze Age organic harpoons (e. g., Békés-Várdomb; Szihalom; Tószeg)[55]. The one closest to the rim of the socket holds the casting core similar to the spearheads.

After casting, the freshly made metal harpoons went through the typical post-casting treatment phases, including the removal of flashes and casting seams, and the grinding of their surfaces. Based on the artifacts available for macroscopic observation, barbs and the weapons' tips received a comprehensive hammering (**figs 7, a, 6; 8, 2. 6**). This could be done by cycles of cold hammering and/or annealing. Maintenance also includes this kind of manufacturing process. As the objects reached the end of their use-life, their midrib was also presumably worked (**fig. 1, 3**).

FUNCTIONAL DESIGN AND USE-WEAR TRACES

All the typological features of the Southeast European bronze harpoons display an intentional and functional design, backed by millennia of technological development. First, one must understand the main purpose of a detachable harpoon, which is to completely embed the head into the flesh of the animal[56]. How a Late Bronze Age metal harpoon head operates and how it can be shafted can be best understood if we

rely on ethnographic analogies and cross-cultural parallels, particularly on those where similarly constructed harpoon heads have emerged[57].

The best sources of Hungarian ethnographic analogies for fishing techniques in the present and historical territory of Hungary are the works of Ottó Herman and Ede Solymos. Due to strict restrictions, harpoon fishing was no longer actively practiced in the Carpathian Basin. It was permanently banned under the Fisheries Act of 1925, and it is currently prohibited under Hungarian law[58]. The ethnographic examples used in the Carpathian Basin are one or more-pronged thrusting harpoons (permanently hafted barbed points) (**fig. 9, 1-4**). The specimens with more than one prong most closely resemble ancient Roman tridents, the antecedents of which are known in prehistoric material (e. g., Uluburun [Antalya Province/TR]; Pariana [Lucca Province/I], Ostrov [Vratsa Province/BG]). The casting mold of a one-pronged harpoon head with two pairs of barbs is known from Příkazy (Olomouc District/CZ)[59]. In the late 1800s, they were used by local poachers for stringing or throwing against spawning or ticking fish such as pikes (*Esox lucius* Linnaeus, 1758), carp (*Cyprinus carpio* Linnaeus, 1758), and catfish (*Silurus glanis* Linnaeus, 1758), which swam close to the water surface or near the edge of ponds and rivers. The harpoon could also be deployed in winter when the water surface was cleaner[60]. The harpoon form that appears in the Hungarian ethnographic material cannot be interpreted as a prime analog to the local Late Bronze Age detachable harpoon heads. The Late Bronze Age harpoon heads are more comparable to the American ethnographic material, in essence, with the Nunavut culture (**figs 10. 12**), which has long served as the main analog for interpreting different prehistoric harpoon heads and techniques. In the followings, I use Robert W. Park's and Douglas R. Stenton's handbook on harpoon heads of the Nunavut, northern Canada (2200 BC - AD 1800)[61].

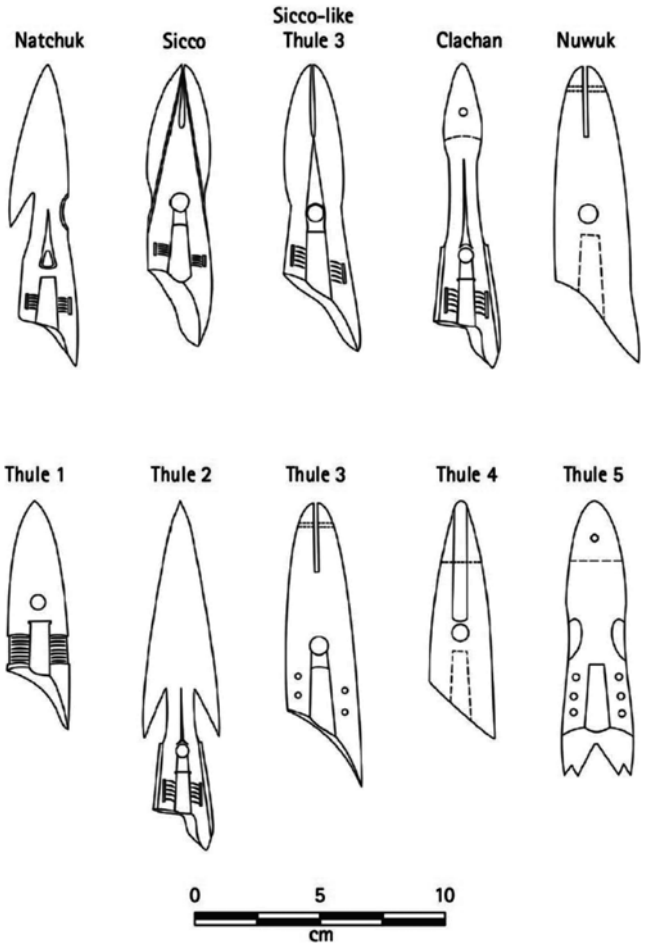

Fig. 10 Precontact Inuit harpoon heads. – (After Whitridge 2016, fig. 35, 2). – Scale 1:3.

The Nunavut harpoon heads followed a broadly similar course of development as that seen between the European Copper Age and the Late Bronze Age. Pieces with the most similar typological construction to the studied metal pieces include the harpoon heads (Thule Type 2) made of antler, ivory, and bone, belonging to the Classic Thule cultural tradition (AD 900-1600) (**fig. 10**)[62]. The tip of these harpoons pierces the skin of the animal, and the blade widens the entry wound (**fig. 11, 2**). Deepening and widening the wound is important not only for embedding but also because this way, the animal loses as much blood as possible. This slows down and weakens the prey, reducing chasing time and allowing the hunter to spare energy. The tip and the blade must be maintained and properly sharpened to penetrate and cut through the additional »defensive« layers of fish and aquatic mammals. In the Carpathian Basin, the scutes of sturgeons or the dense fur of beavers may come to mind. The hunter's thrust, throw, or shot from a bow must be strong

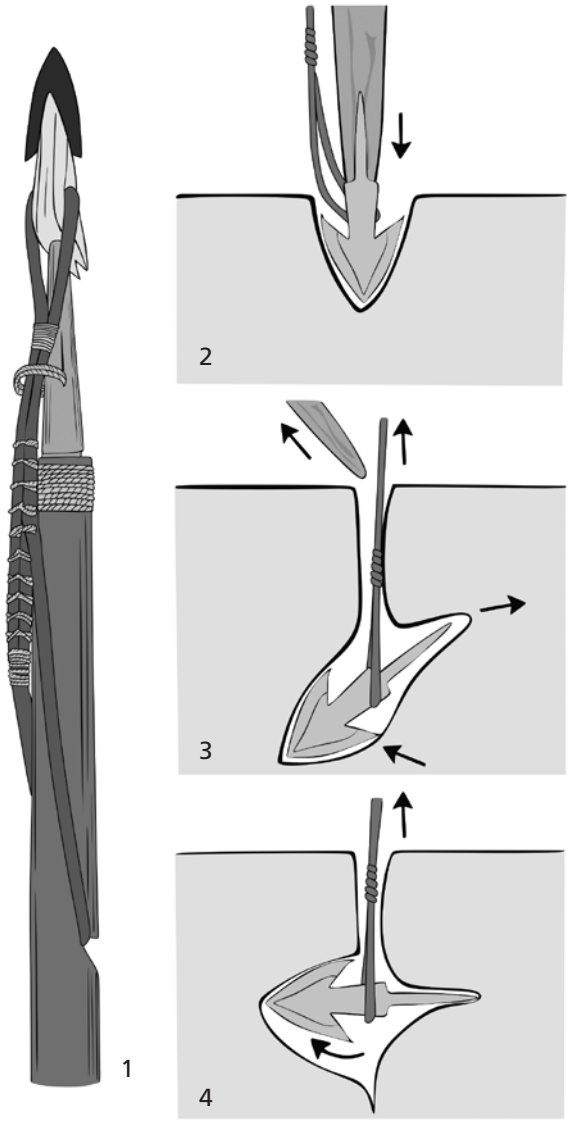

Fig. 11 **1** Toggle harpoon head from the Kuskokwim River, southwestern Alaska/US. – **2-4** the embedding of the toggle harpoon. – (1 after Mason 1900, fig. 81; 2-4 graphic modified after Park/Stenton 1998, 24).

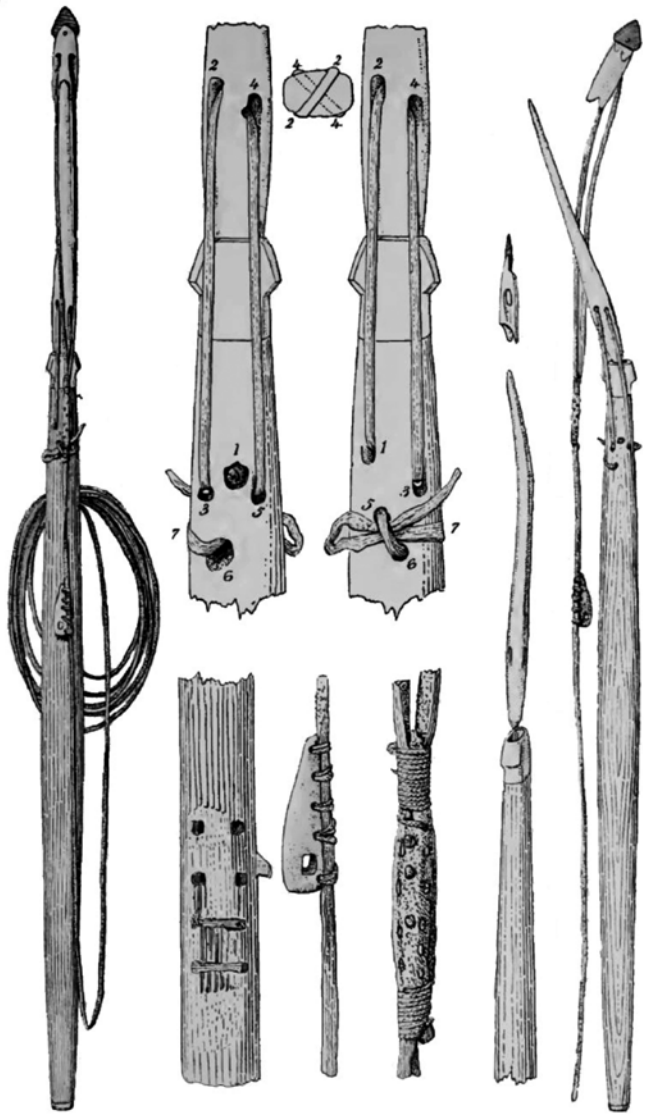

Fig. 12 Complete seal harpoon set from Cumberland Sound, Qikiqtaaluk Region, Nunavut/CA. – (After Mason 1900, pl. 6).

enough not only to pierce these defensive layers but also to embed the harpoon head deep enough to reach lower layers of blubber, fat, and muscle[63]. The Southeast-European bronze harpoon heads are not only equipped with single asymmetrical spurs like their antler counterparts but also with backward-pointing barbs. Exceptional pieces like the Futog harpoon have double asymmetrical spurs. These parts cause the »toggle« effect, the rotation of the head ninety degrees within the wound. As a result, the harpoon acts as a sort of an »anchor«, preventing the prey from escaping. After its release into the animal, the movement of the metal head can be controlled by the harpoon line which is affixed to the head's line hole. The fleeing animal moves the head inadvertently but with the help of the line, the hunter can intentionally pull them back (**fig. 11, 3-4**)[64].

The typological characteristics of the studied Late Bronze Age Southeast-European harpoon heads suggest that they were intended to be »detachable barbed points«[65]. The short socket indicates that they were not intended to be permanently attached to the foreshaft and instead served the purpose of easy detachment

(**fig. 11, 1**). In contrast to local Late Bronze Age spearheads, where the cavity of the socket runs almost the entire length of the midrib, and the wooden shaft's tip completely fills it, the harpoon heads have only few-centimeters-deep sockets. In Southeast Europe, preserved organic remains of harpoons have not been found. We are also unaware that such remains would be preserved in other parts of Europe. Thus, only ethnographic analogies again help us to imagine what these organic parts looked like. Depending on how the harpoon was used, it could be hafted in different ways: thrusting harpoon, throwing harpoon, harpoon bow[66]. According to Robert W. Park and Douglas R. Stenton, the heads of the *unaaq* are hafted on an approximately 1-2-meters-long wooden shaft. The length of this shaft probably adjusted to the physical abilities of the hunter[67]. These may have been made in a similar way as spearheads' shafts, bits of which are preserved in the local Late Bronze Age material[68]. At the end of the shaft, a socket piece can be found which serves as the base of the foreshaft. In the case of thrown harpoons, the foreshaft is mobile. It comes apart from the socket piece when the animal is struck. The head detaches from the foreshaft and embeds into the animal's body, while the foreshaft is retrieved through a loose thong linked to the shaft. Thrusting harpoons have permanently attached foreshafts. The harpoon head is detached from the foreshaft with the aid of a backward tug on the harpoon shaft[69]. The existence of arrow harpoons in the ethnographic material[70] gives credit to those scholars who classified these objects as arrowheads. Otis T. Mason, in his monograph titled »Aboriginal American Harpoons: A Study in Ethnic Distribution and Invention«, discusses the harpoon arrows of Venezuelan indigenous peoples. In these cases, we can see an average arrowhead structure, the difference being that the part near the tip has an analogous construction and operating principle to the above-discussed throwing *unaaqs* (**fig. 13**)[71].

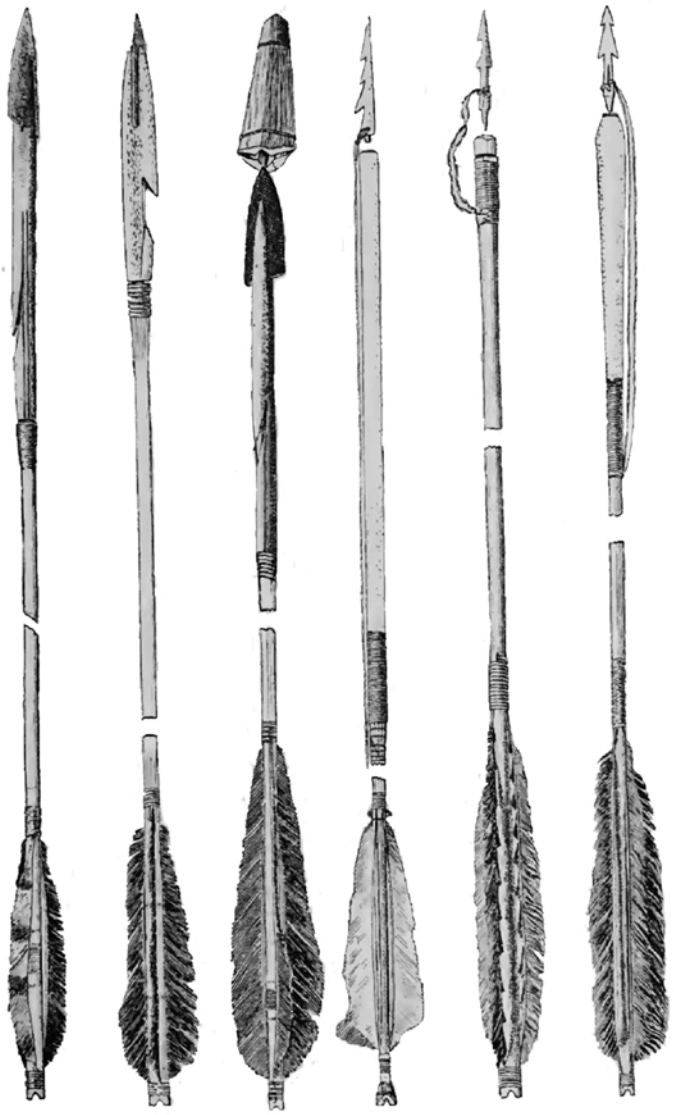

Fig. 13 Harpoon arrows from the Alaskan Peninsula. – (After Mason 1900, pl. 16).

During the preparation of this study, we had the opportunity to examine only three metal harpoon heads (Budapest-Buda; Szentes-Magyartés; and Ráth Collection). Therefore, we can only make a few remarks about use-wear. The most distinctive trace is a small flattening damage on the tip caused by an impact on a harder surface (**fig. 8, 3**). In this harpoon, a small dent is also visible along the blade, near the tip (**fig. 8, 4**). These traces are well in line with the presumed usage of the weapon, which can be thrusting, throwing,

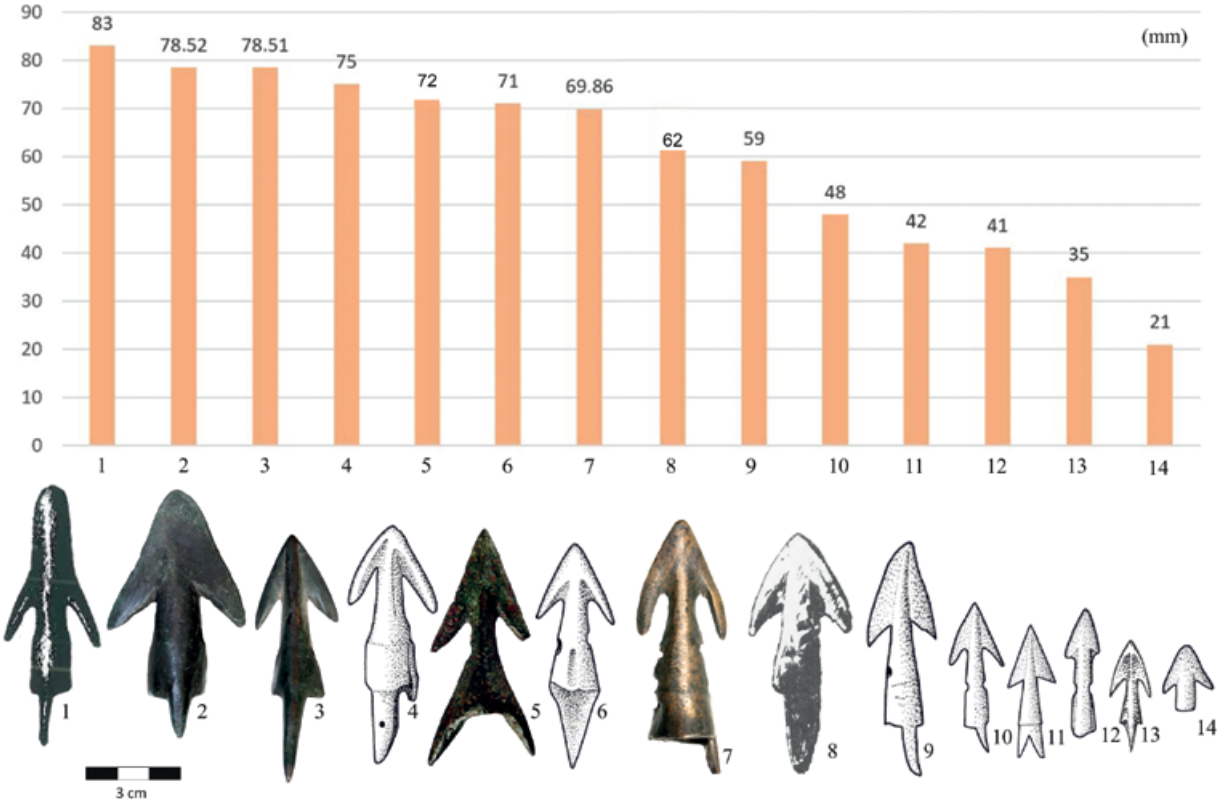

Fig. 14 Sizes of detachable barbed metal harpoons with spurs: **1** Kisvarsány-Hidéri. – **2** Ráth Collection. – **3** Budapest-Buda. – **4** Koželj. – **5** Lovech region. – **6** Borjaš/Borđos. – **7** Szentes-Magyartés. – **8** Karcag-Zádor. – **9** Belgrade-Karaburma. – **10** Belgrade-Zemun. – **11** Futog. – **12** Drmno. – **13** Viss-Török-ér. – **14** Belgrade-Zemun. – (Compiled after Stanczik 1975, 73. 77-78; Mozsolics 1973, 150 pl. 54, 10; Vasić 2015, 76 pl. 18, 371-377; Valentinova 2018, 544 cat. no. 552).

and shooting actions. The Budapest-Buda and the Ráth Collection harpoons showed no traces of prehistoric micro edge-damage (**fig. 8, 5**). But they were most likely used for a long period, as along their tip and blade, comprehensive reshaping marks analogous to traces observed on spearheads are visible. In the case of Budapest-Buda, a part of the tip has been shortened (**fig. 8, 1**). The Ráth Collection specimen was hammered thoroughly, resulting in the disappearance of the midrib. This may be due to the harpoon entering an advanced stage of use-life prior to this deposition.

PREY IN THE CARPATHIAN BASIN?

Harpoons are commonly associated with hunting sea mammals (seals, whales, walruses, and narwhals), freshwater mammals (hippos, beavers), and naturally, fish, in aquatic environments. Research also knows their use in terrestrial conditions to hunt, for instance, birds, gorillas, monkeys, red deer, roe deer, wild pigs, and elk. The Yanomami people in the Amazon rainforest even used them as weapons in combat[72]. The above list is a good example of how a wide range of creatures could have been hunted with harpoons based on ethnographic examples from all over the world. In terms of our topic, we are primarily concerned with a specific period (Br D/Ha A1-Ha B1) and region of Southeast Europe (**figs 14-15**) and the application of detachable, barbed metal harpoon heads with a line hole and a spur.

These metal harpoon heads range in size from 3.5-8.3 cm. The largest head is the piece from the Kisvarsány-Hidéri Tisza River site. The 7-8 cm size is characteristic of the larger metal harpoon heads. Some of

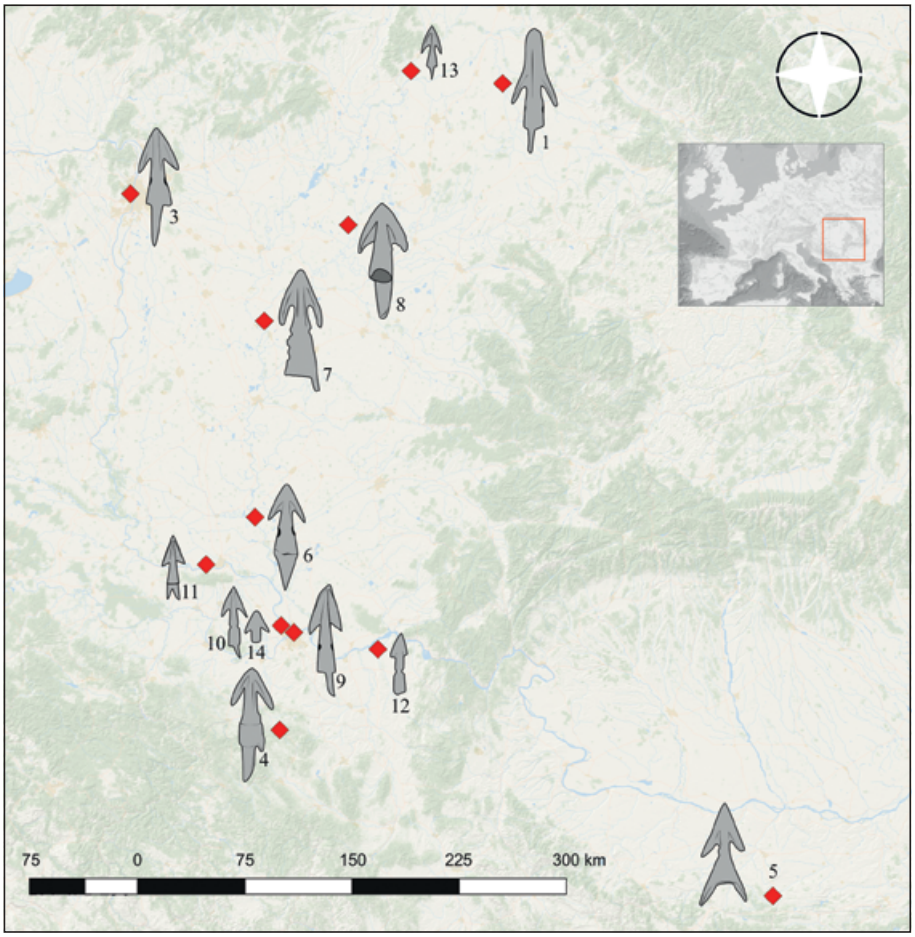

Fig. 15 Distribution of detachable barbed bronze harpoons with line holes and a spur: **1** Kisvarsány-Hidéri. – **3** Budapest-Buda. – **4** Koželj. – **5** Lovech region. – **6** Borjaš/Borđos. – **7** Szentes-Magyartés. – **8** Karcag-Zádor. – **9** Belgrade-Karaburma. – **10** Belgrade-Zemun. – **11** Futog. – **12** Drmno. – **13** Viss-Török-ér. – **14** Belgrade-Zemun. – (See **fig. 14**).

the Serbian specimens are smaller than 3-4 cm (**fig. 14**). Thus, not only the construction but also the size of these harpoon heads correspond relatively well to ethnographic analogs about specialized hunting of small and medium-sized mammals and fishes. The question is, what kinds of creatures were hunted with harpoons in the Late Bronze Age Carpathian Basin?

The use of harpoons as a weapon in combat is also possible, but in the light of local Late Bronze Age weaponry, it is not plausible. In the Carpathian Basin and the northern Balkans, a wide variety and quantity of bronze armor (helmets, greaves, cuirasses, shields), offensive weapons (daggers, swords, axes, spearheads), and projectile weapons appear[73]. Except for certain arrowhead types, which are equipped with barbs and occasionally with a spur[74], practically, none of the offensive weapon types were designed to be embedded in the opponent permanently, but for quick stabs, slashing movements, and cuts. We cannot see harpoons in burials with weapons or hoards, whose composition represents warrior identity. In hoard assemblages, metal harpoons are possibly symbols of local specialist identity, similarly to the selection of metallurgist tools (e. g., the awl and chisel of Futog)[75], which also do not dominate the content of the hoards with heterogeneous composition.

The historical terrestrial and aquatic fauna of the Carpathian Basin includes a huge number of species, including several large animals that can be compared to specimens known from the ethnographic literature in terms of size and strength[76]. However, the examined harpoons were most probably used for catching large fish. First, it is quite certain that the aquatic life of the Danube, Tisza, and northern Balkan rivers was much more abundant in prehistoric times than today, offering ample opportunities for fishing. Riverine and marine habitats begun to decline only from the 19th century onwards, in consequence of overexploitation,

dam construction, river regulations, water pollution, and cargo traffic[77]. The second and main argument for aquatic exploitation is the uniform geographic location of the harpoon sites. As I have mentioned already, all of them were found near the major river sections of the Danube and Tisza, or smaller rivers and brooks. The barbed metal harpoon head discovered in the Danube riverbed at Belgrade-Zemun is an especially significant piece, in my opinion. One can raise the possibility that this object was accidentally lost during a failed fishing expedition[78].

The above arguments suggest that metal harpoon heads were developed for the fishing of larger fish species living in local rivers, as has been suggested by Dušan Borić and Ildiko Medović[79]. Several fish species are known in the region that can be well compared to the large marine mammals and fish hunted with *unaaq* in terms of weight, length, agility, and strength. Among others, various species of sturgeon can be mentioned, including the now-extinct beluga sturgeon (*Huso huso* Brandt, 1869). Catfish (*Silurus glanis* Linnaeus, 1758), northern pike (*Esox lucius* Linnaeus, 1758), and carp (*Cyprinus carpio* Linnaeus, 1758), which are present in almost every freshwater in the Carpathian Basin, are also very plausible candidates (**fig. 16**). Owing to Ottó Herman's seminal monograph from 1880 on fishing in the Carpathians, we are also aware that some of these fishes and other species (e. g., European bullhead – *Cottus gobio* Linnaeus, 1758; Alpine bullhead – *Cottus poecilopus* Heckel, 1837; Brown trout – *Salmo trutta* Linnaeus, 1758; river trout – *Salmo trutta fario* Linnaeus, 1758) were fished by different types of thrusting and throwing harpoons[80].

A fundamental problem with local archaeological research, however, is that, in contrast to earlier prehistoric archaeological periods, ichthyoarchaeological research on Late Bronze Age fishes is severely underdeveloped. The online database containing prehistoric fish remains comprises only one site from western Hungary where fish remains (northern pike, *Esox lucius* Linnaeus, 1758; and common bream, *Abramis brama* Linnaeus, 1758) were identified: Balatonmagyaród-Hídvégpuszta (Zala County/H), a site near to the Kis-Balaton[81]. New results were provided for the Győr-Ménfőcsanak settlement[82] and the Dunakeszi-Székes-dűlő site (Pest County/H)[83]. The rest of the sites studied can be dated between the Early Bronze Age and the Middle Bronze Age from sites near the Tisza, Danube, Körös, and Balaton. Except for beluga sturgeon, all three large fish species (catfish, *Silurus glanis* Linnaeus, 1758; northern pike, *Esox lucius* Linnaeus, 1758; and carp, *Cyprinus carpio* Linnaeus, 1758) are present in this sample[84]. Based on archaeozoological, ethnographic, and historical analogies, we will briefly describe four potential fish species that were or may have been fished locally with harpoons in the period investigated.

Carp (*Cyprinus Carpio* Linnaeus, 1758)

The size range of carp (*Cyprinus carpio* Linnaeus, 1758) may also necessitate harpoon fishing (**fig. 16**, **D**). The favorable habitats for carp are slow waters, shallow lakes, tributaries of the middle and lower reaches of rivers, backwaters with rich vegetation, and swampy waters[85]. According to Ottó Herman, around 1880, in favorable conditions, carps could be grown more than 1 m in length and reach 30 kg[86]. Alfred Brehm estimates their weight between 15-20 kg, and their length at 1.5 m. He also notes that certain specimens can weigh even 35 kg[87]. According to László Bartosiewicz and Clive Bonsall, the usual total weight of prehistoric carps is 30 kg and their usual length is 1 m[88]. The current official carp record in Hungary weighs over 44.15 kg[89].

The ideal season for carp harpooning is between April and May when they spawn. Carps can be best harpooned around dusk and dawn[90]. They can also be fished in winter when the water surface is transparent. Ede Solymos presents a Hungarian carp harpooning strategy. The carp are enclosed by three boats, with the harpooner standing on the bow of the middle one. Spawning carp are pushed towards the water's edge

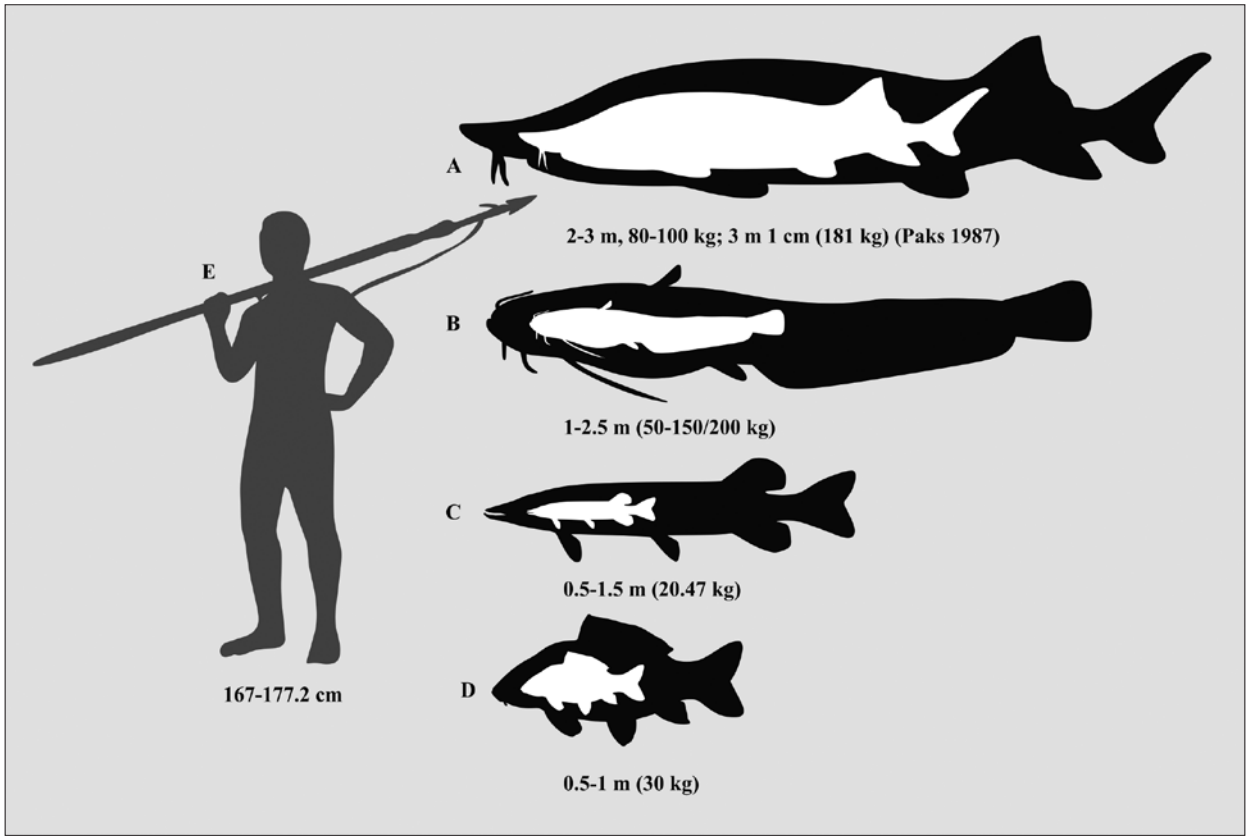

Fig. 16 Comparison of sizes: **A** beluga sturgeon (*Huso huso* Brandt, 1869). – **B** catfish (*Silurus glanis* Linnaeus, 1758). – **C** northern pike (*Esox lucius* Linnaeus, 1758). – **D** carp (*Cyprinus carpio* Linnaeus, 1758). – **E** human, Late Bronze Age (Tumulus culture). – (A-D after Bartosiewicz/Bonsall 2004; E after Hajdu 2008, tab. 5).

with oars. The harpoons are thrown into shallow water from 12-15 m[91]. Ottó Herman also notes ethnographic examples of spawning carp harpooning in Lake Balaton by the Tihany peninsula, Lake Velence, and Lake Fertő/Neusiedl[92].

Carps can be found in all major rivers and lakes of the Carpathian Basin[93]. Based on archaeozoological data, the carp was one of the most commonly fished species during prehistoric times[94]. Carps were present in several Bronze Age sites near the Tisza and Danube Rivers, e. g., Ároktő-Dongóhalom (Borsod-Abaúj-Zemplén County/H); Békés-Városerdő (Békés County/H); Dunaújváros-Kosziderpadlás (Fejér County/H); Polgár-Basatanya (Hajdú-Bihar County/H); Tiszaug-Keménytető (Bács-Kiskun County/H); Mošorin-Feudvar (South Bačka District/SRB); Visegrád-Lepence (Pest County/H). One carp bone was found in the Late Bronze Age, Tumulus culture phase of the Győr-Ménfőcsanak settlement[95].

Northern Pike (*Esox Lucius* Linnaeus, 1758)

The northern pike (*Esox lucius* Linnaeus, 1758) is 40 cm long on average (**fig. 16, C**). Ákos Harka studied 204 fishes in 1980, collected from the Tiszafüred section of the Tisza River. The length of these animals varied between 290-870 mm, and they weighed between 300-7700 g[96]. According to Károly Pintér, the largest pike in Hungary was 117 cm long and weighed over 17.2 kg[97]. In 1880, Ottó Herman also noted pikes weighed over 10-15 kg, and specimens reached 2 m and 35 kg[98]. László Bartosiewicz and Clive Bonsall estimated pike sizes from archaeological assemblages between 0.5-1.5 m and 5-25 kg[99]. The current official

pike record is 20 kg and 134 cm in length and comes from the Sajóörs-Örösi Lake (Borsod-Abaúj-Zemplén County/H)[100].
In the Carpathian Basin, pikes have large populations in all water types, especially in swamps, backwaters, lakes with rich vegetation, and river edges[101]. According to Ede Solymos, pike harpooning is possible all year. The best season for their harpooning is the last month of winter, as their spawning starts on February 24 and continues into March. During this period, the pikes swim to the edge of the waterfront or spawn in shallow waters with rich vegetation, and are not careful enough. Spawning typically occurs in the early hours of the morning and lasts for 2 or 5 days[102]. Like carps, the northern pikes can be harpooned during winter when the ice surface is transparent[103]. Ottó Herman also notes ethnographic examples of spawning pike harpooning in the area of the Tihany peninsula (Lake Balaton)[104]. Alfred Brehm notes pike harpooning with thrusting and throwing harpoons and arrow harpoons from the territory of Germany[105].
Northern pike remains have been discovered at EBA and MBA sites including Balatonmagyaród-Hídvégpuszta (Kis-Balaton area); Békés-Városerdő; and Gyoma (Békés County/H, Körös River); Polgár-Basatanya; Tiszalúc-Dankadomb; and Tiszaug-Keménytető (Tisza River)[106]. Twelve fishbone remains of pikes were found in the Late Bronze Age Tumulus culture phase of the Győr-Ménfőcsanak settlement[107].

Catfish (*Silurus Glanis* Linnaeus, 1758)

Another possible large fish that can be hunted with a harpoon is the catfish (*Silurus glanis* Linnaeus, 1758) (**fig. 16, B**). This fish species is the second largest in the Carpathian Basin after the beluga (*Huso huso* Brandt, 1869). They are dangerous predators. These fish can also hunt as killer whales and prey on domesticated animals (ducks, geese, etc.) drinking on the water's edge. Jakob Heckel and Rudolf Kner note examples when specimens even attacked waterfowl, ducks, or geese grazing on the beach. Remains of a poodle and a little boy were allegedly found in the belly of a large catfish caught in Bratislava/SK (former Pressburg)[108]. A full-grown catfish can reach up to 2 m and weigh 100 kg. According to Ottó Herman, catfish reached 50 kg on average in the 19th century. At the time, examples for 200-kilogram specimens were also known[109]. According to Alfred Brehm, specimens 3 m long and 200-250 kg in weight were caught in the Danube[110]. László Bartosiewicz and Clive Bonsall estimated historical catfish parameters between 2-2.5 m, and 150-200 kg[111]. The current catfish record in Hungary was caught in the Tisza River (between Tiszaeszlár [Szabolcs-Szatmár-Bereg County/H] and Tiszakarád [Borsod-Abaúj-Zemplén County/H]). This specimen weighed over 108 kg and was 242 cm long[112].
In the Carpathian Basin, catfish spawn between May and June, sometimes in July[113]. Alfred Brehm notes that young catfish were caught by hooks and nets, while the larger ones were harpooned during the spawning season[114]. Ottó Herman also notes ethnographic examples of harpooning spawning catfish in the area of Tihany (Lake Balaton) and the Tisza River[115]. For the latter, a fine example is the catfish hunt from the area of Szeged-Tápé (Csongrád-Csanád County/H). The fisherman struck with a harpoon (type: permanently hafted barbed point) and a cutting hook (Hungarian *vágóhorog*) while the catfish pulled him in his boat. The harpoon was thrown into the back of the animal. The cutting hook was embedded in the belly of the fish. The cutting hook was also driven into the fish's jaw when pulled ashore. In the case of large specimens (200-300 kg), an accurate hit with the harpoon to the catfish's brain or spinal cord was essential. A badly struck animal endured the chase for hours (**fig. 9, 5**)[116]. This fishing method is especially dangerous for the fisherman because there is a risk that the animal will tip over the boat during chasing. Such a case is even noted by Alfred Brehm[117]. The Inuit drag float[118] (*avataq*), made of inflated animal skin, was designed specifically for hunting large and powerful aquatic animals (e. g., narwhal). A harpoon line is attached to

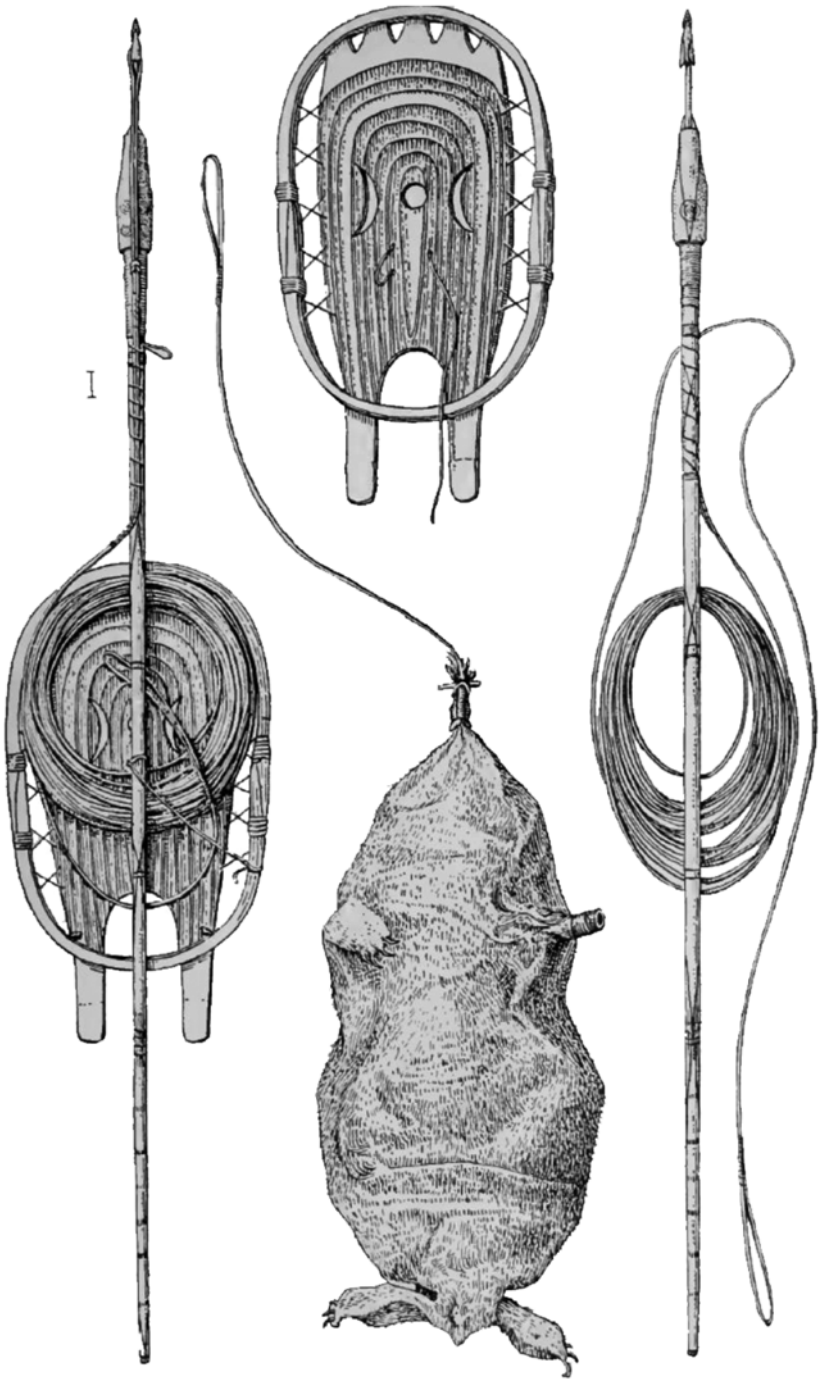

Fig. 17 Toggle harpoon, line, and float from Kusilvak, Yukon River, Alaska/US. – (After Mason 1900, pl. 14).

this instrument. When the animal is harpooned, the drag float is tossed overboard. The movement of the float and its re-appearance on the water surface would signify the exact location of the animal. When the animal re-appears, it can be re-stabbed by a harpoon or killed by a spear. The drag float aims to exhaust the animal without endangering the hunter, and it minimizes the risk of tipping the boat over by the panicked animal (**fig. 17**)[119].

Catfish are common in the major rivers and lakes; they favor stagnant and muddy waters[120]. We are not aware of published catfish remains from Late Bronze Age sites. The so-far known specimens originate from EBA - MBA contexts: Ároktő-Dongóhalom; Békés-Városerdő; Polgár-Basatanya; Tiszalúc-Dankadomb; Mošorin-Feudvar; Tószeg-Laposhalom; Tiszaug-Keménytető[121].

Beluga Sturgeon (*Acipenser Huso* Linnaeus, 1758; *Huso Huso* Brandt, 1869)

The beluga sturgeon was one of the anadromous Danubian sturgeon species that visited the rivers of the Carpathian Basin prior to the regulation of the Danube (**fig. 16, A**). Before the erection of the Iron Gate I and II dams between 1971 and 1984, sturgeons swam through the Danube River from the Caspian Sea and the Black Sea. They reached the middle reaches of the Danube at Bratislava/SK and even Straubing/D. They appeared in the waters of the Tisza (area of Tiszapalkonya [Borsod-Abaúj-Zemplén County/H]), Maros/Mureş, Száva/Sava and the Váh/Vág rivers. After laying down their eggs, sturgeons spent the winter at the bottom of the Carpathian rivers. They had spawned between March and April and returned to the sea. There were two fishing seasons for sturgeons: autumn (August - November) and spring (March - June)[122].

The largest fish in the Carpathian rivers was the beluga sturgeon. The last record-size specimen was fished from the Paks section of the Danube River in 1987. It was 3.01-meters long and weighed 181 kg[123]. An even larger specimen was recorded in 1890 when an 882 kg sturgeon was fished in the south branch of the Danube Delta at Sfântu Gheorghe (Covasna County/RO)[124]. In 1880, their population had already started to decrease in the Carpathian Basin due to river regulation. Ottó Herman noted an average weight of 30 kg for the beluga sturgeon in local rivers. At that time, 200-kilogram specimens with 7-8 m total length were rare[125]. According to written sources from the 17th century, sturgeons grew to be more than 3 m long and weighed more than 280-336 kg, with one exception weighing 504 kg[126]. In 1793, at the Zemun section of the Danube River by Belgrade, one of the areas where Late Bronze Age harpoons were found, a fisherman caught a 700-kg sturgeon[127]. According to László Bartosiewicz and Clive Bonsall, the beluga sturgeon has a 2-3 m average length (maximum 10 m), and a total live weight of 80-100 kg (maximum 1000 kg) in archaeological periods[128]. If beluga sturgeon was harpooned in the Late Bronze Age, a complex system of food production can also be hypothesized. Their fishing required cooperation between fishermen, advanced fishing techniques and gear, as well as a dryland base for food processing and distribution. The most advanced sturgeon fishing in the Danube and Tisza rivers was practiced during the late Medieval period. To catch sturgeon with the most efficiency, fishing companies (Hungarian *céh*) operated in specific locations. Different types of timber structures combined with large-holed netting, the so-called *pipola* nets, as well as weirs, were commonly planted to catch sturgeons. These fish were caught by these specialized weirs (Hungarian *rekesztéses technika*). Before the freezing of rivers, timber structures were placed in a line aligned to the flow of the river, with an open structure tapering towards the other, closed area. After it had swum through, the entrance was shut and the fish became trapped in the closed compartment. The fish was agitated with firearms, drums, and whistles, and then caught by harpoons and nets. The processing phase of the sturgeon involved the cutting and salting of the animal's meat. The sturgeon parts were placed in barrels, which were transported in carts and boats[129].

Serbian and Romanian archaeologists have pointed out that sturgeons could be easily fished during prehistoric times such as the Mesolithic if the environmental conditions were ideal. At the Iron Gates section of the Danube, the river becomes shallow near the banks and then falls into deep gullies about 30 m. Fish may have been caught here by various techniques (dams, traps, fishing tackle), some were killed by massive elongated clubs found in the Lepenski Vir (Majdanpek District/SRB) settlement. After Mihailo Petrović »Alas«, Ivana Živaljević mentions that identical fishing techniques were recorded in the Danube Gorges at the beginning of the 20th century. Fishermen used wooden clubs to stun the fish, then the whirlpools drive them into traps with nets. When they were caught, the fishermen stunned the fish with two or three blows to the head[130]. Alexandru Dinu also noted that the easiest way to harpoon beluga sturgeon in the Iron Gates was on occasions when the fishes rubbed against big rocks to ease the unpleasant sensation caused by their parasites[131].

Prehistoric archaeozoological evidence for sturgeon fishing in Southeast Europe was recovered from Mesolithic and Neolithic sites in the Tisza section of Hungary and along the Lower Danube area in Serbia and Romania: e. g., Tiszaföldvár (Jász-Nagykun-Szolnok County/H, »prehistoric«); Tiszaug (Bács-Kiskun County/H, »prehistoric«); Padina (Kovačica District/SRB, Neolithic); Schela Cladovei (Mehedinți County/RO, Neolithic); Mora Vagei (Bor District/SRB, Neolithic); Mihajlovac (Bor District/SRB, Neolithic); Lepenski Vir (Majdanpek District/SRB, Mesolithic)[132]. Sturgeon bones were found in the Százhalombatta tell settlement (Pest County/H, Phase I/Level 5 - late MBA)[133].

The lack of beluga sturgeon remains in the Hungarian archaeozoological samples does not mean that this species was not fished during the Late Bronze Age. First, there are only a handful of analyzed fish samples from this period. An example is the Győr-Ménfőcsanak, where sturgeons were present in the Late Bronze Age/Early Iron Age material[134]. Even from the Medieval period, when sturgeons were actively fished, sturgeon remains are scarce compared to Mesolithic and Neolithic sites from the Lower Danube. László Bartosiewicz, Clive Bonsall, and Vasile Şişu explained this phenomenon by the differences in excavation aims, and also site functions. During the Medieval period, catching and preparation sites were situated in different locations than consumption. Concerning this period, research is more focused on the consumption sites, i. e., the high-status settlements like forts and castles. During the Mesolithic and Neolithic, these functions were not yet separated in spatial terms[135]. If the Late Bronze Age population had complex fish-based food production and trade similar to Medieval times, we would also be faced with similar evidence.

The exploitation of large fish may have contributed greatly to the sustenance of prehistoric communities. We lack archaeological evidence for fish preservation in the Carpathian Bronze Age. Large fish are unlikely to have been consumed immediately after capture. Some methods of preservation must have developed locally as fish spoils easily. Preservation methods are known from the contemporary Eastern Mediterranean: drying and/or salting fish (e. g., Room 6 of the West House at Akrotiri/GR; the Tomb of Two Brothers at Saqqara/EG, Dynasty V - 2500 BC); fermented fish paste made of pickerels and bogues, small string rays and cereal seeds (e. g., Room 6 of the West House at Akrotiri)[136]. Salt was essential to both techniques. In our opinion, it was also accessible to the local communities of the Carpathian Basin through exchange. In this regard, an important find is a rock salt/halite lump found in feature 141 from the Br D/Ha A period Urnfield settlement at Lébény-Kaszás-domb (Győr-Moson-Sopron County/H)[137]. Evidence is also known for Bronze Age salt extraction in Transylvania, Romania[138]. Liviu Marta also assumes that the salt trade existed during the Ha B1 in the eastern Carpathian Basin, as the distribution of Hajdúböszörmény-type hoards correlates with Medieval salt routes[139].

CONCLUSION

A special type of detachable barbed bronze harpoon with a spur was discussed in this study. Specimens of this fishing/hunting instrument are distributed in the territories of Hungary (Budapest-Buda; Karcag-Zádor; Kisvarsány-Hidéri; Szentes-Magyartés; Viss-Török-ér) and Serbia (Belgrade-Karaburma; Borjaš/Borđos; Drmno; Futog; Koželj; Belgrade-Zemun), and Bulgaria (Lovech region). Metal harpoons were common in bronze hoards dated between the Br D and Ha A1 periods. One appears as an out-of-time artifact in the Ha B1 Karcag-Zádor hoard. The predecessors of the metal harpoon heads appeared during the Late Neolithic in Europe. These tools were commonly made of antler and lacked barbs. A missing link between antler and metal harpoons is the specimen found in Auvernier. This object was cast in bronze and imitated its organic predecessors.

Research has long recognized that the function, hafting, and usage of prehistoric antler harpoons can be best understood through ethnographic analogies, especially from northern Canada and Greenland. The de-

tachable metal harpoon heads in the Carpathian Basin can be hafted in different ways. They could be used as throwing harpoons, thrusting harpoons, or harpoon arrows. A harpoon could be used to hunt different aquatic and terrestrial animals, but we believe that the Carpathian ones were primarily used to catch large fish species. There is a correlation between the archaeological distribution of these objects and the 19th- and 21st-century topographical position of the major rivers like the Danube and Tisza. The Belgrade-Zemun specimen was even recovered from the Danube riverbed. Local ethnographic analogies from the 19th and early 20th centuries for harpoon fishing and fish species, as well as archaeological data, help us to formulate an opinion on the possibilities of harpooning in prehistory. There are numerous species in Carpathian rivers and lakes whose full-grown specimens may require a similar harpooning technique to that used by the Inuits. Here, we introduced the sizes, harpooning season, and favored habitats of four local large fishes, which appeared in the historic and/or prehistoric eras of the Carpathian Basin: beluga sturgeon (*Huso huso* Brandt, 1869), catfish (*Silurus glanis* Linnaeus, 1758), northern pike (*Esox lucius* Linnaeus, 1758), and carp (*Cyprinus carpio* Linnaeus, 1758).

In contrast to other prehistoric periods, archaeozoological data from the Late Bronze Age Carpathian Basin on fishes is sparse, especially in Hungary. Evidence for large fish exploitation dates primarily from the Early and Middle Bronze Ages, as well as the Neolithic and Mesolithic periods. The Late Bronze Age metal harpoon heads may have been a far more effective and lethal fishing/hunting weapon than their antler predecessors. Their presence in the local archaeological material may signify the importance of large fish exploitation along the Danube and Tisza Rivers during the investigated period. The fundamental question is whether harpooning was an additional fishing technique, or whether these metal harpoon heads refer to specialization and systematic exploitation of the local large fish stock. To what extent local communities relied on the consumption of big fish? Were these aquatic animals consumed only occasionally as a delicacy? Was the meat of these large fishes preserved by special techniques known from the Eastern Mediterranean and much later Medieval analogs? Can we count on the presence of specialized settlements, catch and preparation sites near the rivers, and consumption sites in the settlements? Could the preserved meat of the large fish have played a role in the region's exchange system? These are the questions that can be formulated based on the presence of detachable barbed metal harpoon heads with a spur in the local archaeological material. They can only be answered by the publication of new archaeozoological data from excavated riverbank sites of the Tumulus, Urnfield, and Gáva cultures.

APPENDIX

I) Metal Harpoons from Hungary

1) Budapest-Buda (inv. no. 1910.177): Large, barbed socketed harpoon head with a short socket, and a cast horizontal line hole. It has hammered barbed blades and a single asymmetrical spur. L. 78.51 mm, L. (b) 52.38 mm, W. (r) 17 × 17.13 mm, W. (b/mr) 27.27 × 7.52 mm, Th. (b) 1.92 mm, Wt. 27 g. Observations: hammered blades (**figs 1, 1; 8, 1-2**).
2) Ráth Collection (unprovenanced) (inv. no. 1876.1.173): Large, barbed, socketed harpoon with a spur and line hole. Its blade is hammered, and the tip is blunt. L. 78.52 mm, W. (r) 19.09 × 23.26 mm, W (b/mr) 44.75 × 13.11 mm, Th. (b) 1.82 mm, Wt. 78.3 g. Observations: hammered blade, blunt tip, modern tip damage (**fig. 1, 3; 8, 5-6**).
3) Szentes-Magyartés (inv. no. 10.1880.3): A barbed harpoon head with a long conical socket, and a spur. It has two line holes along the socket. Casting seams are visible along its narrow sides. L. 69.86 mm, W. (r) 17.78 × 18.20 mm, W (b/mr) 24.69 × 6.69 mm, Th. (b) 2.68 mm, Wt. 26.9 g. Observations: casting seams along the narrow sides, blunt tip, sharpened cutting edge, crushed socket, broken spur (**figs 1, 2; 8, 3-4**).

II) Other Metal Finds from Szentes-Magyartés

1) Spearhead (inv. no. 1880.10.1): A spearhead with a flame-shaped stepped blade and long conical socket with two peg holes. L. 206.78 mm, W. (r) 26.99 × 26.26 mm, W (b/mr) 26.88 × 12.70 mm, Th. (b) 1.76 mm, Wt. 122.9 g. Observations: narrow blade, modern damages on the edges and tip (**fig. 3, 1**).
2) Socketed axe (inv. no. 1880.10.2): A socketed axe with a narrow body, and three cast ribs below its thick collar. Along the narrow side, along the loop, its mouth is damaged. The loop is missing due to breakage. A long and a short blade impact are visible on the body below the ribs. Its cutting edge is straight. L. 101.95 mm, W. (r) 29.99 × 30.59 mm, W. (bs) 27.41 × 16.30 mm, W. (b) 39.73 mm, Wt. 164.5 g. Observations: short blade, hammered blade (**fig. 3, 2**).
3) Chain of rings (inv. no. 1880.10.4): A chain of rings consisting of three cast-in-one annular rings with rhomboid cross-section. The central ring was made in a four-piece mold, as it shows vertical casting seams as well. The fourth ring has a rounded terminal and D-shaped cross-section and it is decorated with bundles of lines. a) 57.26 × 55.34 mm, Th. 6.69 × 7.90 mm, Di. 41.53 mm; b) 50.97 × 51.25 mm, Th. 8.78 × 7.30 mm, Di. 36.65 mm; c) 55.61 × 57.20 mm, Th. 8.24 × 6.83 mm, Di. 41.31 mm; d) 57.80 × 53.51 mm, Th. 7.93 × 4.24 mm, Di. 49.98 mm, Wt. 128.7 g. Observations: worn surfaces (annular rings), heavily worn pattern (ring with D-shaped cross-section) (**fig. 3, 3**).

Notes

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2) Mozsolics 1985, 171.
3) Hampel 1880, 140-141.
4) Mozsolics 1973, 47-48. 150.
5) Mozsolics 1985, 47-48; 2000, 52.
6) Kemenczei 1984, 127-128. 176.
7) Borić 1997, 65.
8) Blažić 1991; Medović 2010, 66.
9) Vasić 2015, 75-76.
10) Filipović 2015, 262-263 pl. 1, 26.
11) Ickerodt 2011.
12) See Petrescu-Dîmbovița 1977, 94. 109-110 pls 143, 1; 202, 8; 1978, 119-120. 128-129 pls 99C, 8; 152, 435.
13) 1910 inventory book of the HNM.
14) Kőszegi 1988, 128-129.
15) Stanczik 1975, 71.
16) https://maps.arcanum.com/hu/map/secondsurvey-hungary/?layers=5&bbox=1951714.5278659707%2C5770376.472089643%2C1979575.8246759174%2C5780924.781992996 (29.8.2022).
17) Stanczik 1975, 71-78; Kemenczei 1984, 174 pls 117, 1-27; 198, 1-33; Patay 1990, 23 pl. 10, 15; Mozsolics 2000, 51-52 pls 4-45; Vasić 2015, 76.
18) Mozsolics 1967, pl. U15, 1-18; 1973, 47. 149-151 pl. 54.
19) Inventory Book of the HNM 1880.10.1; Kemenczei 1984, 176 pl. 180D, 1-4.
20) Hampel 1880, 140-141.
21) Tóth 1880.
22) Tóth 1880.
23) Tóth 1880.
24) Kemenczei 1984, 176; Vasić 2015, 76.
25) Kemenczei 1984, 127; https://maps.arcanum.com/hu/map/secondsurvey-hungary/?layers=5&bbox=2386805.646874404%2C6141098.071836818%2C2400736.2952793776%2C6146372.226788495 (29.8.2022).
26) Kemenczei 1984, 127 pl. 65B, 1-8; 1991, 19; Vasić 2015, 76.
27) Vasić 2015, 75-76 pl. 18, 371-377.
28) Todorović 1971, 83-84 pls 39, 20; 86, 27; Vasić 2015, 76 pl. 18, 371.
29) Vasić 2015, 76 pl. 18, 375.
30) Medović 2010, figs 4-5 pl. 1, 2; Vasić 2015, 76 pl. 18, 372.
31) Todorović 1971, 84 pls 39, 18; 87, 33; Vasić 2015, 76 pl. 18, 376-377.
32) Jacanović 1992, 65-66 pl. 1; Vasić 1994, 27. 39. 45. 48-49 pls 6, 85; 22, 294; 24, 348; 28, 466; 2015, 76 pl. 18, 373; Harding 1995, 42 pl. 15, 111A.
33) Inventory Book of the HNM 1913.31.1-445; Borić 1997.
34) Borić 1997; Vasić 2015, 76 pl. 18, 374.
35) Borić 1997, pl. 6, 90; Valentinova 2018, 544 cat. no. 552.
36) Vasić 2015, 75-76.
37) Tarbay 2022, 61. 64-66.
38) Vasić 2015, 75.
39) Feustel 1973, 150-165. A detailed study on the ethnographical and archaeological analysis of bone/antler harpoons was given by Ulf F. Ickerodt. Therefore, we do not consider it necessary to elaborate on this topic in detail here. See Ickerodt 2011, 113-125.

40) Mason 1900; Wintemberg 1905, 50-51; Quimby 1946; Gábori 1950; Torke 1993; Jost 1994; Park/Stenton 1998.

41) Banner 1950; Gábori 1950; Kalicz 1968, 71.

42) Kimmig 1992, 54-55 pls 24, 1-2; 25, 1-4.

43) Jost 1994.

44) Keller 1866, pl. 45, 5; Korošec/Korošec 1969, 38-39. 43-44 pls 84, 1-9; 117, 12; Torke 1993, 59-65; Jost 1994, 135 fig. 7; Hansen 2015, 288 figs 36-37; Nicodemus/Lemke 2016, tab. 2.

45) Csetneki Jelenik 1876, 281; Pósta 1889, 145 fig. 2, 3; Banner 1950; Gábori 1950, pl. 9; Kalicz 1968, 71 pls 47, 10; 67, 5; 71, 4; 78, 25; Banner/Bóna 1974, 148 pl. 6, 6-7; Bóna 1975, 140. 164-165 pls 86, 13-16; 195, 6-8; Csányi/Tárnoki 1992, 191 cat. nos 231-233; Gál 2018, 126 fig. 13.

46) Ilon 2011a, 244 pl. 17, 3-4.

47) Glačić 1991, 142 pl. 41, 14-21.

48) Rychner 1979, pl. 128, 3-7; Torke 1993, 59; Jost 1994, 135.

49) Medović 2010, 66.

50) Specimens used for comparison: Trommer/Bader 2013, Appendices 1-2.

51) Specimens used for comparison: Hampel 1886, pls 2, 9; 5, 3; Ilon 1996, pl. 2, 9; Říhovský 1996, pl. 27, 422; Gedl 2014, pls 8, 629-632; 9, 638.

52) During the writing of the study, only three specimens (Budapest-Buda, Szentes-Magyartés, Ráth Collection) were available for study.

53) Péterdi 2004.

54) Park/Stenton 1998, 18-19.

55) Gábori 1950, pl. 29, 5-9.

56) Park/Stenton 1998, 4.

57) Torke 1993; Jost 1994; Ickerodt 2011.

58) Herman 1880, 493; Solymos 2005, 126. 128-129. See current Hungarian law: 1997. évi XLI. törvény a halászatról és horgászatról 23§ https://mkogy.jogtar.hu/jogszabaly?docid=99700041. TV (29.8.2022). 314/2014. (XII.12.) Korm. rendelet 4§ a halgazdálkodási és a halvédelmi bírságról. https://net.jogtar.hu/jogszabaly?docid=a1400314.kor (29.8.2022).

59) Pernier 1925, 126 fig. 1A; Říhovský 1996, 120 pl. 25, 385; Pulak 1998, 210 fig. 23; Bernal Casasola 2011, 135-137; Ickerodt 2011, 128; Leshtakov 2018, 544 cat. no. 553.

60) Solymos 2005, 126-127.

61) Park/Stenton 1998.

62) Park/Stenton 1998, 9. 42-43.

63) Park/Stenton 1998, 5; Ickerodt 2011, 131.

64) Torke 1993, 61; Borić 1997, pl. 6, 90; Park/Stenton 1998, 4. 6. 17-18. 22-24; Ickerodt 2011, 131 fig. 11.

65) Ickerodt 2011, 128-130.

66) Gábori 1950, 131; Jost 1994, 134; Park/Stenton 1998, 2-3.

67) Jost 1994, 136; Park/Stenton 1998, 4.

68) Tarbay et al. 2021.

69) Park/Stenton 1998, 4.

70) Mason 1900, 212; Gábori 1950; Banner/Bóna 1974, 148; Ickerodt 2011, 127.

71) Mason 1900, 217-218 fig. 11 pl. 3; Jost 1994, 136.

72) See Hallam et al. 1973; Hartz et al. 2007, 584-585; Ickerodt 2011, 114-115. 130-131; Hansen 2015, 286-287; Maydana 2020, 145.

73) See Mozsolics 1973, 12-34; 1985, 11-29; Kemenczei 1988; 1991; Harding 1995; Mozsolics 2000; Vasić 2015; Mödlinger 2017.

74) e.g., Patek 1968, pls 27, 14-15; 35, 1-4; 68, 6. 10; Kemenczei 1984, pls 6, 16; 36, 10; 188, 4-5; Mozsolics 1985, pl. 162, 14-15; Ilon 2011b, fig. 8, 4-12; Vasić 2015, 71-76.

75) Borić 1997, pl. 6, 87-90.

76) Bartosiewicz 2006.

77) Herman 1880; Brehm 1905; Antipa 1909; Petrović 1941, 1-22; Bartosiewicz/Bonsall 2004, 253 tab. 3; Dinu 2010, 299.

78) Vasić 2015, 76 pl. 18, 376-377.

79) Borić 1997, 65; Medović 2010, 66.

80) Herman 1880, 343. 345. 676-678. 684. 688. 736. 740. 742-743.

81) Takács/Bartosiewicz 1998, tab. 1, a.

82) Ilon/Bartosiewicz/Galik 2016.

83) Csippán 2007, tab. 1.

84) Takács/Bartosiewicz 1998, tab. 1. a.

85) Herman 1880, 684-685; Brehm 1905, 252; Dinu 2010, 305; Lajkó/Pintér 2015, 70.

86) Herman 1880, 688.

87) Brehm 1905, 249.

88) Bartosiewicz/Bonsall 2004, 261 tab. 3.

89) http://rekordlista.mohosz.hu/rekordok/legnagyobb (29.8.2022).

90) Herman 1880, 454. 686-687; Bartosiewicz/Bonsall 2004, tab. 7.

91) Solymos 2005, 127.

92) Herman 1880, 345. 347-348.

93) Lakes (1880-1905): Balaton, Fertő/Neusiedl. Rivers: Berettyó/Barcău, Bodrog, Borzhava/Borzsa, Crasna/Kraszna, Danube, Dráva/Drava, Ipoly/Ipeľ, Körös/Criș, Latorica/Latoritsa/Latorca, Olt, Rába/Raab, Sajó/Slaná, Szamos/Someș, Száva/Sava, Tisza, Váh/Vág. Creeks (1880-1905): e.g., Budapest-Ördög árok, Budapest-Rákos patak, Serne/Szernye-patak. Herman 1880, 688; Brehm 1905, 252.

94) Galik et al. 2015, 343 tab. 1.

95) Bökönyi 1959, 63-64. 66-68; 1974, 342; Blažić 1991; Takács/Bartosiewicz 1998, tab. 1, a; Bartosiewicz/Bonsall 2004, 264 tab. 5; Medović 2010, 66; Ilon/Bartosiewicz/Galik 2016, tab. 2.

96) Harka 1983, 105.

97) Pintér 1980.

98) Herman 1880, 733.

99) Bartosiewicz/Bonsall 2004, 261 tab. 3.

100) http://rekordlista.mohosz.hu/rekordok/legnagyobb (29.8.2022).

101) Pintér 1980; Kucska 2007, 15; Lajkó/Pintér 2015, 68. Lakes (1880-1905): e.g., Balaton, Fertő/Neusiedl, Kopácsi-tó, Țaga/Cegei-tó (Hódos-tó), Velence, Zirc-Szarvastó. Rivers (1880-1905): e.g, Borzhava/Borzsa, Berettyó/Barcău, Bodrog, Bodva/Bódva, Crasna/Kraszna, Danube, Dráva/Drava, Ipoly/Ipeľ, Körös/Criș, Latorica/Latoritsa/Latorca, Maros/Mureș, Mura, Olt, Tuhár/Tugár, Rába/Raab, Rábca/Rabnitz, Sajó/Slaná, Szamos/Someș, Száva/Sava, Zagyva, Váh/Vág. Creeks (1880-1905): e.g, Hodos-patak (Hodos-holtág), Serne/Szernye-patak. Herman 1880, 733; Brehm 1905, 323.

102) Herman 1880, 733; Pintér 1980; Bartosiewicz/Bonsall 2004, tab. 7; Solymos 2005; Kucska 2007, 15.

103) Herman 1880, 343. 345-346.

104) Herman 1880, 345.

105) Brehm 1905, 326.

106) Bökönyi 1959, 64. 66-68; Takács/Bartosiewicz 1998, tab. 1, a; Bartosiewicz/Bonsall 2004, 204 tab. 5.

107) Ilon/Bartosiewicz/Galik 2016, tab. 2.

108) Heckel/Kner 1858, 311.

109) Herman 1880, 736.

110) Brehm 1905, 238.

111) Bartosiewicz/Bonsall 2004, 261 tab. 3.

112) http://rekordlista.mohosz.hu/rekordok/legnagyobb (29.8.2022).

113) Herman 1880, 736; Bartosiewicz/Bonsall 2004, tab. 7.

114) Brehm 1905, 240.

115) Herman 1880, 267-268. 340-341. 345. 488-489 figs 152. 225.

116) Herman 1880, 487-490. 736-737.

117) Brehm 1905, 240.

118) Drag floats are generally used for transportation, civilian or military river crossings throughout the world. See Hornell 1942.

119) Leroi-Gourhan 1935, figs 4-6.

120) Lajkó/Pintér 2015, 71. Lakes (1880-1905): Balaton, Fertő/Neusiedl. Rivers (1880-1905): Berettyó/Barcău, Bodva/Bódva, Borzhava/Borzsa, Crasna/Kraszna, Danube, Dráva/Drava, Ipoly/Ipeľ, Körös/Criș, Latorica/Latoritsa/Latorca, Olt, Maros/Mureș, Mura, Rába/Raab, Sajó/Slaná, Szamos/Someș, Târnava/Küküllő, Tisza, Váh/Vág, Zagyva. Creeks (1880-1905): Serne/Szernye-patak. Herman 1880, 736; Brehm 1905, 239.

121) Bökönyi 1959, 62. 64. 66-68; 1974, 342; Blažić 1991; Takács/Bartosiewicz 1998, tab. 1, a; Bartosiewicz/Bonsall 2004, 264 tab. 5; Medović 2010, 66.

122) Brehm 1905, 436; Petrović 1941, 3; Bartosiewicz/Bonsall 2004, 268 tab. 7; Bartosiewicz/Bonsall/Şişu 2008, 48; Dinu 2010, 303 tab. 2; Bartosiewicz/Haidvogl/Bonsall 2019, 62. 64-65.

123) Bartosiewicz/Bonsall 2004, 261-262; Bartosiewicz/Bonsall/Şişu 2008, 42 tab. 4 fig. 5; Kákai et al. 2017, 88-91.

124) Antipa 1909, 265; Bartosiewicz/Haidvogl/Bonsall 2019, 68.

125) Herman 1880, 757.

126) Batizi 2021, 131.

127) Petrović 1941, 3.

128) Bartosiewicz/Bonsall 2004, 261 tab. 3.

129) Bartosiewicz/Bonsall 2004, fig. 8; Solymos 2005, 151-169; Bartosiewicz/Bonsall/Şişu 2008, 47-51; Bartosiewicz/Haidvogl/Bonsall 2019, 63; Batizi 2021, 131-132.

130) Petrović 1941; Živaljević 2012, 202.

131) Petrović 1941, 8; Dinu 2010, 305.

132) Bonsall et al. 1997, 57. 75-76; Bartosiewicz/Bonsal/Şişu 2008, 40. 46-48 figs 8-9; Dinu 2010, 301 tab. 1; Živaljević 2012, 198; Galik et al. 2015, 340 figs 3-5; Bartosiewicz/Haidvogl/Bonsall 2019, 63.

133) Bartosiewicz 2020.

134) Ilon/Bartosiewicz/Galik 2016, tab. 2.

135) Bartosiewicz/Bonsal/Şişu 2008, 49.

136) Alessandri et al. 2019, 5-6; Zohar/Artzy 2019, 900-901. 906-909 fig. 1; Mylona 2021, 386-389 fig. 9.

137) T. Németh 2011, 251-254 pl. 3, 1-2.

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139) Marta 2017, 200-203 fig. 1.

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Zusammenfassung / Summary / Résumé

Spätbronzezeitliche abnehmbare Harpunen mit Widerhaken, Fangleinenloch und Sporn aus Ungarn
Die Studie beschäftigt sich mit ostmitteleuropäischen abnehmbaren Harpunenspitzen mit Widerhaken und einem Sporn aus Bronze. Diese einzigartigen spätbronzezeitlichen (Br D - Ha B1) Fischerei- und Jagdinstrumente waren in den Gebieten des heutigen Ungarn, Serbien und Bulgarien entlang der großen Flüsse wie Donau und Theiß verbreitet. Wie ihre Gegenstücke aus Geweih, die während der Kupferzeit in Europa aufkamen, finden sich für diese Harpunenspitzen aus Metall gute funktionale Entsprechungen im ethnographischen Material der Nunavut-Kultur in Nordkanada und Grönland, insbesondere in der klassischen Thule-Kultur (900-1600 n. Chr.). Es ist sehr wahrscheinlich, dass diese Harpunen in der Vorgeschichte des Karpatenraums für die Ausbeutung von Großfischen (Karpfen, Wels, Hecht, Beluga-Stör, etc.) genutzt wurden, die in den lokalen Strategien der spätbronzezeitlichen Nahrungsmittelproduktion eine wichtige Rolle gespielt haben könnten. Die Studie untersucht die Funktion und den Gebrauch von Harpunenspitzen aus Metall, ihre Befestigungsmöglichkeiten und die Bedeutung des Harpunierens im täglichen Leben der spätbronzezeitlichen Gesellschaften im Karpatenbecken.

Late Bronze Age Bronze Detachable Barbed Harpoons with Line Hole and a Spur from Hungary
A study is being conducted on Eastern Central European detachable barbed harpoon heads with a spur made of bronze. These unique Late Bronze Age (Br D - Ha B1) fishing / hunting instruments were distributed in the territories of present-day Hungary, Serbia and Bulgaria along the main rivers like the Danube and the Tisza. Like their antler counterparts that emerged during the Copper Age in Europe, these metal harpoon heads have fine functional analogs in the ethnographic materials of the Nunavut culture in northern Canada and Greenland, particularly of the Classic Thule cultural tradition (AD 900-1600). In Carpathian prehistory, it is very likely that these harpoons were used for big fish (carp, catfish, northern pike, beluga sturgeon, etc.) exploitation, which may have played an essential role in the local Late Bronze Age food production strategies. The study explores the function and use of metal harpoon heads, their hafting possibilities, and the importance of harpooning in the daily lives of Late Bronze Age societies in the Carpathian Basin.

Harpons barbelés détachables en bronze de l'Âge du Bronze tardif avec trou de ligne et éperon de Hongrie
L'étude porte sur des têtes de harpon barbelées détachables d'Europe centrale orientale avec un éperon en bronze. Ces instruments de pêche / chasse uniques de l'Âge du Bronze tardif (Br D - Ha B1) étaient distribués dans les territoires de l'actuelle Hongrie, Serbie et Bulgarie le long des principaux fleuves comme le Danube et la Tisza. Comme leurs homologues en bois de cervidé apparus à l'Âge du Cuivre en Europe, ces têtes de harpon en métal ont des analogues fonctionnels dans les matériaux ethnographiques de la culture du Nunavut au nord du Canada et au Groenland, en particulier dans la tradition culturelle Thulé classique (900-1600 ap. J.-C.). Dans la préhistoire des Carpates, il est très probable que ces harpons aient été utilisés pour l'exploitation de gros poissons (carpes, poissons-chats, brochets, esturgeons bélugas, etc.), qui ont pu jouer un rôle essentiel dans les stratégies locales de production alimentaire de la fin de l'Âge du Bronze. L'étude explore la fonction et l'utilisation des têtes de harpon en métal, leurs possibilités de fixation, et l'importance du harponnage dans la vie quotidienne des sociétés de l'Âge du Bronze tardif dans le bassin des Carpates.
Traduction: J. Chameroy

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Eastern Central Europe / Late Bronze Age / metal harpoon heads / prehistoric fishing / ethnography / production technology / use-wear analysis / animal exploitation
Europe centrale orientale / Âge du Bronze tardif / têtes de harpon en métal / pêche préhistorique / ethnographie / technologie de production / analyse de l'usure / exploitation animale

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