Millennia of continuity in the votive behaviour of Europeans
The testimony of tools for determining the value of metal

Tisíciletá kontinuita votivního chování Evropanů
Svědectví nástrojů k určení jakosti kovu

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Archaeology has a great deal of experience with how the misinterpretation of finds creates a false image of the past. The main reason for this is down to ideologically-conditioned stereotypes. The paper describes one such case involving hundreds of thousands of finds of one type of artefact, commonly classified as whetstones, pendants, amulets, etc., from the Chalcolithic up to the Early Middle Ages. The article emphasises that although touchstones from ancient burials had already been identified using an electron microscopy half a century ago, the interpretation of these finds corresponding to the paradigm from the early 19th century remains popular to this day. For the chemical microanalysis of metal traces preserved on the surface of these stone artefacts, samples were selected from Russian, Slovakian, Swedish and Ukrainian sites, from the Hallstatt period up to the Early Middle Ages, with special regard for their previous interpretation history. However, the main aim is to point out the symbolic role of tools used to test the value of precious metals outside the grave context. Finds from wet environments in particular reveal the continuity of the behaviour of European over the millennia, regardless of the current ideology or cult, and the diversity of artefacts that were, and still are, chosen as a medium for votive behaviour.

Europe – burial – votive behaviour – wetland – water – touchstone – pilgrim badges

Archeologie má mnoho zkušeností s tím, jak chybná interpretace nálezů vytváří falešný obraz minulosti. Hlavní důvod spočívá v ideologických stereotypech. Jeden z příkladů nabízí tento článek, jehož tématem jsou stovky tisíc kamenných předmětů obvykle klasifikovaných jako brousky, přívěšky, amulety apod., a to od eneolitu do raného středověku. Ačkoli byly prubířské kameny z dávných hrobů identifikovány za použití elektronového mikroskopu už před půlstoletím, interpretace dotyčných nálezů zůstává poplatná paradigmatu první poloviny 19. století. Článek přináší ukázky z ruských, slovenských, švédských a ukrajinských lokalit, od doby halštatské do raného středověku. Avšak hlavním cílem je vyzdvihnout symbolickou roli nástrojů užívaných k určení hodnoty kovu mimo pohřební kontext. Zejména nálezy z mokrého prostředí odhalují tisíciletou kontinuitu v chování Evropanů, nezávislou na dobové ideologii či kultu, a také šíři škály předmětů, které byly, ba dosud jsou, voleny jako prostředek votivního jednání.

Evropa – hrob – votivní chování – voda – prubířský kámen – poutnické odznaky

1. Introduction

The social circumstances leading to certain disciplines ignoring, for many decades, clear facts that do not suit the current consensus form an attractive subject in the history of science. An illustrative example is offered by an explicitly formulated article published in a renowned journal almost half a century ago. On the basis of chemical microanalyses, *Gad Rausing* (*1976*) claimed that hundreds of Late Neolithic stone artefacts from Sweden, presumed to be whetstones, are in fact tools used to determine the nature and test the value

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of precious metal, touchstones. (With the Scandinavian Late Neolithic dating to the Chalcolithic and Early Bronze Age of Central Europe, for example.) These artefacts made of fine texture stone materials (most often silt, schist or slate) have a rectangular cross-section, narrow and finely polished sides, and often a hole in one end for hanging on a belt. Although Rausing dealt with only black or dark stones from southern Sweden (the dark colour is not a *condicio sine qua non* for ancient touchstones: for numerous examples see, e.g., *Ježek 2017*), he mentions 225 finds of which at least 71 are from graves. While the position of these tools in relation to the skeleton could be reported for only three of the grave finds, even this information is very important: twice by the head, once by the chest. In both post-Chalcolithic graves and period depictions, these artefacts occur mostly in the area of the waist, thus corresponding to 'live' reality; however, they also appear in various positions in children graves or multiple burials (see *Ježek 2017*, 95 and figs. 4 and 13). On two of the seven specimens chosen by Rausing for chemical microanalysis have been identified streaks of gold. The author also addressed the question as to why other touchstone candidates revealed no metal streaks, explaining in brilliant fashion that the curved shape of the sides of the relevant stones resulted from the removal of older streaks, a measure essential for conducting future tests. Although Gad Rausing cleverly captured key aspects of this significant subject of European archaeology, scholars who have subsequently taken up the matter of ancient touchstones (e.g. *Zedelius 1981*; *Oddy 1983*) were not prepared to utilise his insights, a Rausing's discovery fell into oblivion.

As a result, there are at least dozens of thousands of putative 'whetstones' today in archaeological publications and museum catalogues. Since typical stone artefacts sometimes occur in prehistoric and early medieval graves along with knives, 'whetstones' became frequent in the inventory lists of ancient graves. In fact, no publication of ancient whetstones confirmed analytically exists. The assessment of sources was replaced by 'common sense'. This classification of individual finds ignored the fact that numerous burials furnished with a 'whetstone' did not contain any object that required sharpening. Children's graves furnished with touchstones, including the graves of infants (see *Ježek 2017*, 83–85, with refs.), are particularly eloquent. The erroneous classification of burial finds has also affected the interpretations of typical stone tools from hundreds of metallurgical workshops, trade centres and elite sites (for selected examples, see *Ježek 2013*, 723–726).

The reason of the generally shared error is straightforward and consists of stereotypes conveying the ideological climate of the first half of the 19th century, when archaeology, along with other scientific fields, was established as a discipline (see *Ježek 2015*; *2017*, 150–151, with refs.). The naive interpretation of European grave inventories resulted from archaeologists' notions concerning the faith of ancient populations in the posthumous activity of the deceased, during which they would require the use of a wide range of items, including whetstones for sharpening blades in the afterlife. Generally, the approach of European archaeologists inevitably reflected finds from the cradle of archaeology, Egypt. The impressive image of its burial rites has inevitably influenced the interpretation of archaeological finds in Europe – right in the first decades of the 19th century, in particular after the Napoleon's expedition – despite the fact that Baruch Spinoza had already revealed the extraordinary nature of Old Egyptian culture in connection with death long before the advent of archaeology (see *Assmann 2005*, 343–348; *Ježek 2017*, 66–68). In the words of *J. Assmann* (*2005*, 10–11), 'the dead are nothing other than dead' in ancient Mesopotamia, Israel or Greece (and Europe in general, we can add), unlike in Egypt, where the belief in immortality and an afterlife played a significant role. 'Where others sat back and let matters take their course, the Egyptians took things into their own hands' (*Assmann 2005*, 19): the results of this effort, including pyramids, mummies, and funeral writings, are obvious. By the way, the stone artefacts under discussion are not known from burials excavated in Egypt.

The prehistoric and early medieval European (unlike Egyptian) graves of adults and children (including infants) alike also contain different tools used to test the value of precious metal, i.e. weights and balances, as well as other tools which have led to widespread speculation about the profession of the deceased (in the case of children's graves, mostly nonsensical ramblings: see *Ježek 2015*, 127; *2017*, 84, with refs.). These reflections – graves of merchants (in the case of finds of balances and/or weights), craftsmen (working tools), smiths (forging tools), metallurgists (casting moulds, tuyeries, crucibles, etc.), or even their descendants – admire the high social status of ancient craftsmen, in particular smiths, based on their other grave goods, often very rich, or even on the dimension of relevant mounds (for typical example, see *Steuer 1982*, 477–482). Again, similar notions come from the post-Enlightenment ideology, in this case from romantic ideas on the free status of prehistoric craftsmen, including their free wandering. An approach which can in retrospect be designated as a Morganist-Engelsist (later elaborated into Stalinism's periodisation of history) is popular in archaeological literature across Europe to this day, despite episodic and unavailing protests (e.g. *Rowlands 1971*; *Gibson 1996*; *Ježek 2015*, with refs.). A vicious circle, based on the 'professional' interpretation of grave inventories, as was common in the early stage of archaeology, confirmed the ideologically conditioned cliché concerning the spiritual aspects of ancient societies.

The situation changed with the introduction of chemical microanalysis using a scanning electron microscope (SEM) for numerous assemblages of typical stone artefacts. Its result is the revelation that in the Bronze Age up to early medieval Europe, common tools, used simply to test the value of metal, acquired a symbolic meaning on the occasion of the final farewell, as was also the case of forging and other metallurgists' tools (comprehensively *Ježek 2017*, with refs.). At the same time, the question of the significance of the same artefacts at ritual sites, especially those in wet conditions (see below), has been opened. While there is no longer any doubt today over the ritual motivation of throwing weapons in the water in prehistoric and early medieval Europe (comprehensively *Bradley 2017*, with refs.), the same environment has also produced other, albeit less attractive, finds that are assumed to be lost artefacts or waste. One of the aims of this article is to expand the virtual 'list' of artefacts connected with votive behaviour to include those that remain unrecognised or, until recently, especially in water, simply undiscovered.

One of the aims of this paper is to identify a continual phenomenon occurring from at least the Bronze Age up to the Early Middle Ages in Europe. But not even late medieval Europe abandoned its millennia-long tradition. In the period in which the importance of tools used to test the value of metal was limited in Europe to the needs of specialists, as the result of the prevalence of coin exchange, pilgrim badges assumed the role of generally-shared media for ritual behaviour. The vast majority of today's find inventory comes from rivers and seaports. And yet, even the end of the popularity of pilgrim badges in the 16th century did not mean that the ancient custom was forgotten. In connection with – again, symbolic – valuables, this tradition lives on today as an eloquent example of *longue durée* behaviour transcending various socio-cultural and religious systems.

2. Touchstones as a subject of archaeological study

During the prehistoric and early medieval periods in Europe and the Near East, it was necessary to test a wide range of objects and raw materials not only by metallurgists, goldsmiths, prospectors, etc., but it was trade in particular, that provided endless opportunities for the use of tools required to determine metal type and value. Touchstones, balances and weights occur frequently anywhere trade was not dominated by coins minted by local authorities. The northern part of Europe in the 9th–11th century AD, i.e. the so-called bullion economy zone, as defined by *J. Werner* (*1954*: *Gewichtsgeldwirtschaft*), where hack-silver was used as currency (comprehensively *Steuer 1987*), provides an illustrative example for our understanding of this phenomenon in earlier periods. Tools used to determine the value of precious metal belong to common finds in both settlements and burials there, unlike regions where monetary exchange prevailed.

The simplest means for testing a non-ferrous metal was a quick and reliable tool – a touchstone. The advantage of this essentially non-destructive method was its speed. Theoretically, comparison of the colour of a streak from a metal object on the smooth face of a touchstone with the colour of a streak from a reference needle from a needle set, as recommended by the 16th-century masters as Georgius Agricola (*Hoover – Hoover 1950*, 252–255) or *Lazarus Ercker* (*1574*, 54–57), allowed one to precisely determine the purity of precious metal (see *Caley – Richards 1956*, 150–156). However, no set of reference needles is known among prehistoric and early medieval finds. This includes burials where touchstones have been correctly classified among grave goods without the use of SEM (e.g. *Graham-Campbell 1980*, no. 171; *Zedelius 1981*; *Schemainda 1988*; *Scull 1990*, 185; *Die Franken 1996*, fig. 472; *von Freeden 2003*, 5–6; see also below) as well as settlements, trade centres and workshops from which touchstones were both identified on the basis of SEM analysis (e.g. *Eluère 1985*; *Oddy – Meyer 1986*, 159; *Wietrzichowski 1993*, 38; *Ježek et al. 2010*) and without it, simply after the streaks visible by naked eye (e.g. *Löhr 1985*; *Cauuet 1994*, fig. 24; *1999*, fig. 47; *Fleischer – Teegen 2004*; *Valiulina 2016*, 265–266, fig. 19: 8–14). An ancient user of a touchstone was probably able to ascertain the quality of the tested metal simply by studying the colour of its streak on the touchstone, although with less accuracy, but solely with the naked eye. Due to the great number of ancient touchstones as well as various social ranks of the individuals buried with them, we doubt the use of natural acids (for a discussion, see *Ježek 2017*, 15–16, with refs.).

As is typically the case, a specific source has major limitations. The identification of ancient touchstones among archaeological finds depends primarily on the willingness of museums to lend the stone artefacts (usually lying in repositories without any attention) for chemical microanalysis in a laboratory equipped with a SEM. Another problem is connected simply with the use of a touchstone in the past. As mentioned above, before a touchstone could be used for testing a metal object, it was necessary to remove the remnants of previous tests using a non-metallic abrasion tool, sometimes even resulting in the concave shape of the touchstones' sides. Therefore, we observe just micrometrical traces of metals more often than clear linear streaks in a SEM. For the purpose of studying these artefacts, the method of chemical microanalysis (using EDS) combined with surface observations of the objects (BSE) is utilised (for technical details, *Ježek 2014*, 423). In this way it is possible to identify streaks of metal preserved on touchstones and to approximately determine their chemical composition. The results given in weight percent are calculated at

100 % in the tables below. These data are semiquantitative and their accuracy is not to be overestimated: they remain merely the results of SEM measurements, not the determination of the chemical composition of the artefacts whose streaks are preserved on the examined stone artefacts. We should also recall the inhomogeneity of ancient alloys (see *Holub 2017*) and the fact that we are often not able to specify whether the streaks preserved on touchstones come from artefacts, metallurgical semi-products (including unintentional ones), or ores. However, even these results provide an overview of the presence and relative representation of elements from which the formerly tested metal objects were composed.

Traces of silver and its alloys are sometimes preserved on touchstones in the form of sulphides or chlorides of silver – a secondary surface crust of this metal that could result from atmospheric corrosion or the reaction of silver to compounds containing chlorine and sulphur during the use of the object (e.g. NaCl from human sweat) or inside the grave (e.g. reactions with hydrogen sulphide resulting from the decomposition of organic material). A minor amount of chlorine appears in one streak of gold (for analogies, see *Ježek 2017*, 99). The most probable explanation is the decay of organic materials, which also releases chlorides. A minor amount of sulphur in streaks of copper and tin can be explained by the supergene processes. Streaks on finds from cremation graves could also have been affected by fire (see below). In short, the preservation and the chemical image of metal streaks on ancient touchstones is the result of many factors, including the washing of finds after an archaeological excavation. Therefore, none of the artefacts presented below were observed on all their sides, and the analytical results do not have a quantitative aspect: each one would be confusing.

With an awareness of the careful removal of traces of earlier tests on touchstones, even the absence of metal streaks is important for a discussion on the function of the relevant artefacts. It is difficult to imagine a thorough cleaning of a whetstone after a metal cutting edge is sharpened (see *Ježek 2017*, 15–16). This triviality is especially important in the interpretation of typical stone artefacts dated from the Iron Age up to the Middle Ages. In the case of whetstones, massive streaks of iron would be expected. In practice, in attempt to find a clearer image of the past (not only in SEM), more promising finds from the Iron Age and later periods are available for chemical microanalyses. And given the issue of relevant contexts, their dating and culture-anthropological interpretation, grave goods are more appropriate than finds from trenches dug in settlements or metallurgical workshops.

Across Europe, the study of the relevant artefacts often runs into problems both mundane, such as – e.g. for the Bronze Age – the difficulty in locating finds in museum repositories (e.g. Tiszafüred-Majoroshalom grave B 115, Hungary: *Kovács 1995*, fig. 5: 4), and the curious, such as the modern method of exhibiting burials preventing their retrieval for study (e.g. a pink touchstone candidate from grave 18/1 at Neckarsulm, Germany: *Knöpke 2009*, 150, pl. 38: 3; today under a glass floor). There are numerous touchstone candidates from Bronze Age burials in Great Britain (e.g. *Woodward – Hunter 2015*, 76–82) or from France (e.g. *Cordier 2009*, 570–629; for additional regions, e.g. *Ježek 2017*, 24, 26, 28, 82, 84, with refs.). However, just few analysed burial finds can be listed: Touchstone from prestigious grave 474 in Nižná Myšľa, Slovakia, 1700–1500 BC, bears streaks of silver, gold with an admixture of silver, and also streaks of copper, tin with an admixture of copper (and streaks of iron, probably from an archaeological tool: see *Ježek 2017*, 108, tab. 6). The prestigious Bell Beaker culture grave from Amesbury, England, regarded in the traditional manner as ‘the earliest grave of a metalworker found thus far in Britain’

(*Fitzpatrick 2011*, xvi), contains a fine, dark grey/black stone artefact with streaks of silver and copper-rich gold (*Cowell – Middleton 2011*; cf. *Ježek 2017*, 24–25). The examination of a stone artefact from the Bell Beaker culture grave in Künzing, Germany, revealed streaks of gold with an admixture of copper (*Bertemes et al. 2000*). Analysis of perfectly elaborated stone artefact, regarded as a touchstone or anvil previously (*Bertemes 2010*, 154), from prestigious Early Bronze Age tumulus in Leubingen, Germany, confirmed streaks of gold and copper – and yet, streaks of gold are interpreted as a modern contamination (*Martin 2019*, 240–242). In any case, the presence of this tool and three chisels in the 'princely' mound (as is also the case of Helmsdorf tumulus from the same period, for example) illustrates the limits of traditional concept of highly respected smiths' or metalworkers' burials (see *Ježek 2015*).

Generally, for the Chalcolithic and the Bronze Age, the question remains as to how to interpret occasionally observed streaks of copper on typical stone artefacts, including streaks of copper with an admixture of silver (e.g. *Martin 2019*, 236–239).

3. Tools for determining the value of precious metal as an age-long symbol

Tools used to determine the value of precious metal come from both prestigious and standard graves in Europe, even those without additional grave goods, and from male, female and child burials. The long history of the symbolic use of tools for determining the value of precious metal (and also of other metal-touching tools) during funeral rituals begins in the fourth millennium BC; the touchstones from burials of the Maikop culture can serve as examples (see *Ježek 2017*, 23–24, 53–55, 82, 156, fig. 3: B). As is also the case of this eponymous site from the northern foothills of Caucasus, the monumental (40–60 cm-long) stone artefacts of the typical shape occur in both Early Bronze Age and early medieval prestigious burials across Europe (*Ježek 2017*, 16, 71–74). The famous 'Sutton Hoo sceptre', regarded as a whetstone without any signs of use in this way, may serve as an example. However, the size of these objects does not permit examination in a SEM chamber. Hence, the question of the (purely?) symbolic function of these 'oversized' artefacts remains unresolved; unlike the question of the function of their 20–30 cm-long siblings with observed streaks of precious metals (e.g. *Ježek 2016*; *2017*, 85).

The finds from the royal cemetery at ancient Ur (Iraq) illustrate the issue. Dozens of touchstone candidates come from local burials (for selected examples, see *Ježek 2017*, 24, 37, fig. 9), however, since the Penn Museum and British Museum turned down our request to perform chemical microanalyses on these artefacts, the only option is to turn attention to the close relatives from the same site. After *W. B. Hafford* (*2012*, 47), 'by far the largest numbers of weights with recorded find-spots at Ur come from funerary contexts. Nearly half (43.8%) of all provenanced weights are found in or associated with burials, from Early Dynastic to Neo-Babylonian.' This finding justifiably embarrasses the expert on this issue, focussed, however, on the weight and metric parameters of studied objects: 'Weights are not common in Egyptian tombs, but the idea of weighing as part of the afterlife, or entry to it, is clear in tomb paintings. Yet at Ur, weights and weighing may not have this connotation. […] If there had been a widespread belief of weighing associated with death, a higher percentage would likely display these objects and a clear myth cycle concerning

Fig. 1. Two of three gold balances from prestige female burial in Mycenae (Greece), shaft grave III (Grave Circle A). Not to scale. Archaeological Museum in Athens (photo by Ima Pictures).

weighing in judgment of the dead would be expected in texts and art.' (*Hafford 2012*, 47–48). The author therefore prefers the traditional paradigm, which also forms the conclusions of numerous works on European prehistoric and early medieval burial finds. Let us quote his ideas here, not because they concisely summarise the current approach of archaeologists (see above), but because they contain important information regarding burial finds of scales at Ur: 'weights were probably buried with the people who used them in their everyday lives, such as merchants or metalsmiths. If the belief were that people continued their work in an afterlife, they would need their tools to do so. Nonetheless, nearly a third of the graves with weights contained only a single example, which is not a functional tool. A set is needed to evaluate almost anything. Scales are also needed, and yet such objects are present in only four graves, with possible traces in two others. Perhaps all that was deemed necessary was a representation of weights and weighing in order to continue work in the afterlife, or identify profession to the gods.' (*Hafford 2012*, 48).

Eloquent testimony for the symbolic role of tools used to determine the value of metal comes in the form of three gold balances, i.e. non-functional imitations (*fig. 1*), from one of the richest graves at Mycenae, Greece (woman; Grave-Circle A, shaft grave III: *Schliemann 1877*, figs. 301, 302; *Karo 1930*, pls. 34, 81, 82). From the Iron Age prestigious grave 59A at Lefkandi, Skoubris (Greece), come two lead balance pans, probably originally deposited above this shaft grave. We agree with previous scholars (e.g. *Vermeule 1964*, 298; *Pare 1999*, 474–475) that the above-mentioned 'balances' were used prior to their deposition in the grave as a symbol of power or as cult equipment. Also coming from Lefkandi, from the monumental so-called Heroön tomb, is probably the most impressive

(27-cm-long) touchstone candidate in Greece (impossible to analyse in an available SEM; see *Ježek 2017*, 26, with refs.).

The most conspicuous testimony of the association between cult and metalworking on the Greek mainland comes from Mycenae (e.g. *Mylonas 1972*; *French 1981*; cf. *Lupack 2007*, 59–62). Similar links between sanctuaries and metalworking are recorded in numerous ancient Mediterranean shrines and sites, including Olympia, Delphi, etc. (e.g. *Matthäus – Schumacher-Matthäus 1986*; *Hägg 1992*; *Risberg 1992*; *1997*; *Hänsel 1997*; *Blakely Westover 1999*; *Karageorghis – Kassianidou 1999*; *Orfanou 2015*, 57; *Muhly – Muhly 2018*; all with add. refs.). Traditionally, evidence of metallurgy in Greek sanctuaries use to be connected with (hypothetical) production of cult items in their areas. At the same time, numerous votive hoards containing (among other, often prestigious objects) scraps of precious metal, weights, touchstones, etc., from ancient Greek and Near Eastern shrines (see below) support the notions about non-economic motives of relevant activities. Even ritual performances conducted by local leaders have been suggested in the interpretation of the frequent association of cult and metalworking in Europe during the Bronze Age and Iron Age (e.g. *Doonan et al. 2012*; *Kristiansen 2012*, 382; *Schucany – Winet 2014*; *Ježek 2016*, 501–502). In fact, both (interpretation) models could take place together in ancient shrines.

Above mentioned Lefkandi is situated 10 km from Eretria, where remnants of work with gold, bronze and iron have been found in the sanctuary of Apollo Daphnephoros (*Verdan 2007*), including a fine touchstone candidate (*Verdan 2013*, 27, 161, no. 469). Few sherds of common kitchen pottery with traces of gold have been identified among local finds, too (*Verdan 2007*, 348; *Meeks – Craddock 2013*). From just few additional examples of excellent evaluation of archaeological finds, Iron Age ceramic sherds with traces of gold from Sardis, Turkey, should be recalled (*Ramage – Craddock 1958*, figs. 5.5 and 5.6; for a touchstone from Sardis, *Greenewalt Jr. et al. 1988*, 68, fig. 12). The SEM analysis of similar finds, recorded in the hundreds in early medieval Prague (*Zavřel et al. 2019*, with refs.), shows that sherds of domestic pottery served commonly for testing metallurgical products or semi-products in the past. The question remains: how numerous are unrecognised finds of this kind from ancient shrines in Europe and the Near East? In any case, sherds of common domestic pottery secondarily used for metallurgical purposes from the area of ancient sanctuaries testify common (non-ritual) activities of local metallurgists.

Functional balances, or their parts, occur as grave goods in both prehistoric and early medieval burials in Europe. For example, at least 24 burials are known from Bronze Age Greece alone, in particularly prestigious ones, both female and male (*Vermeule 1964*, 128, 298, 349; *Pare 1999*, 470–476, with refs.); the princely Vapheio tholos tomb, also furnished with delicate weapons, alabaster, gold, silver vessels, etc., contains five pairs of bronze balance pans, including extraordinarily large ones with a diameter of 13.5 cm. The lone bronze pan from the prestigious Thorikos tholos grave is even 17.7 cm in diameter (*Pare 1999*, 474, with refs.), and perhaps refers back to the previous paragraph. In any case, numerous burials containing functional balance pans are also known from ancient graves in Cyprus and the Near East, including prestigious graves, however, weights and, especially, touchstones are far more frequent here (for examples, see *Ježek 2017*, 26–27, 145–146, with refs.). *Ch. Pare* (*1999*, 422–449) presents dozens of weights from Late Bronze Age (more or less) prestigious burials in Greece and Central Europe, and additions appear gradually (e.g. *Pankau 2013*, 41).

The symbolic role of tools for determining the value of precious metal in the distant past is apparent and the link between them and precious metal is clear. However, in the case of burial furnishing, it would be misleading to connect specific burials with the individuals using these tools. In Europe, this custom becomes evident in Chalcolithic prestigious male burials. From the Bronze Age, tools for determining the value of precious metal belonged to the traditional expressions of affection of the survivors for the deceased, regardless of the social rank, gender or age of the deceased. The presence of these tools in graves does not mean that the buried individuals were users, or even owners of these tools (see *Ježek 2017*, 75–79, 145–147). At the same time, the choice of the symbols used in the farewell ritual depended on a wide range of traditional possibilities. Only some of the survivors chose tools used to determine the value of metal for this occasion. It is futile to search for specific reasons as to why a certain object was placed in a grave, as the survivors themselves were either unaware of this reason or construed it in connection with the traditions of their own society. The placing coins (i.e. easily available precious metal) in ancient burials provides an illustrative example: the explanation of this custom differs totally even in the works of its educated Greek and Roman contemporaries between the 5th century BC and the 2nd century AD (*Stevens 1991*). In any case, at the moment of the final farewell, ancient survivors did prefer the objects that had been used on this occasion from time immemorial.

4. Analytical results versus archaeological stereotypes

The number of touchstones (or touchstone candidates) from prehistoric and early medieval settlements, workshops and elite sites in Europe and the Near East is literally without end. They are usually classified as whetstones, hones, etc. Not even the identified streaks of gold have changed an erroneous classification, including prestigious objects from extraordinary sites. The 13th–12th century BC object with a gold finial in the shape of a lion's head from a remarkable votive hoard in a temple in Susa, Iran, can serve as an example (*Tallon 1992*, as 'whetstone […] with inexplicable traces of gold on it'; cf. *Ježek 2017*, 39, fig. 11).

Another example (I thank Jan Kysela for kind information) documents the current state of archaeology on a much more modest specimen, but in the same manner as Rausing's discovery. The La Tène period oppidum and exceptional site of a mint, Stradonice in central Bohemia, produced dozens of parts of balances and numerous 'whetstones' (e.g. *Píč 1906*, 75, pls. XXVII, LVIII). In 1953, i.e. without any chemical microanalysis, one of the local finds (*fig. 2A*) was described by geologist Karel Hlávka as a 'touchstone for testing gold', in the inventory of an assemblage collected in the 19th century. The assemblage was reviewed in the 1980s, when an expert on the La Tène period classified the same object in the 'modern' manner as a 'pendant with a polished stone, an amulet'. Black and perfectly smoothed stone artefact of rectangular section, a petrographic determination of which has not been successful (even with knowledge of its chemical composition), is set in an elegant copper finial with a decorative eyelet for suspension purposes. The stone is attached to the finial by means of a rivet that utilised a hole in the stone, with a diameter of c. 5 mm; however, the diameter of the hole in the finial is only c. 2 mm. As a result, the hole in the stone pokes out from the bottom of the finial. The question remains as to whether or not the stone itself was used prior to being set in the metal finial (cf. *Ježek 2017*, 30). Using the SEM, linear streaks of gold with a marginal admixture of silver, as well as numerous streaks of an alloy of gold, copper and silver, were observed (*fig. 2B*; *tab. 1*) on the two work surfaces of the stone, both measuring 2.5 × 2.3 cm.

A touchstone function was also suggested long ago for stone artefacts furnished with finials made of gold (in fact, with an admixture of silver: for examples, see *tab. 2: 19–21*) from extraordinary – and for their richness famous – 4th-century BC kurgans in Eurasian steppes (*Williams – Ogden 1994*, 142; see also *Ježek 2017*, 28–32, with add. refs.). Still, artefacts of this type continue to be presented traditionally as whetstones (with the excep-

Fig. 2. A: Touchstone from the La Tène oppidum of Stradonice, Czech Republic (inv. No. KT00556 in the catalogue of the National Heritage Institute of the Czech Republic). – B: An example of streaks of an alloy of gold, silver and copper (*tab. 1: 2*). Microphoto: Š. Křížová. Courtesy of the NHI.

An. No.	Ag	Au	Cu	Fig.
1	3	96	1	
2	17	64	19	*2B*

Tab. 1. Results of point analyses of metal streaks on the touchstone from Stradonice. Each analysis number (An. No.) belongs to a separate streak. The semi-quantitative data given in weight percent (wt%) are calculated at 100 %. The geochemical background, i.e. elements deriving from the raw material of the stone (Si, K, Ca, etc.), is excluded.

tions of *Alexeyev 2012*, 222, and *Kalashnik 2014*, 126–127). Thanks to the generous help of the colleagues from the State Hermitage Museum in St. Petersburg, it was possible to carry out chemical microanalysis on selected specimens (*fig. 3*), dug up in the 19th century in Chertomlyk (Ukraine), Karagodeuash (Russia), Kul'-Oba (Crimea), Malaya Bliznitza (Russia) and Talaevsky (Crimea). As with a similar touchstone from the hoard in Ahtanizovka (Russia; see *Ježek 2017*, tab. 1; with a predominance of streaks of alloys of silver and copper and streaks of alloys of lead and tin), all mentioned stone artefacts are literally covered with streaks of precious metals (*tab. 2*; *fig. 4*). Besides streaks of gold and alloys of gold and silver, traces of silver were documented on two of these stones, and streaks of copper with minor admixture of lead on one of them. The differences in the composition of the recorded gold and silver alloys also document that at least the majority of these cases cannot result of the attaching luxurious finials. No streaks of iron were observed.

Among the hundreds of analyses conducted on touchstones from Northern, Eastern and Central Europe, the occurrence of manganese in the results of two point analyses of streaks preserved on the artefact from Chertomlyk (*tab. 2: 1, 4*; *fig. 5A*) is unique. The presence of manganese in the precious metal that left a streak on the relevant touchstone is improbable: Mn would end up in slag during the cupellation of gold. Nevertheless, the site is located in Donbas, a vast area of sedimentary deposits of iron and manganese, the largest in Europe. Under surface conditions, oxidic Mn compounds are reduced to dendrites and

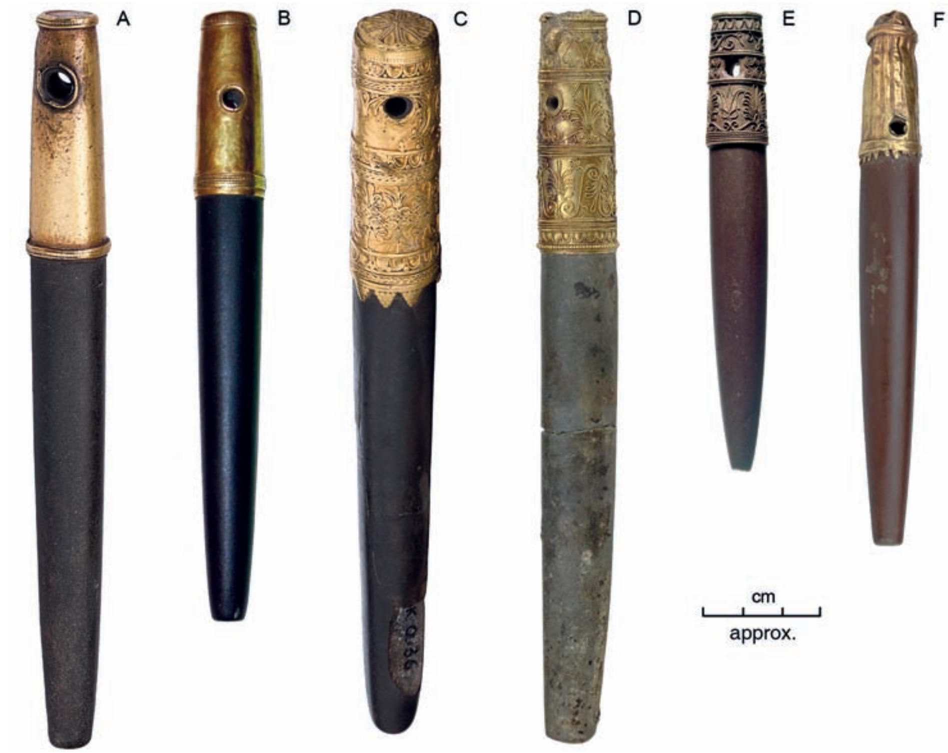

Fig. 3. Examples of fourth-century BC touchstones from Scythian and other barbarian environments from the collection of the State Hermitage Museum, St. Petersburg. A – Chertomlyk kurgan (inv. No. Dn.1863-1/446), length 18.4 cm; B – Karagodeuash kurgan (inv. No. 2492/37), length 15.4 cm; C – Kul'-Oba kurgan (inv. No. KO.-36), length 17.3 cm; D – Malaya Bliznitza kurgan (inv. No. Mal.B.-14), length 18.5 cm; E – Talaevsky kurgan no. 1 (inv. No. Kr.18911/25), length 11.6 cm; F – Ahtanizovka hoard (inv. No. Aht.-16), length 13.4 cm. Photos: A and E: L. Kheifets; B: A. Ju. Alekseev, C: A. Koksharov; D and F: P. Demidov. Courtesy of the State Hermitage Museum, St. Petersburg.

the material for the touchstone could be contaminated by Mn in supergene conditions. However, it is more likely a secondary coating that formed on the artefact inside the barrow.

Post-excavation contamination is also possible with old finds. Fortunately, Russian colleagues analysed two freshly uncovered finds of this type (i.e. typical stone artefacts with decorated gold finials) from a Scythian barrow in Filippovka (South Urals, near Orenburg). *O. V. Anikeeva* (*2010*) documented streaks of precious metals and traces of tin (and iron) on them. The function of these prestigious artefacts from the environment of the Scythians and their neighbours is therefore settled once and for all. However, countless prestigious and completely common barrows, including 'poor' graves, as well as numerous settlements and workshops from the Iron Age, and not only those from the steppes stretching from Pannonia all the way to Altay, have produced the same artefacts without metal finials (for selected examples, see *Burghardt 2012*; *Metzner-Nebelsick 2002*, 398–400; both with add. refs.). A SEM analysis of such finds should now rank among mandatory procedures, without which it is not possible to responsibly classify the find inventory with all the impacts on a social, cultural and economic interpretation of the find situation.

Kurgan	An.No.	Ag	Au	Br	Cl	Cu	I	Mn	Pb	S	Sn	Zn	Fig.
Chertomlyk	1	49	33		8	4		1		5			
	2 *	17	78		1	3				1			
	3	39	55		1	4				1			
	4	1	93		1	1		3		1			*4a*; *5A*
	5		98		1	1							*Ježek 2017*, fig. 7c
	6	27	68		2	1				2			
	7	13	85		1	1				+			*4b*
Karagodeuash	8 *	1	97		1	1				+			*4c*; *Ježek 2017*, fig. 7d
Kul'-Oba	9 *	2	95		1	+				2			
	10 *	3	97			+							
	11	7	69		8	2				15			*Ježek 2017*, fig. 7e
	12	82			17					1			*4d*
Malaya Bliznitca	13	29	43		8	5				15			
	14	14	59		3	5				10	9		
	15	1			20	70			4	5			
	16	18	70		5	3				4			
	17	32	54		7	2				5			
	18	70			14	11				4		+	
	19	16	81		1	2							Metal finial
Talaevsky	20	30	68			2							Metal finial
	21	43	48	3	3	2	2						Metal finial; *5B*
	22 *	39	54		1	5				1			*4e*; *Ježek 2017*, fig. 7f
	23 *	36	60		1	2							*4f*
	24	49	46		1	4				+			
	25	59	29		1	+			1	10		+	

Tab. 2. Selected results of point analyses of metal streaks on the touchstones (and of selected points from their metal finials: Nos. 19–21 in grey) from Chertomlyk (Ukraine), Karagodeuash (Russia), Kul'-Oba (Crimea), Malaya Bliznitza (Russia) and Talaevsky (Crimea); for the inv. Nos. after the State Hermitage Museum, St. Petersburg, see *fig. 3*. Each analysis number (An. No.) belongs to a separate streak. The semi-quantitative data given in weight percent (wt%) are calculated at 100 %. Elements present in concentrations below 1 wt% are marked by +. Cases in which numerous streaks of the same or of a highly similar composition were recorded are marked with an asterisk in the second column. The geochemical background, i.e. elements deriving from the raw material of the stone (Si, K, Ca, etc.), is excluded (cf. *fig. 5*).

A Hallstatt period (or Vekerzug culture) example comes from Chotín, southern Slovakia (thanks to great help of the Danube Region Museum in Komárno). A total of 465 graves were uncovered in 1952–1962 at a site previously disturbed by the extraction of sand (*Kozubová 2013*, 15). These were common graves, both cremation and inhumation. Prestigious graves did not occur at the site, nor did precious metals (if we do not include the foil/plating and the heads of mostly bronze ornaments), unlike amber. The nature of the cemetery without manifestations of distinct social stratification also applies to (at least) nine graves that contained touchstones (*fig. 7*; we did not investigate certain stone artefacts: grave 148/1953: *Kozubová 2013*, 73, pl. 57, or the oval stone artefact from grave 87/1954, which also contained analytically confirmed touchstone). These burials included both inhumations and cremations, a grave without additional finds, graves with average furnishings and even one of two graves classified as exceptional at Chotín (despite likely having been robbed), also for the size of the grave pit (*Kozubová 2013*, 352–353). This

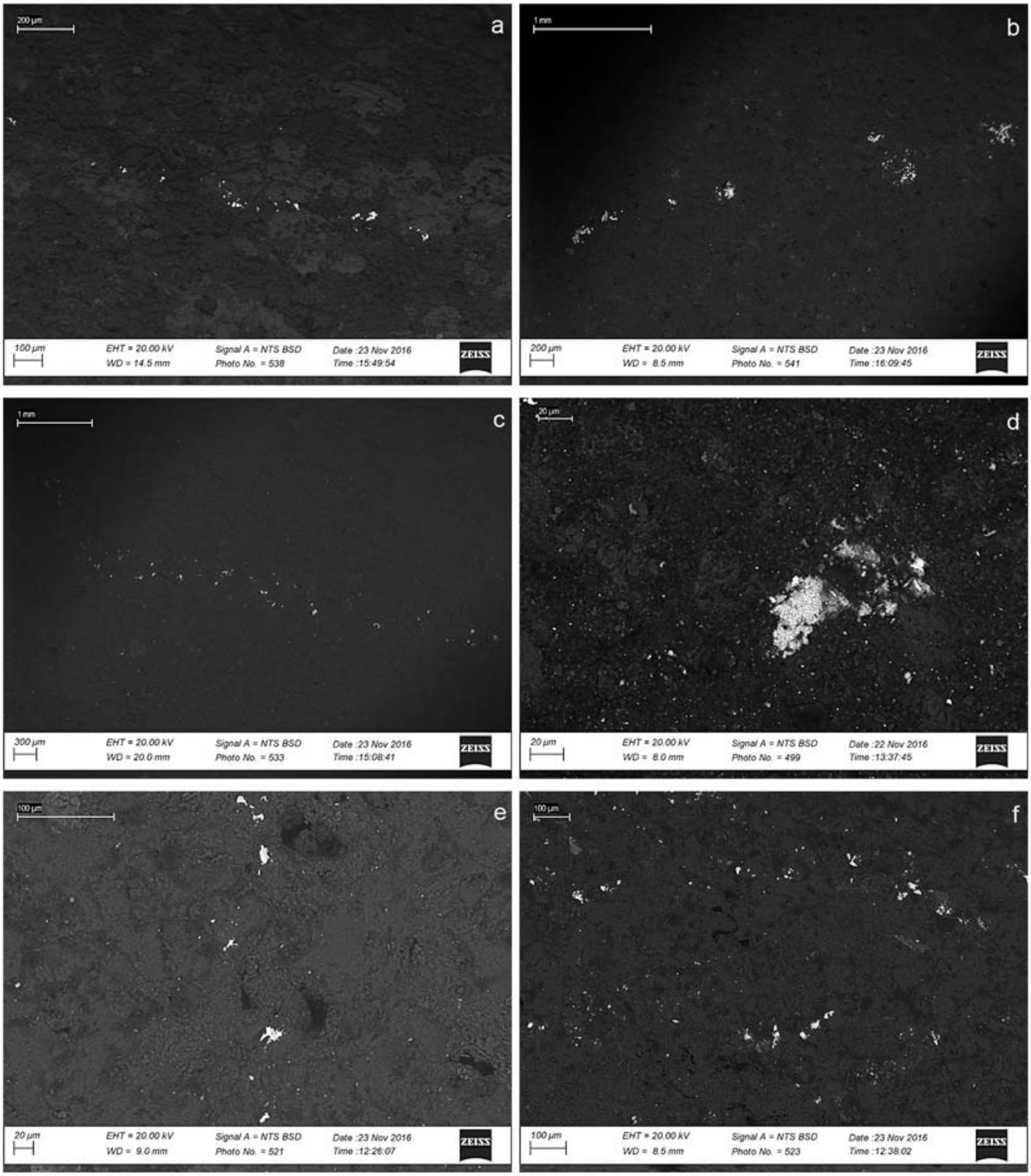

Fig. 4. Examples of the streaks of metal on touchstones from: a – Chertomlyk, gold (*tab. 2: 4*; *fig. 5*); b – Chertomlyk, an alloy of gold and silver (*tab. 2: 7*); c – Karagodeuash, gold (*tab. 2: 8*); d – Kul'-Oba, silver (*tab. 2: 12*); e-f – Talaevsky, alloy/s of gold and silver with an admixture of copper (*tab. 2: 22, 23*). Microphotos: Ks. Chugunova.

latter grave 49/1961 is situated in an accumulation of burials separated by empty space from the other graves. Documented in this accumulation are female and children's graves with above-average furnishings, including children's grave 20/1961 with a touchstone,

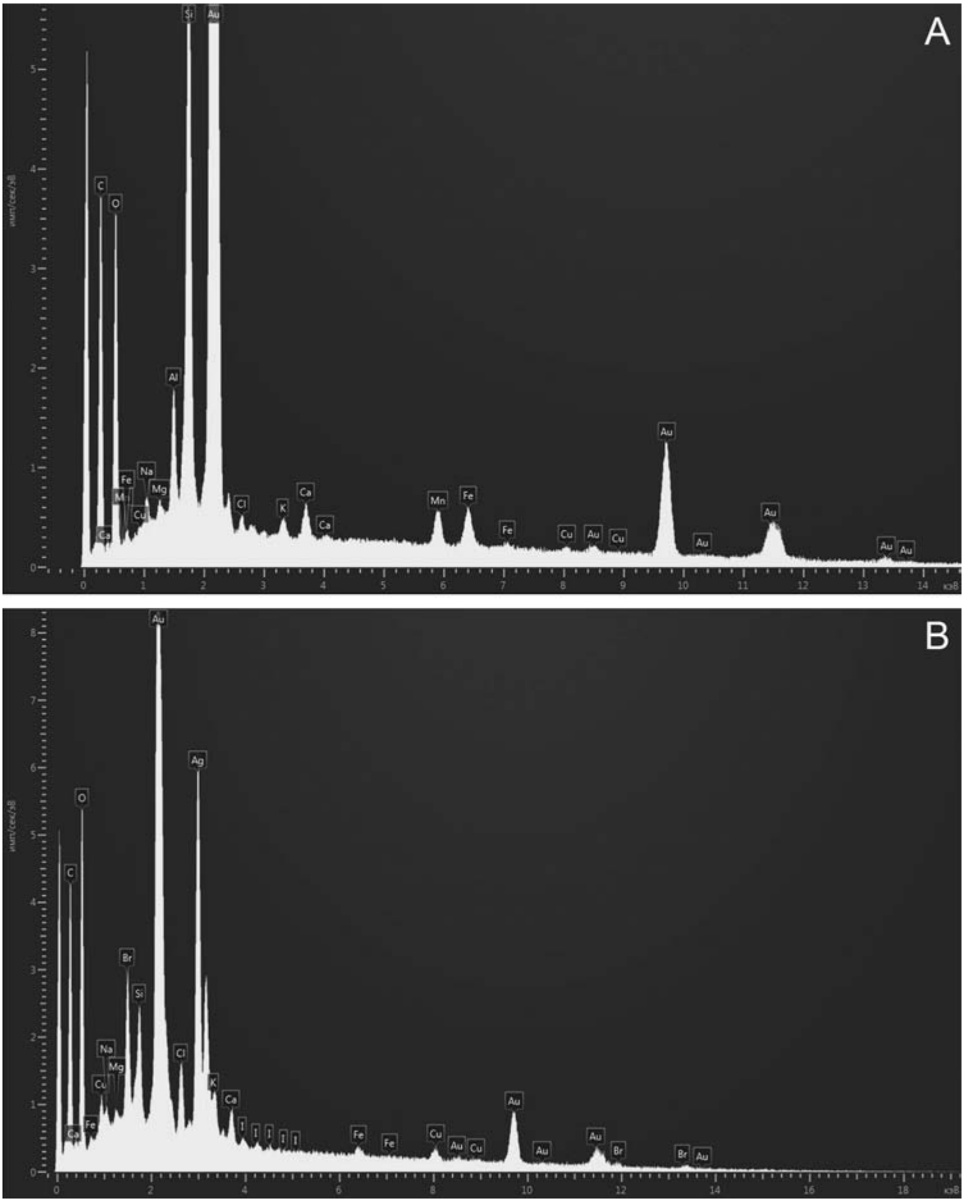

Fig. 5. A: Chertomlyk (*tab. 2: 4*): spectrum of the streak of gold providing the presence of manganese in the analysed point. – B: Talaevsky (*tab. 2: 21*): spectrum of the point analysis of the touchstone's metal finial, with the presence of iodine and bromine.

and cremation grave 23/1961 with a gold-plated bronze torc, an artefact unique at the site (*Kozubová 2013*, 363).

Only four of nine graves containing touchstones now being analysed could be anthropologically identified from Chotín (*tab. 3*). Children's grave 20/1961 has even two anthro-

Grave No.	Ritus	Gender, age	Jewells	Weapons	Riding	Knive	Other	*Kozubová 2013*
24/1952	Crem.	Undet.						p. 15, pl. 7
156/1953	Skel.	Male, maturus		Spearhead		1	Pottery	p. 75, pl. 59
167/1953 Triple burial	Skel.	Undet.	Glas, clay and amber beads	Arrowhead		1	Iron bracelet, pottery	pp. 78–79, pl. 62
87/1954	Crem.	Undet.		Arrowhead, quiver fittings		4	Fragments of pins, pottery	p. 35, pl. 27
92/1954	Crem.	Undet.				1		p. 36, pl. 28
20/1961	Skel.	Child	Glas and clay beads, bronze ore-ring				Pottery	p. 122, pl. 95
44/1961	Skel.	Male, adultus			Fragments of a gear	1	Chape, pottery	pp. 128–129, pl. 100
49/1961	Skel.	Male, adultus	Clay bead	Chakan axe, 8–12 arrowheads	Horse bones, whip grip	1	Iron objects	p. 130, pls. 102, 103
68/1962	Skel.	Undet.		2 arrowheads		1	Iron fragments, pottery	p. 136, pl. 109

Tab. 3. Chotín, Slovakia. The furnishing of the Vekerzug culture graves containing analytically confirmed touchstones (see *tab. 4*). After *Kozubová 2013*.

pological determinations: (1) infans II, (2) two individuals in the age of 2–4 and 7 years. All three male graves and three undetermined burials (including a triple burial) contained weapons and/or riding gear. There is no evidence suggesting that any of the local graves furnished with touchstones were female burials. In any case, as already mentioned, the buried individuals need never have come in contact during their lifetime with the touchstones deposited in their graves (this was probably not the case with the luxurious finds from the barrows of barbarian leaders presented above). It is irrelevant to connect not only the character and frequency of randomly preserved streaks on touchstones but even the occurrence of these and similar tools in graves with the social standing of the buried individuals. The discussed artefacts from Chotín were made from commonly available elongated fluvial pebbles of sandstone, siltstone, marlstone and quartzite.

Most abundant among the recorded streaks preserved on the nine observed stone artefacts from Chotín (*tab. 4*; *fig. 6*) are those of lead, tin and their alloys, often with an admixture of copper. Streaks of alloys of gold and silver with an admixture of copper were identified on five of them. One streak of metal is composed of copper and silver. Pure copper appears only rarely, and the most common are streaks of brass, even with a share of zinc around 35 % (for parallels, including metal objects, see *Ježek 2017*, 101; see also below, *tab. 5*). The brass streaks, often just micrometric grains, are too small to be interpreted as a contamination caused by a modern brush during the cleaning of archaeological finds. Moreover, not even a repeatedly confirmed composition of grains made up of approx. 87 % Zn and 13 % Cu (*tab. 4: 4*) is extraordinary (cf. *tab. 5: 27, 28*; see *Ježek 2016*, tab. 2; *2017*, 93–94, 101–105, tab. 3, tab. 10: 70). Zinc gives a golden hue to brass, and an increase in zinc content makes the colour of a metal object more golden: such alloys could be imitations of a high-quality precious metal. Numerous grains of nickel on one of the studied stone artefacts from Chotín permit nothing more than to repeat the conclusion on the manifestation of speiss occurring unintentionally during copper metallurgy (*Ježek et al. 2018*, 337–340). A streak of metal composed of dominant antimony, lead and

An.No.	Inv.No.	Grave	Ag	Au	Cl	Cr	Cu	Fe	Ni	Pb	S	Sb	Sn	Zn	Note and fig.
1	4561	167/1953								8			92		Numerous grains
2					3		11			19	5		62		
3					1		9			59	3		28		Numerous lines; *fig. 6a*
4							13							87	Repeatedly; *fig. 6b*
5			58	27			2								
6										44			56		Numerous grains
7			49	41			4				6				
8	4683	156/1953	71	13			5				11				Numerous grains
9													100		Area of the hole: from a ring
10							8			47			45		Repeatedly
11							2			27			71		Numerous; *fig. 6c*
12						17		83							Line: modern contamination
13										100					
14										67			33		Numerous lines
15					6					41			53		Area of the hole: from a ring
16	4793	24/1952								43			57		
17										25			75		
18					1					10			89		Numerous grains
19			24	62			14								Numerous grains; *fig. 6d*
20										4			96		
21										75			25		*fig. 6e*
22	4883	87/1954					33			67					
23										100					Grains, repeatedly
24							5			28		67			
25			32	60			8								Lone grain
26	4891	92/1954						100							Linear streak
27							62				2			36	
28										100					
29					3		9			88					
30	4949	20/1961	36	62			2								Numerous lines; *fig. 6f*
31	4970	44/1961					100								Grains, repeatedly
32									100						Numerous grains
33							82							18	Area of the hole: from a ring
34							4						96		Lone grain
35							73				12		15		Grains, repeatedly
36			37				41				22				
37	4985	49/1961								100					Grains, repeatedly
38					3		34						54	8	Lone grain
39					3		5			20			72		
40					1		62				2			35	Lone grain
41	5007	68/1962								100					Grains, repeatedly
42													100		

Tab. 4. Selected results of point analyses of metal traces on stone artefacts from graves excavated in Chotín. Inv. Nos. after the Danube Region Museum in Komárno. Each analysis number (An. No.) belongs to a separate streak. The semi-quantitative data given in weight percent (wt%) are calculated at 100 %. The geochemical background, i.e. elements deriving from the raw material of the stone (Si, K, Ca, etc.), is excluded. 'Grains' mean traces just 5–50 μm in size. Traces of (unpreserved) metal rings in the areas of the hole are grey in the table.

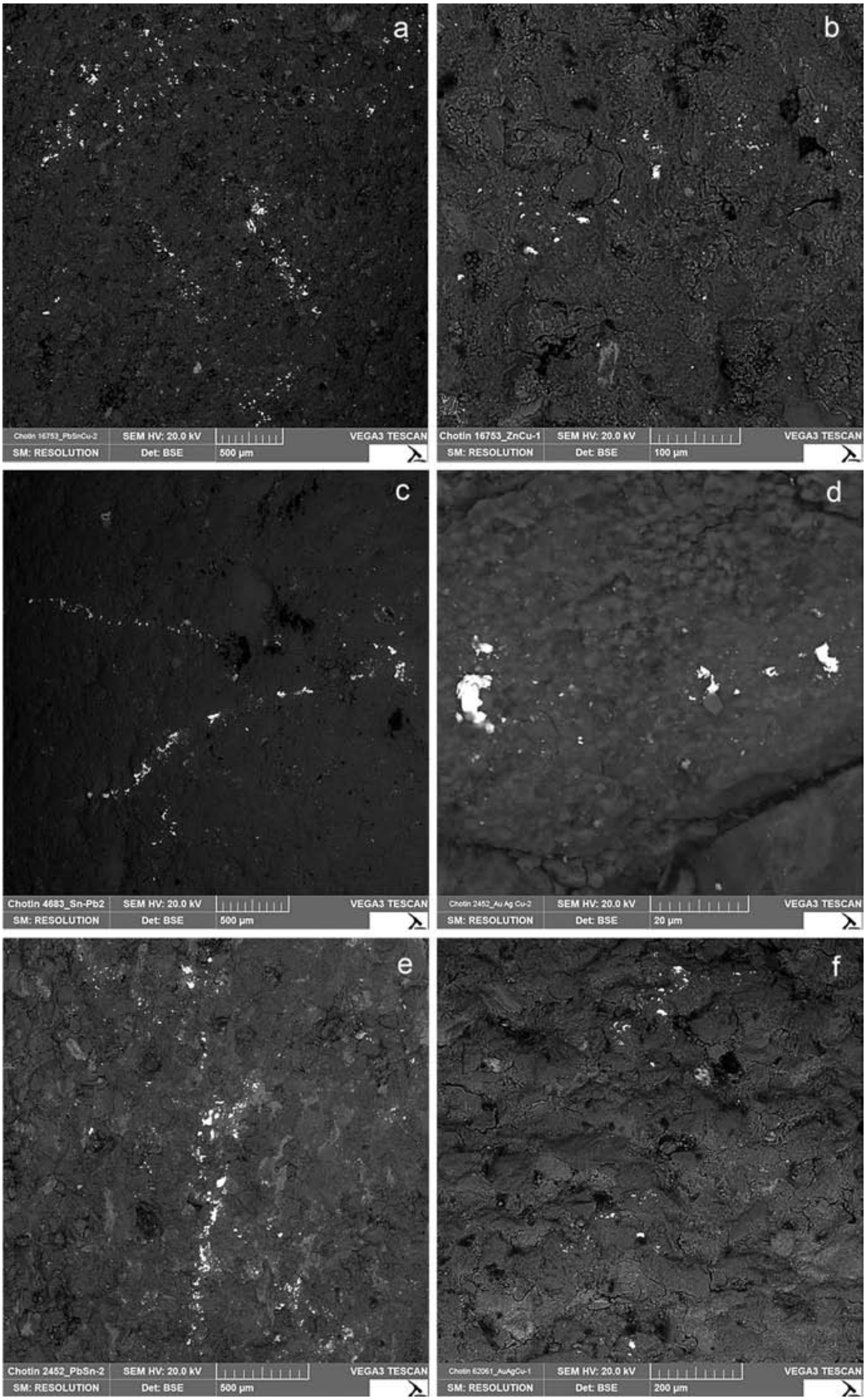

Fig. 6. Examples of streaks of metals on the touchstones from Chotín: a – grave 167/1953, alloy of lead, tin and copper (*tab. 4: 3*); b – grave 167/1953, zinc with an admixture of copper (*tab. 4: 4*); c – grave 156/1953, alloy of tin and lead (*tab. 4: 11*); d – grave 24/1952, alloy of gold, silver and copper (*tab. 4: 19*); e – grave 24/1952, alloy of lead and tin (*tab. 4: 21*); f – alloy of gold and silver (*tab. 4: 30*). Microphotos: Š. Křížová.

Fig. 7. Stone artefacts from the Vekerzug culture graves in Chotín, Slovakia, selected for SEM analysis. Grave Nos. in black, inv. Nos. in grey (after the Danube Region Museum in Komárno). Courtesy of the Danube Region Museum.

a marginal amount of copper is thus far unprecedented (*tab. 4: 24*). Cu-Pb-Sb sulfosalts are relatively common components in a wide variety of Au-Ag-bearing ore deposits (for refs., see *Li et al. 2019*) and occur relatively frequently also in Slovakia (e.g. bournonite $PbCuSbS_3$). The recorded streak confirms that not only intentionally created alloys, but also striking minerals were tested on touchstones in the distant past (see *Ježek 2017*, 148). Two lines of iron were recorded in the Chotín assemblage, one of them with an admixture of chromium (*tab. 4: 12*), clearly modern contamination from archaeologists' tools (for analogies, see *Ježek 2017*, 107–108, with refs.).

5. An example from Helgö, Sweden

The helpfulness of the Swedish History Museum (SHM) in Stockholm makes it possible to draw on the 'long Iron Age' in Scandinavia. After other sites (*Ježek 2014*; *2016*; *2017*), thanks to the systematic processing of the find inventory by Swedish colleagues, we can focus on another iconic site, the island Helgö in Lake Malären (comprehensively *Zachrisson 2004*; *Clarke – Lamm 2017*). Of the 1,094 recorded 'whetstones' or 'grindstones' (*Lamm 2008*, 103), we selected 17 stone artefacts (*fig. 8*) for a chemical microanalysis in a SEM. The samples come both from graves (12 specimens) and from settlement/workshop contexts (5 specimens). They are dominated by mere fragments.

The stone artefacts from Helgö have been assessed from various perspectives (see *Grandin 2008*; *Kresten 2008*; *Lamm 2008*; with refs.), but only occasionally were typical oblong artefacts with a rectangular cross-section treated separately; these specimens are made mostly of schist, siltstone and sandstone. 'Schist or phyllite whetstones […] are rare at Helgö […] Kresten [2008] has found […] that an unusually high percentage of high-quality imported stone artefacts were deposited in the Helgö cemeteries, including seven whetstones of Eidsborg phyllite and two of 'Norwegian blue' phyllite […] A few pendant schist whetstones have been found in Helgö's cemeteries and building groups. They are all of the type with a single perforation at one end'. Although these artefacts attracted the attention of Jan Peder Lamm, in his knowledgeable evaluation he claimed that 'although some stones of sufficient hardness were found at Helgö, none could be confidently interpreted as a touchstone' (*Lamm 2008*, 105–107; however, for an analytically confirmed example, see *Oddy – Meyer 1986*, 159). Pondering grave finds from Helgö, the prescient *J. P. Lamm* (*2008*, 117) asked: 'Why were whetstones so common as grave-goods? Did they symbolise something in particular or were they such an intrinsic part of personal equipment that they accompanied their owners even to the grave?' Our response is: these artefacts did not serve as whetstones, and they need not have had anything in common with the people in whose graves they were deposited. And yes, these artefacts had symbolic meaning as grave goods, though in the Middle Ages this practice had been a traditional custom for so long that a specific causal justification was no longer sought.

Six cemeteries are known at Helgö: the completely excavated cemeteries 116 and 150, the partly excavated cemetery 118, two unexcavated cemeteries (114 and 117), and one excavated grave in cemetery 115, leaving 19 local graves intact (*Clarke – Lamm 2017*, 36–42, with refs.). There are not prestigious burials in Helgö, however, in Skrävsta on the southern shore of Lake Malären facing towards Helgö, the Vendel period aristocratic burial contains one of the finest examples of early medieval touchstones (see *Lamm 2008*, fig. 23: b), along a Merovingian sword comparable to that from Sutton Hoo, England (where a superb oblong stone artefact was also found). We can recall the important petrographic insight of *P. Kresten* (*2008*, 153): 'Finds from cemeteries 116 and 118 and their adjacent Building groups 6 and 7 include an unusually high percentage of imported and generally high-quality stones. […] What clearly distinguished the areas covered by cemeteries 116 and 118 and their adjacent settlements from cemetery 150 and the main settlement sites (Building groups 2 and 1–4) and the workshop (Building group 3) is the abundance of high-quality imported goods […]'.

Cemetery 116 in Helgö was in use for about five centuries, from the Late Migration period to the Viking Age (*Sander 1997*, 11). A total of 49 graves (sometimes with multiple burials) include burials without any furnishings, as well as burials containing precious metals. Whereas several graves evidently belong to the local elite, none of them are exceptional in character. The inventory of the majority of graves was composed of standard combs, beads, finger-rings, lumps of metal, etc. According to *B. Sander* (*1997*), 'whetstones' appear in six graves: A11 (with a hole in one end), A23 (two specimens), A24, A25, A30 (eight 'fragments of whetstones or polishing stones' and a 'stone with smoothed surfaces', which come from several burials in this grave) and A42 (*Sander 1997*, 27–32, figs. 2:9, 2:18, 2:20, 2:21, 2:29, 2:44; a fragment of a 'polishing stone' is also reported from grave A8). The finds come from the cremation layers. The Helgö collection held in the SHM also contains additional touchstone candidates attributed to certain other graves from this cemetery (e.g. A1 and A31: see below). The graves for which a gender determination could be made belonged to adult men (*Jonsson 1997*, tab. 10). We selected six specimens for chemical microanalysis from this cemetery (*fig. 8: 9–14*).

Cemetery 118, with 35 excavated cremation graves (c. 65 % of the total number of local graves), dates from the Late Vendel period to the Viking Age, for c. 150–200 years. 'Whetstones', 'polishing stones', 'flint pebbles', etc., were found in graves 12, 17, 21, 24, 25A (at least seven specimens), 27, 37 and 57 (*Melin 2001a*, figs. 10: 10; 27: 10; 36; 41: 6; 42: 7; 47: 4; 54: 6; 72: 2, 3). None of these graves deviate from the cemetery standard, at which neither graves without inventory nor graves with extraordinary grave goods occurred. All identifiable human remains belong to adult individuals (their gender remains unknown; *Sigvallius 2001*). We selected three specimens for chemical microanalysis from this cemetery (*fig. 8: 15–17*). The adjacent Building group 7 provided few additional touchstone candidates (*Melin 2001b*, figs. 99, 100, 104, 108, 109).

All 41 graves were excavated at cemetery 150, which was in use between c. 500 AD and the early 9th century. Suspected 'whetstones' made from sandstone or schist, typically in fragmented condition, were recorded in at least seven graves: 41, 47, 51, 53, 57, 59 and 105 (*Waller – Hallinder 1970*, 160; figs. 84: 4; 88: 3; 91: 7; 94: 8; 96: 7; 112: 2), mainly in the cremation layers, in one case in an urn. Based on the available anthropological determination of the cremated remains (*Persson 1970*), these graves belonged to young (graves 47 and 57) and old (grave 53) women, adult men (graves 51 and 59) and a child aged 11–13 years (grave 105). We selected three specimens for chemical microanalysis (*fig. 8: 2–4*), including the find from the child grave, which is the only burial at this cemetery that also contained a crucible (*Waller – Hallinder 1970*, 191), and the find from feature 39, a stone setting typical for local graves, but without human remains (*Holmqvist – Arrhenius eds. 1964*, 51).

Metalworking workshops are part of several excavated building groups at Helgö (e.g. *Holmqvist ed. 1972*, with refs.), and finds of typical stone artefacts are common in them (e.g. *Holmqvist ed. 1961*, 232–237; *Holmqvist – Arrhenius eds. 1964*, 230–237; *Holmqvist ed. 1970*, 120–123). The largest of the excavated workshop areas was located in Building group 3. Many crafts were carried out at this site, including bronze casting and goldsmithing. Thousands of fragments of moulds and 234 kg of whole and fragmentary crucibles, iron slag, tuyeries, melted lumps of gold, rods and threads of gold, remains of bronze metallurgy, etc., mostly from the 5th to 7th centuries AD, were discovered (see *Wigren – Lamm 1984*; *Lamm 2008*, 95–97). Regarding 'whetstones/grindstones', 'the database includes 445 measured examples from Building group 3' (*Lamm 2008*, 105); 'the workshop area was stocked mainly with hones or grindstones of an adequate but not ideal quality […] most of the rock used was obtained locally' (*Kresten 2008*, 150).

In the first step of the investigation, we excluded from the assemblage intended for SEM analysis finds on which a binocular microscope failed to identify suitable areas for further observations. However, this does not mean that streaks of metal are not preserved on them. The positive results obtained from 17 stones observed in the SEM often revealed such small metal streaks that they were not observable in any other way. There is a predominance of metal concentrations in the range of tens of micrometres, and sometimes clusters of such concentrations occur (see *fig. 9*), but grains only several micrometres in size were also recorded in the SEM. Linear metal streaks do not occur on the analysed material. In general, the analysed stone artefacts from Helgö reveal a different picture to other analysed early medieval finds of touchstones from Sweden (with numerous linear streaks: *Ježek 2014*; *2016*; *2017*). At the same time, they have counterparts in the SEM findings on touchstones from numerous European early medieval graves (e.g. *Ježek – Holub 2014* for the Viking environment), including elite burials (e.g. *Ježek – Płociński 2013*).

Along burial finds, five specimens from the hundreds of stone artefacts from building groups in Helgö were observed in an SEM, primarily those that do not correspond to the 'classic' claims for touchstones. There are in fact plenty of such 'classic' objects from Helgö (e.g. *Holmqvist ed. 1961*, pl. 62; *Holmqvist – Arrhenius eds. 1964*, pl. 59, 62: 1, 2, 5; *Holmqvist ed. 1970*, pl. 28: 1, 7–10; see *Oddy – Meyer 1986*, 159). However, not belonging to this group is the lone local specimen with a ring preserved in its hole (see *Lamm 2008*, 94), as the surface has only partially the qualities necessary for a touchstone (*fig. 8: 6*). Streaks of copper and lead have been observed there (*tab. 5: 15, 16*). The function of other analysed artefacts from Helgö remains uncertain in some cases even after the performance of chemical microanalyses. However, the reason is not a streak of iron (*tab. 5: 32*)

Fig. 8. Stone artefacts from Helgö, Sweden, selected for SEM analysis. Inv. Nos. after the Swedish History Museum, Stockholm. **1** – 25343 F2010, Building group 2; **2** – 26481 A39, Cemetery 150; **3** – 26481 F2, Cemetery 150, grave 105; **4** – 26481 F3, Cemetery 150, grave 51; **5** – 27448 F7233, Building group 1; **6** – 27687 F8268, Building group 4; **7** – 28480 F9631, Building group 3; **8** – 28480 F9792, Building group 3; **9** – 30249 F10 A31, Cemetery 116, grave 31; **10** – 30249 F16 A25, Cemetery 116, grave 25; **11** – 30249 F28 A42, Cemetery 116, grave 42; **12** – 30249 F30 A30, Cemetery 116, grave 30; **13** – 30249 F99 A1, Cemetery 116, grave 1; **14** – 30249 F106 A23, Cemetery 116, grave 23; **15** – 30710 F4 A37, Cemetery 118, grave 37; **16** – 30710 F14 A17, Cemetery 118, grave 17; **17** – 30710 F27 A27, Cemetery 118, grave 27. Photos by the author, courtesy of the Swedish History Museum.

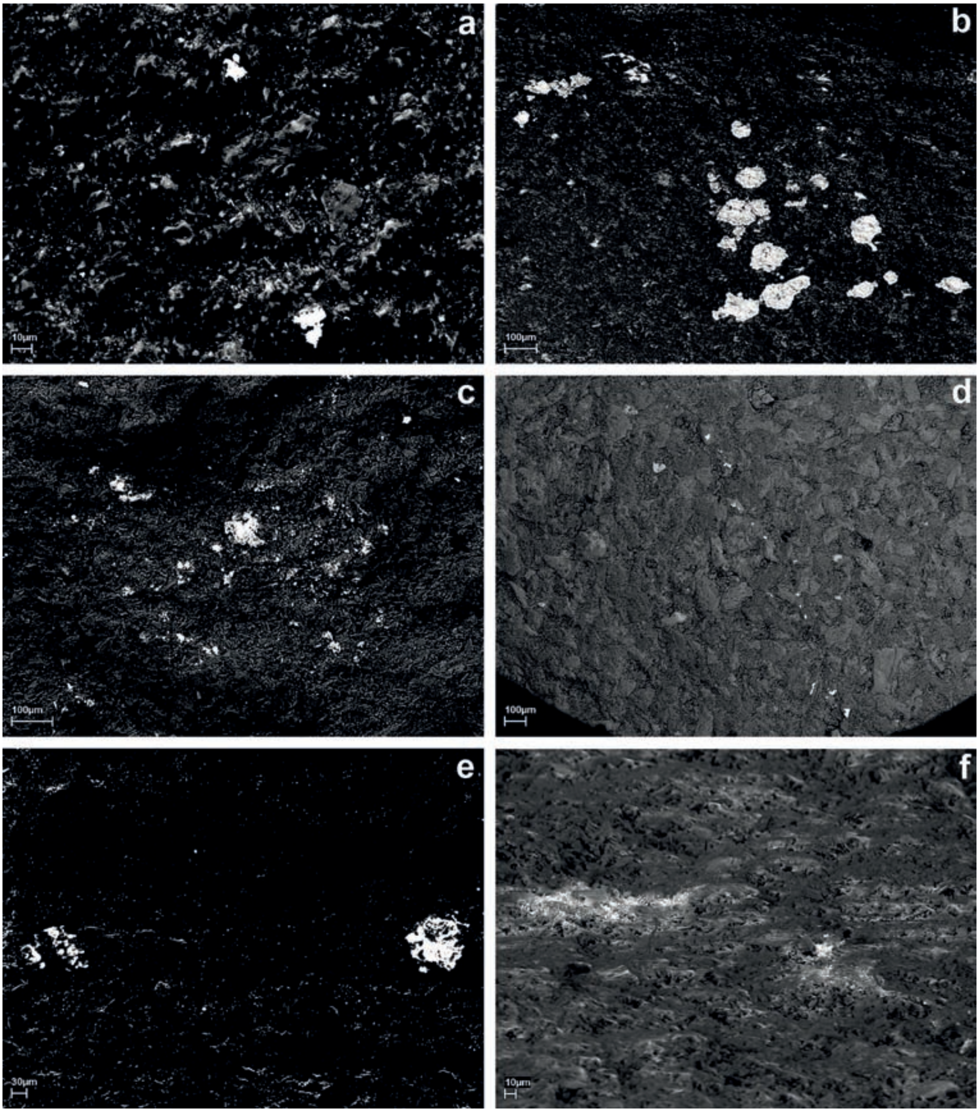

Fig. 9. Examples of the streaks of metal on selected stone artefacts from Helgö. a – 26481 F3, gold with an admixture of copper and silver (*tab. 5: 11*); b – 27687 F8268, copper (*tab. 5: 15*); c – 27687 F8268, lead (*tab. 5: 16*); d – 28480 F9792, brass (*tab. 5: 19*); e – 30249 F16 A25, gold (*tab. 5: 29*); f – 30710 F4, zinc (*tab. 5: 41*). Microphotos: G. Wife.

of unknown age, observed (along with streaks of copper and an alloy of copper and lead) on the surface of one of the 17 analysed stones (see above). Several of them are clearly touchstones, but others could have been used for different purposes in non-ferrous metalworking (see *Kresten 2008*, 150). However, in the case of burial finds, the actual function of the stone artefacts bearing streaks of non-ferrous metal is not of key importance for their symbolic meaning at the moment of the final farewell.

An. No.	Inv. No.	Find-context	Ag	Au	Cl	Cu	Fe	I	Ni	Pb	S	Sn	Zn	Fig.
1	25343 F2010	Building group 2								100				
2	26481 A39	Cem. 150, gr. ? 39	84		1	2		2			11			*9a*
3						98					2			
4										100				
5						14				17		69		
6													100	
7	26481 F2	Cem. 150, gr. 105			5	55			13		3		24	
8						7				9		84		
9			35								32		33	
10			28			6					28		38	*10b*
11	26481 F3	Cem. 150, gr. 51	6	81		13								*10a*
12			7	78		15								*10c*
13	27448 F7233	Building group 1				63							37	
14					2						3	95		
15	27687 F8268	Building group 4				97					3			*9b*
16										100				*9c*
17	28480 F9631	Building group 3	92			8								
18				87		13								
19	28480 F9792	Building group 3				66					2		32	*9d*
20						64					5		30	
21										100				
22	30249 F10 A31	Cem. 116, gr. A 31	82		17						1			
23			87		13									
24				97	3									
25					12	51							37	
26					2							98		
27					18	34							48	
28					16	31					3		50	*10d*
29	30249 F16 A25	Cem. 116, gr. A 25		100										*9e*; *10e*
30													100	
31	30249 F28 A42	Cem. 116, gr. A 42			5	76				19				
32							100							
33					7	73				20				
34						90					10			
35	30249 F30 A30	Cem. 116, gr. A 30				62					2		36	
36						2				49		49		
37			10	72		18								
38					1							99		
39	30249 F99 A1	Cem. 116, gr. A 1										100		
40	30249 F106 A23	Cem. 116, gr. A 23	89								11			
41	30710 F4 A37	Cem. 118, gr. 37											100	*9f*; *10f*
42	30710 F14 A17	Cem. 118, gr. 17	83			4					13			
43										100				
44	30710 F27 A27	Cem. 118, gr. 27	4	77		19								
45			5	81		14								

Tab. 5. Results of point analyses of metal streaks on selected stone artefacts from Helgö, Sweden (cem. – cemetery, gr. – grave). The order of specimens corresponds with *fig. 8*. Each analysis number (An. No.) belongs to a separate streak. The semi-quantitative data given in weight percent (wt%) are calculated at 100 %. The geochemical background, i.e. elements deriving from the raw material of the stone (Si, K, Ca, Fe, etc.), is excluded (cf. *fig. 10*). Some of the data from the individual streaks observed on the same stone artefact are very similar: Quantifications are accompanied in our database by spectra and by microphotographs recorded at the same (analytical) time, from which a radical selection had to be made, and this is a way how to avoid confusion.

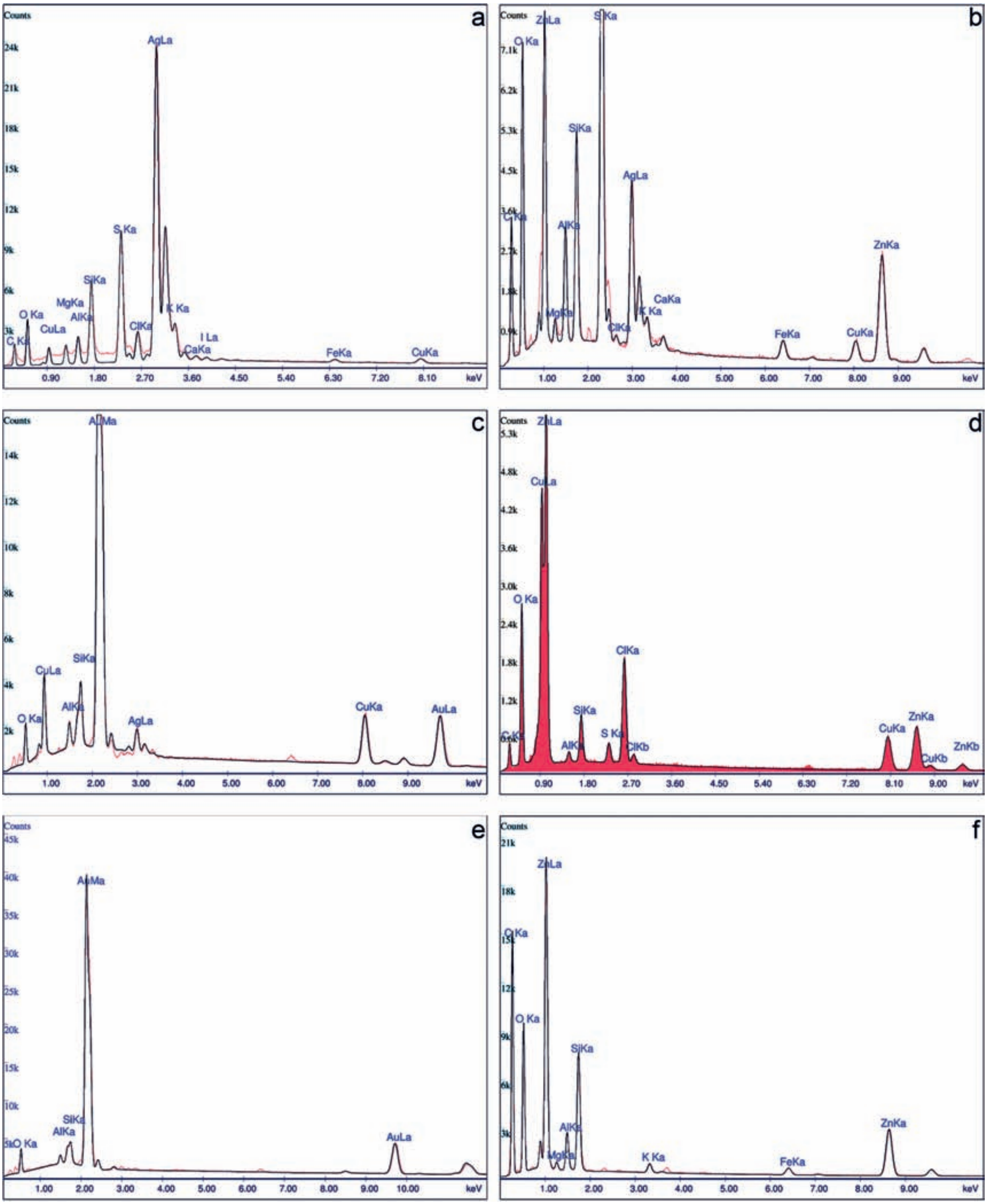

Fig. 10. Selected spectra of the metal traces preserved on selected stone artefacts from Helgö: a – 26481 A39 (*tab. 5: 2*); b – 26481 F2 (*tab. 5: 10*); c – 26481 F3 (*tab. 5: 12*); d – 30249 F10 A31 (*tab. 5: 28*); e – 30249 F16 A25 (*tab. 5: 29*); f – 30710 F4 A37 (*tab. 5: 41*).

Traces of precious metals were observed on ten specimens in our assemblage from Helgö, i.e. 59 % (*tab. 5*). Unlike other analysed assemblages of Viking Age touchstones, gold slightly predominates over silver. Silver also occurs in various alloys with other metals, the most common being copper and its alloys, including bronze. The marginal content of iodine in a streak of silver is typical for the SEM findings from Swedish Uppland. Recently, we suggested the testing of raw ore: halogens could not survive any smelting process (*Ježek 2017*, 98–99). However, the marginal content of iodine is recorded in the Scythian touchstone finial made of an alloy of gold and silver (*tab. 2: 21*; *fig. 5B*), along with bromine. The latter element could appear as a result of the finial's contact with organic material, however, the issue of iodine remains open (the marginal presence of iodine was also recorded during the chemical analyse of a 9th-century AD wire made of silver and copper: *Galuška 2013*, fig. 130). Tin appears both 'pure' and as the dominant part of an alloy, typically with lead, on the observed stones from Helgö. Compared to other sites, the relatively low frequency of streaks of lead and its alloys is noteworthy here, as is also the streak of an alloy with an even share of tin and lead (*tab. 5: 36*; for lead, see above). The share of zinc in streaks of brass of up to 40 % is common on ancient touchstones (see above). Both zinc and nickel form a part of an alloy with dominant copper (*tab. 5: 7*). Similar alloys are designated as nickel brass, or α´ phase of the Cu-Ni-Zn system in the modern period (better known under the names of nickel silver, alpacca or paktong: for analogies, see *Ježek 2017*, tabs. 2 and 10; *Ježek – Holub 2014*, tab. 1). Of greater interest are traces of an alloy composed of a balanced content of zinc and silver (with an admixture of copper: *tab. 5: 10*; *fig. 10b*), and the streak of a metal composed of (dominant) zinc and copper (*tab. 5: 27, 28*; *fig. 10d*; see above). Three truly micrometric – and dubious – concentrations of 'pure' zinc do not permit any conclusions, including the possibility of streaks of hydrozincite mineral (*figs. 9f* and *10f*; cf. *Ježek 2016*; *2017*, 101–106).

Due to the similarity of the preserved streaks on the observed stone artefacts from both the graves and the building groups in Helgö, we do not attribute any special meaning to the find circumstances in the question of preserved streaks. The majority of the stones from graves, or better from the cremation layers, do not show signs of fire (cf. *Ježek 2017*, 93; the find from cemetery 116, grave 1, does not even come from the cremation layer: *fig. 8: 13*). Nevertheless, stones that are burnt (e.g. specimens from cemetery 116, grave 23, and from cemetery 118, grave 17: *fig. 8: 14, 16*), revealed only isolated grains of precious metal few micrometres in size. It should be noted that conspicuous linear grooves occur sometimes on the artefacts under discussion across Europe (including Helgö) and the SEM never determined any traces of metal in these grooves: their purpose remains unexplained.

Regardless of what actual purpose the stone artefacts from Helgö served, a conclusion can be drawn: The stone artefacts under discussion are not whetstones. At the very least, some of them served as touchstones, others could have been used for different purposes in non-ferrous metalworking. However, it is likely that the removal of traces of metal streaks on the relevant stone artefacts plays a key role in the find picture from Helgö. This practice was necessary for the normal use of touchstones, but it was needless for other uses of stone artefacts with metals (e.g. smoothing of semi-finished metal products, or even sharpening). A further testament to the regular cleaning (grinding) of the presented stone artefacts is the concave shape of several of their sides.

The observed stone artefacts from Helgö (inv. No. of the Swedish History Museum = SHM):

Cemetery 116

Fig. 8: 13. Grave A 1: SHM 30249 F99 A1 (not mentioned in *Sander 1997*)
An irregular four-sided artefact with a variable, more or less trapezoidal cross-section as the result of the heavy grinding of one side. Three sides smoothed, the fourth side carelessly levelled. Length 5.7 cm, width 0.9 cm, height 0.5/1.0 cm. Grey quartz phyllite.

Fig. 8: 14. Grave A 23: SHM 30249 F106 A23 (not mentioned in *Sander 1997*)
A regular four-sided artefact with a nearly square cross-section. One end is broken off. The sides are straight, originally smooth. Preserved length 5.9 cm, cross-section 1.7 × 1.8 cm. Light beige-grey sandstone. Burnt.
From the same cremation layer comes another fragment of a typical stone artefact (*Sander 1997*, fig. 2:18).

Fig. 8: 10. Grave A 25: SHM 30249 F16 A25 (*Sander 1997*, 24, fig. 2:21)
Originally a regular square cross-section tapering slightly from one end to the other; glued together from several fragments. Sides smoothed to a gently rough surface, one of which features a shallow groove 3.8 cm long. Length 10.0 cm, cross-section 2.5 × 2.5 cm at one end, 2.8 × 2.9 cm at the other end. Fine-grained light grey sandstone.

Fig. 8: 12. Grave A 30: SHM 30249 F30 A30 (see *Sander 1997*, 27–32)
A small artefact originally with a rectangular cross-section, one end broken off, one side split. The opposite end is ground on both sides to a dull edge. The three preserved sides are smoothed. Preserved length 4.9 cm, width 1.1 cm, preserved height max. 0.8 cm. Dark grey phyllite schist.

Fig. 8: 9. Grave A 31: SHM 30249 F10 A31 (not mentioned in *Sander 1997*)
The small bar-shaped artefact has two fractured ends; triangular cross-section. One side is convex, the other two are flat and at a right angle to one another. Smooth sides. The preserved length is 5.2 cm, max. width 1.0 cm, max. height 0.8 cm. Dark grey quartz phyllite.

Fig. 8: 11. Grave A 42: SHM 30249 F 28 A42 (*Sander 1997*, 38, fig. 2:44)
A fragment of a four-sided artefact with a nearly square cross-section, both ends broken off. Two sides smoothed, the other two are roughly levelled and uneven. Preserved length 6.7 cm, max. width 1.8 cm, height 1.9 cm. Grey quartz phyllite.

Cemetery 118

Fig. 8: 16. Grave 17: SHM 30710 F14 A17 (*Melin 2001a*, 28, fig. 27: 10)
The cremation layer produced (glued) burnt fragments of an elegant slender artefact. The straight sides are perfectly smoothed. Original length exceeded 15.5 cm, the largest preserved fragment has a rectangular cross-section with dimensions 1.8 × max. 1.1 cm. Phyllite schist.
Another fragment of a stone artefact comes from the fill of the mound (*Melin 2001a*, 24, fig. 26: 3).

Fig. 8: 17. Grave 27: SHM 30710 F27 A27 (*Melin 2001a*, 41, fig. 47: 4)
The cremation layer produced a burnt grey oval flint pebble with a smooth surface. Dimensions 4.5 × 2.7 × 1.7 cm.

Fig. 8: 15. Grave 37: SHM 30710 F4 A37 (*Melin 2001a*, 48, fig. 54: 6)
The cremation layer produced a fragment of a carelessly worked artefact with a rectangular cross-section. Only one side is smoothed in places; this side is wavy as a result of irregular grinding. Preserved length 10.7 cm, cross-section 2.1 × max. 1 cm. Phyllite schist.

Cemetery 150

Fig. 8: 2. SHM 26481 A39 (*Holmqvist – Arrhenius eds. 1964*, 51)
This find, along with fragments of a crucible, glass, a spur, etc., comes from a stone setting typical for graves, but without human remains. A four-sided artefact with a trapezoidal cross-section, three sides smoothed with local unevenness, the fourth side roughly levelled. Max. length 7.6 cm, max. width 3.0 cm, height 2.6 cm. Red-grey sandstone.

Fig. 8: 4. Grave 51: SHM 26481 F3 (see *Waller – Hallinder 1970*, 173–174)
A fragment of a massive four-sided artefact that fractured in lengthwise fashion into thin splinters (several subsequently glued together). One end is missing. Three sides smoothed (one of which is ground into a concave shape), the fourth carelessly worked into a bumpy surface. Preserved length 7.6 cm, max. width 3.0 cm, max. height 2.1 cm. Grey mudstone.

Fig. 8: 3. Grave 105: SHM 26481 F2 (see *Waller – Hallinder 1970*, 191)
A fragment of an artefact, now a flat rectangular slab as the result of several pieces being glued together, but apparently only a small part of an artefact that splintered. The preserved surface of one side has a groove that is 0.5 cm wide and 0.2 cm deep. Preserved length 5.5 cm, (preserved?) width 2.4 cm, preserved height 0.6 cm. Beige mudstone.

Building groups

Fig. 8: 5. Building group 1: SHM 27448 F7233

Both ends of the four-sided artefact are broken off. The cross-section is trapezoidal. Smooth sides. Preserved length 7.8 cm, width 1.9 cm, height 1.7 cm. Grey clay shale.

Fig. 8: 1. Building group 2: SHM 25343 F2010

The artefact fragment (both ends broken off) is composed of two pieces glued together. Today's shape of the slab is the result of the absence of other parts of the artefact. The original surface is preserved only on the slender, smoothed 'sides'. Preserved length 5.6 cm, preserved width 2.4 cm, preserved height 0.9 cm. Light grey clay shale.

Fig. 8: 7. Building group 3: SHM 28480 F9631

A fragment of a rectangular artefact, three sides smooth and perfectly polished, one of which features a wide groove; a fracture forms the fourth side. It is possible that the stone split lengthwise in the place of the originally wider groove and that only roughly half of its original width was found. One end broken at an angle and smoothed, the other broken off. Preserved length 7.8 cm, preserved width 2.2 cm, height 2.0 cm. Light grey quartzite.

Fig. 8: 8. Building group 3: SHM 28480 F9792

A stone slab with both ends nearly rounded, one of which is damaged, the other ground. Surface smoothed. A slight depression is ground into the middle of one of the wide sides; the other side is smoothed less carefully. Preserved length 9.4 cm, preserved width 3.9 cm, preserved height 1.3 cm. Red-grey fine-grained sandstone.

Fig. 8: 6. Building group 4: SHM 27687 F8268

A small artefact with a hole in the narrower end, preserved wire ring. The artefact slightly expands from the end with the perforation; the cross-section is consistently a regular hexagon, the side edges of which are slightly rounded. The elegant shape of the artefact contrasts with the working of its surface. Only a smaller part of the widest side is smoothed or polished, as are small patches on some of the other sides. A larger part of the widest side and most of the other sides have only a rough surface. The opposite wider side is not flat and roughly levelled. Length 4.9 cm, width 1.7/1.9 cm, height 0.8/1.0 cm; hole diameter 0.3 cm. Dark grey siliceous clay shale.

6. The *longue durée* of one type of Europeans' votive behaviour

The symbolic role of tools used to determine the value of precious metal was not limited to the ancient burial ritual. For early medieval Scandinavia, *J. Lund* (*2008*, 56) summarises: 'It was not only coins and jewellery of precious metal that were deposited during the Viking Age; weapons, tools, keys and *whetstones* have all been found in wetland contexts, deposited singly or in larger groups […]. Focusing exclusively on the silver hoards as an economic value, as treasure to be regained from the lakes at a later time, does not take account of finds that do not fit this frame of interpretation. It would, for instance, make it difficult to account for the depositions of *whetstones* in wetlands' (the italics by M. J.). Again, this phenomenon is not limited to the Vikings or to the Early Middle Ages, but is tied to a tradition thousands of years old. Typical stone artefacts already occur in few Late Neolithic hoards in Sweden, including these from wet sites (*Karsten 1994*, 91).

Although manifestations of votive behaviour differ in various societies, the custom of the deposition of certain types of objects in a wet environment in Europe crosses not only geographical and chronological borders, but also religious, ethnic and cultural transformations of the European population (see *Bradley 2017*). Generally, over the centuries, or even millennia, ritual behaviour lost its original motivation and is performed without its actor even thinking about the meaning of their actions. However, the fact that ritual behaviour relatively quickly becomes a habit does not mean that different societies do not find their own explanation and motivation conforming to current ideologies and cults (see *Ježek 2017*, 65–68). An inherited custom whose formal manifestations do not otherwise differ in various regions can therefore take on distinct ideological content in different societies. This is even truer for the votive handling of objects.

Swedish waters and wetlands provide many well-documented examples of votive behaviour, but let us limit just on the recently published examples. Among them belongs the deposition of fishing tools from the 6th millennium BC (*David 2018*; for that matter, fishing tools also occur in prehistoric and early medieval graves across Europe: *Ježek 2017*, 77–78, with refs.). Many wetland cult sites in Sweden were visited for centuries or even millennia (comprehensively, including other parts of Europe, *Bradley 2017*). In the peat layers at Hindbygården fen (southern Sweden), numerous artefacts (axes, spearheads, knives, daggers, sickles, etc.) and animal (and a few human) bones dating from c. 4500 BC to c. 1300 BC were found, most of them from the (Swedish) Neolithic to the Early Bronze Age (*Berggren 2007*; *2014*). At least two dozen suspected 'Neolithic' or 'Early Bronze Age' stone artefacts were found here (*Berggren 2007*, 86). Röekillorna spring (southern Sweden) was used for ritual purposes from the Early Neolithic to the Roman Iron Age. From local finds, ten stone and bone weapons and three flint chisels belong to the early period of local cult, while seven 'whetstones' of the shape typical for touchstones (see *Stjernqvist 1997*, 40–42, figs. 7 and 109) are difficult to date. Thousands of artefacts from the fen of Skogsmossen (central Sweden), attributed to the Funnel Beaker culture (the 4th millennium BC), are justifiably classified as votive deposits (*Hallgren et al. 1997*). Finds from the fen include about 90 kg of pottery, 34 intact and fragmented axes, a spectacular curved knife made of a red and greyish-green slate, several arrow- and spearheads, numerous grinding stones, etc. At least six 'whetstones' are among the finds from the site. Another 64 artefacts classified as 'axe-polishing stones' were recorded there, one-third of them in the fen.

Of the finds made in wetlands, the greatest attention used to be paid across Europe to weapons. An early example is Neolithic jadeite axes, whose votive deposition with ties to watercourses has been confirmed by modern research (*Pétrequin et al. eds. 2012*; *Walker 2018*). Offerings of weapons at north European wet sites are widely known, and numerous finds from other regions of Europe document similar practices across ages (e.g. *Gaspari 2003*; *2004*; *Scholz 2007*; *Turk et al. eds. 2009*; *Anders 2013*; *Husár 2016*; *Bradley 2017*). While it is difficult to differentiate offerings of war booty from manifestations of votive behaviour (especially in cases dating from the Iron Age to the Early Middle Ages, including eponymous La Tène), this uncertainty is eliminated with agricultural and craft production tools from the bottom of northern European lakes and fens. The famous chest from Mästermyr contained – besides numerous tools, three bells, etc. (*Arwidsson – Berg 1983*) – also two touchstones (for additional votive finds from Viking Age Sweden, see *Lund 2006*, with refs.). Touchstones already occur in hoards in the Bronze Age, including those with a clear votive context (just from the aforementioned, Late Bronze Age Susa and Iron Age Ahtanizovka). The same is true for other tools used to determine the value of precious metal, and even generally for metallurgical tools, in Mesopotamian, Near East, Cypriot and Greek shrines (e.g., for the Bronze Age, *Arnaud et al. 1979*, 20–21, also with a touchstone; *Matthäus – Schumacher-Matthäus 1986*, 162–163; for ancient Greece generally *Orfanou 2015*, 33–62, 291–299; with add. refs.). For example, in Moravia, stone hammers and anvils (or touchstones?), clay casting moulds, etc., are present in 10 % of the Middle and Late Bronze Age hoards of metal objects (*Salaš 2005*, 60; *2014*).

However, continuing to evade the interest of archaeologists are many artefacts – agricultural tools, working tools, grinding stones, etc. – found alone at the bottom of fens, lakes and rivers (disregarding finds made here while dredging riverbeds and similar sites). The reason for this, besides the complications and specific nature of underwater excava-

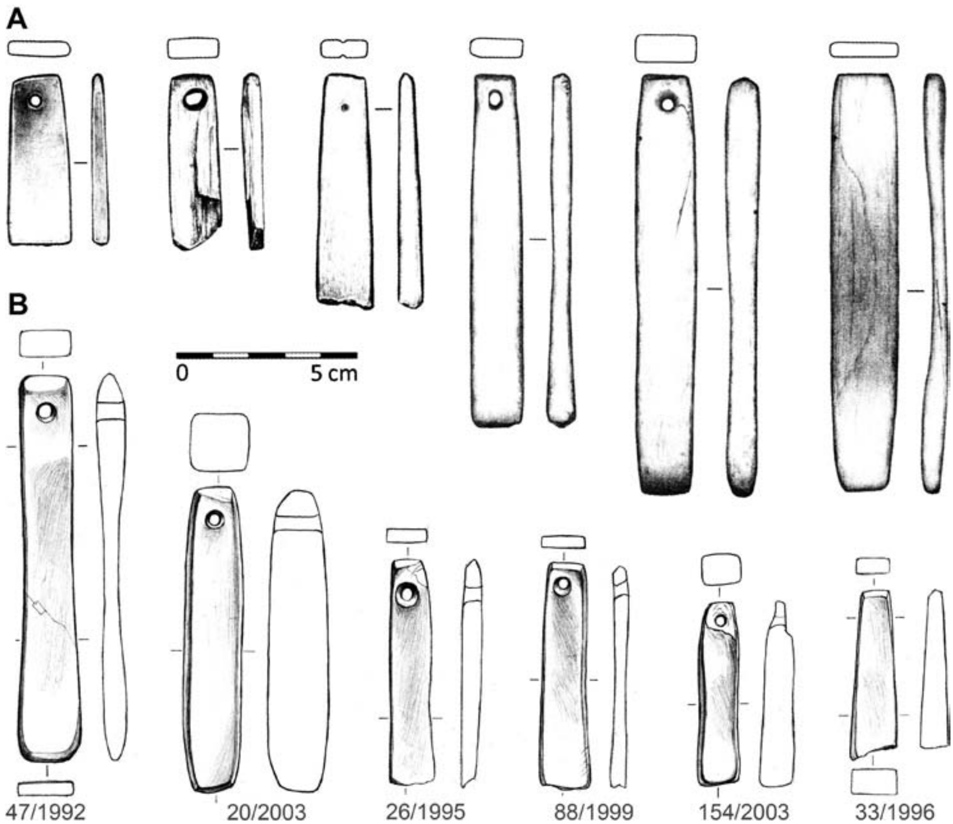

Fig. 11. A: Examples of touchstone candidates from the bottom of the lake close to the early medieval peninsula castle at Żółte (Poland). After *Chudziak – Kaźmierczak eds. 2014*, figs. 6.64 and 6.65. – B: Examples of touchstones (with relevant grave Nos.) with preserved streaks of precious metal, selected from 29 analytically confirmed finds of this kind from the early medieval cemetery in Dziekanowice (Poland). After *Ježek 2017*, fig. 38.

tion, is the difficultly in documenting the intentionality of their resting place at the bottom. And yet, it is precisely these finds that could open new horizons for archaeology. Let's take a look at the mainland of the Baltic Sea opposite to Scandinavia.

Poland is a country not only belonging to the same (bullion) economic zone as Scandinavia in the Early Middle Ages, but mainly to countries with excellent results produced by underwater archaeology. From local intensively explored lakes surrounding islands and peninsulas with early medieval fortresses, a representative example is Lake Lednickie (Greater Poland) with its island castle featuring a church in the 10th century, midway between secular (Poznań) and Church (Gniezno) centres of the early Piast state (30 km in both directions). Divers retrieved from the bottom of the lake 141 axes, over 80 swords, etc., including several weapons dating to the Late Middle Ages, i.e. a period in which the local castle was already abandoned (see *Ježek 2017*, 123–126, with refs.). Instead of 11th–12th-century luxurious weapons and riding gear, we will emphasise here less attractive artefacts: more than 100 specimens of agricultural equipment (ploughs, sickles, etc.), a pair of balances, seven weights, and ten stone artefacts with the same characteristics as more than fifty (selected and) analytically confirmed touchstones from both the island and the large cemetery excavated on the lakeshore in Dziekanowice (*Ježek 2017*, 137–144; see *fig. 11B*). Balances, 24 weights, thirty touchstone candidates ('whetstones' in the original publication; see *fig. 11A*), 11 coins and other objects, including weapons, were retrieved from the Lake Zarańskie close to the local peninsula castle at Żółte (West Pomeranian Voivodeship: *Chudziak – Kaźmierczak eds. 2014*, 178, 273–278, fig. 6.64, 6.65, 6.140, 6.141). I was not permitted to observe these stone artefacts in an SEM; consequently, we are missing any information on the effect of lake water on the metal streaks on touchstones after a millennium. A rather exceptional example of the use of underwater archaeology in 'Germania Slavica' is Plauer See (Mecklenburg-Vorpommern): a balance pan was found along the bridge to the island fortress (*Bleile 2008*, 94–97).

In individual cases it is difficult to prove that tools used to determine the value of precious metal (or other finds) reached the bottom of the lake intentionally. Even more difficult is to document the ritual motivation behind their presence in water. However, if finds of both weapons and tools used to test the value of precious metal from Polish and Pomeranian waters from the 11th–13th century can be connected to the tradition of pre-Christian practices in the Christian environment, a key question is whether customs of the European population in place for thousands of years end with the radical change in religious faith, i.e. whether Christianity altered the ritual behaviour of Europeans (cf. *Bradley 2017*, 43–44).

Renowned symbols of Christian faith – pilgrim badges – from the late 12th – 16th century offer an answer. A decade ago, it was stated that roughly 70 % of these artefacts (made of an alloy of tin and lead) known to modern scholars came from rivers (*Brumme 2008*, 129). Thousands of such artefacts were retrieved from riverbeds in large cities, often along weapons, coins, etc. (e.g. from the Seine in Paris: *Bruna 1996*; the Thames in London: *Spencer 2010*; the Weser in Bremen; the Trave in Lübeck; the Elbe in Hamburg; the Odra in Szczecin; the Loire, Saône, Somme, Scheldt, etc., e.g. *Köster 1983*; *Rębkowski 2013*; with refs.). At least hundreds of badges were raised from the seabed in ports or connected canals on (not only) the North and Baltic seas (*Andersson 1989*, 19; *Ansorge 2008*; *Brumme 2008*, 131–132; with refs.). Although the current figure could change with new publications, the water environment remains clearly dominant. For example, three-quarters of around 1,200 pilgrim badges and other devotional items retrieved in Gdańsk (Poland) come from the area of the medieval port (*Paner 2016*).

Upon returning home, many pilgrims evidently regarded water as the best place for depositing these souvenirs (cf. *Merrifield 1987*, 108–109; *Kühne 2011*, both with add. refs.). This by no means concerned only sea and river water, which could evoke for interpreters today the thought of carrying the deposited messages great distances. For example, a scallop shell, a souvenir from Santiago de Compostela (Spain), was found at the bottom of a 14th-century well on a city parcel in Most (Czech Republic). Typically, the author of the excavation connects this cult item with Christian-motivated faith in its power to secure pure drinking water (*Klápště 1992*). And yet, the true meaning of this deposit apparent rests in much deeper layers of the medieval European psyche. For that matter, Church officials were wisely indifferent to the practice of tossing pilgrim badges in the water: there are no records indicating any ban on this activity. And again on the spiritual background: In the Baltic region, the end of this custom could theoretically be connected with the Reformation. However, finds of pilgrim badges, and their production in general, are also missing in traditionally Catholic regions in Europe from the late 16th century.

7. Conclusion

The long history of depositing selected objects in wet environments in Europe shows that late medieval Christians retained millennia-long votive habits but simply changed the objects used in their expression. In the new circumstances (important also for archaeology: cf. the reduction of grave goods in common graves in Europe), pilgrim badges, i.e. objects with a society-wide shared symbolic meaning, took over the role of a generally comprehensible medium. Although a final resting place beneath the water was probably not a necessary condition for the fulfilment of the role of the badges, thousands of pilgrims entrusted them just to water. Ritual behaviour of late medieval Europeans in the form of depositing widely shared symbols in water is tied to practices from much deeper into the past. Illustrative examples are Bath in England and Duchcov (Dux) in Bohemia with thousands of valuables thrown into the local extraordinary springs during the Iron Age (*Cousins 2014*, with add. examples; *Kruta 1971*). This practice is documented from the Late Bronze Age in Europe already (*Bradley 2017*, 8, 60–64).

At the opposite chronological end is the question of why people today toss coins into fountains. Some 4,500 Roman coins were deposited in a thermal spring at Bourbonne-les-Bains (France), and even earlier cases are available in Southern Europe (*Sauer 2005*). However, ancient coins (made of precious metal) are just one medium bearing generally shared significance, and the issue is surely interwoven with the hack-silver hoards (including dirhams and other coins or their fragments), a different form of currency, typical for the bullion-economy (or northern) zone of early medieval Europe. Modern coins have little in common with precious metal, however, just this connects them with the symbolic role of tools used to determine the value of precious metal during European prehistory and the Early Middle Ages: The importance of tools used to determine the value of precious metal began to fade once the quality of currency began to be guaranteed by the imprints of local authorities on coins.

Nevertheless, to avoid mixing two subjects, of which one (votive offerings in wet environment) was treated by *R. Bradley* (*2017*), let's return to 'our' – essentially worthless – stone artefacts. In Europe and the Near East, tools used to determine the value of precious metal and other objects connected with metal-working acquired a ritual significance in specific contexts (graves, hoards, votive circumstances) between the Chalcolithic and the Early Bronze Age (see *Ježek 2015*). Or, in the words of *S. Orfanou* (*2015*, 62, with refs.): "Once objects were ritually deposited they were interwoven with the supernatural, thus holding a special meaning and importance amongst the context of material culture […] Even if objects were made for everyday use and were never dedicated themselves, once they belonged to an artefact type that was suitable for ritual deposition they were 'converted' into items of symbolic value which had an effect on the way these objects were perceived, used and produced by contemporary societies […]".

The earliest evidence of the symbolic importance of touchstones comes from the environment of the Maikop culture in the northern foothills of the Caucasus. There, or in the environment of the Yamnaya culture, not only the origins of metallurgy, but also origins of the Indo-Europeans are also searched due to the archaeogenetic and language data (*Anthony 2007*; *Haak et al. 2015*; *Kristiansen et al. 2017*; *Heyd 2017*; *Olalde et al. 2018*; *Narasimhan et al. 2019*; all with add. refs.). From the Bronze Age up to the Early Middle Ages, touchstones occur primarily in male graves, less often in female graves, and even in a child graves. These tools appear in both prestigious and common graves. Neither the gender and age nor the social position of the deceased played a key role in the selection of objects for bidding the final farewell.

Finally, the territory of Sweden has produced hundreds of grave finds of touchstones from the (local) Late Neolithic and Early Bronze Age, whereas only dozens are recorded in contemporary (i.e. Bronze Age) Central Europe. Similarly, Scandinavia, Baltic region and northwestern Russia have produced at least thousands of early medieval touchstones, whereas from Central European territory outside the bullion-economy zone (i.e. south of the Elbe River and Riesengebirge/Krkonoše Mts.) only dozens of similar finds from the same period are known (the same is true for both hack-silver hoards and finds of balances and weights). The find picture of various European regions could be interpreted as a mirror image of different exchange systems in the Early Middle Ages (as did *Ježek 2013*; *2017*, with refs.). However, the congruence in the geographic distribution of burial finds of touchstones over millennia, or in the votive role of tools used to determine the value of precious metal, testifies to the *longue durée* of differences in behaviour and traditions of various European societies. It casts serious doubts about the significance of migrations for related cultural changes between the Bronze Age and Early Middle Ages in Europe.

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