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Metallic Idiophones 800 BCE to 800 CE in Central Europe: Archaeology of sound, textiles and costumes

Introduction

The aim of the project, “Metallic Idiophones”, was to gain deeper knowledge about idiophones, such as bells, pellet bells, and sounding jewellery, concerning their function, their acoustic and psychoacoustic influence on human auditory, their chemical compositions, handicraft, and symbolic meaning. Textiles from archaeological contexts together with idiophones are further objects of research and the results presented here are only parts of the larger project, “Metallic Idiophones”.

The function of the textiles is studied and, in case of garments, the connection between the visibility of the textiles and the sound of the idiophones are studied. As case studies, 31 Hallstatt culture idiophones (pellet bells, bobbles, ring pendants, and fibulae) from Switzerland and Hallstatt (AT) were investigated, as well as 218 Roman bells (Austria, Hungary) and 266 pellet bells from the Avar period/Early Middle Ages (Hungary, Slovakia, Austria) (e.g. Pomberger et al. 2020; 2022a; 2022b; 2022c; 2022d; 2023a).

Hallstatt culture jewellery, found in women’s burials, are markers for social status and influence, and could be religious symbols (Schumann 2015; Glunz-Hüsken 2017).

Roman bells were unearthed in settlements and military camps, in buildings, roads, in and near wells, in the context of metal workshops, in temples and hoards, in ditches and graves, nearly everywhere. They played several roles in everyday life (fig. 1), but were primarily signalling instruments, and/or had apotropaic functions, and were objects of status and prestige (Pomberger et al. in print). As signal instruments they heralded markets, bathing hours, rung when fires broke out, used to regulate life in

military camps and settlements, and announced executions. Pasture and pack animals as well as pets wore bells on collars. People, especially children, wore small bells on bracelets or necklaces as apotropaic magic amulets. Bells were hung inside and outside of *villae urbani* and *rusticae*, temples, and on pillars and statues for apotropaic purposes, again, demonstrating status and prestige. They sounded for various cultic purposes and enriched the soundscape of daily life (“Klangkulisse”).

Pellet bells appeared in the Avar Khaganate from the middle of the 7th century. They are present in less than 1% of all graves, thus are quite rare, and were mainly found in children’s burials near the hips, thighbones, wrists, and neck. Only a few adults had

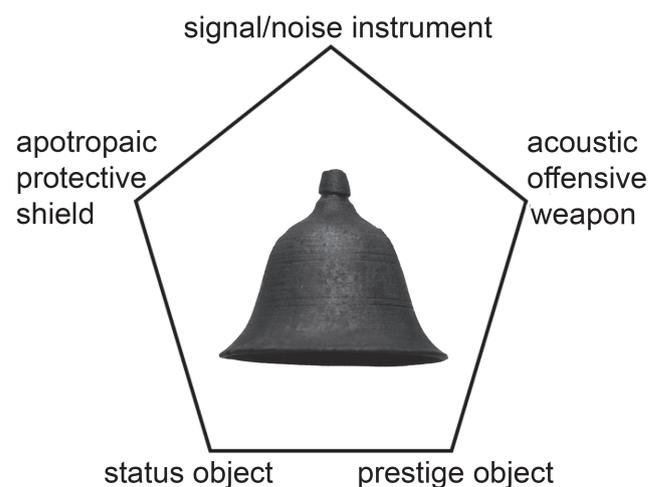


Fig 1: Bells as multifunctional objects (Image: Beate Maria Pomberger)

pellet bells, and some belonged to horse tack. Humans wore them as apotropaic amulets hanging from their belts, attached to ribbons or chains.

Analysis of the idiophones

Sound and frequency analyses shows that their ranges depend on size, shape, weight/density, and material of the idiophones. Well-preserved bells and pellet bells were recorded and analysed acoustically and psychoacoustically. Their peak frequencies range from 1.2 kHz up to 8 kHz. Since the ear is very sensitive in the 2–5 kHz range and can perceive even lower levels, this characteristic gives the objects an averagely good audibility even with moderate noise. Bells and pellet bells are bright and sharp in sound. Because of their shapes, bells show more tonal components than pellet bells (Pomberger et al. 2022a).

Chemical analysis on the metals carried out on numerous samples of all periods showed that sounding jewellery from the Hallstatt culture was cast in bronze, while Roman bells and Avar pellet bells were made of bronze, gunmetal, leaded bronze, leaded copper, brass, and iron sheet.

In an experimental approach, one bell type and one pellet bell type were cast as replicas in six different copper alloys to gain more information about the influence on sound and sensory euphony. While no significant correlation – from a statistical point of view – could be proved between the copper content and (psycho)acoustical parameters, tin is the only element which correlates with decay time and tonality (Mühlhans and Pomberger in print). A listening study of recorded sounds of original artefacts and replicas was carried out online as part of the project. It showed that the sounds of the replicas were perceived as more positive and cheerful than those of the originals that had been buried in the ground for a long time. The reason for this is corrosion, which influences the sounds. Therefore, we listened not to the original but the conserved sounds.

Textile analyses

Remains of textiles adhering to some of the Avar period pellet bells from burials were examined; 25 of these were also analysed regarding their technological properties, expanding the currently rather small database of textiles from this culture. Additionally, some textiles – not necessarily from clothing – could provide further information on the function of the pellet bells.

The textiles analysed (e.g. Pomberger et al. 2022b, 69–73) were mostly typical when compared to known textiles from the Avar culture (Dolejšová 1987; Grömer

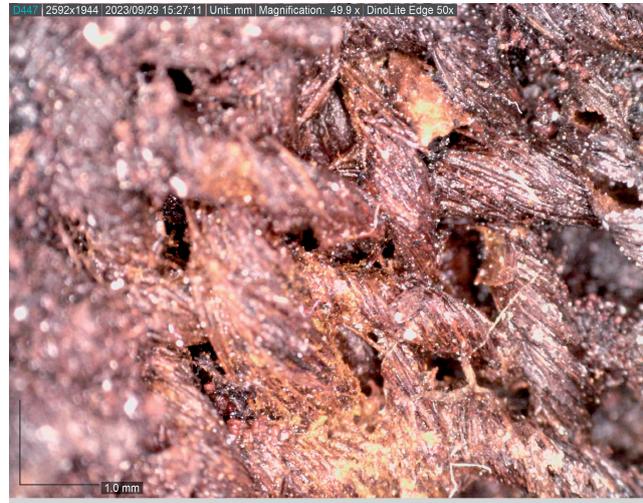


Fig. 2: Textile attached to an Avar period pellet bell from Zillingtal, Burgenland, Austria, showing z-yarns in one system and s-yarns in the other (DinoLite digital microscope, 50x magnification; Image: Kayleigh Saunderson)

2015, 200; Grömer and Rapan Papeša 2015): all were of single yarns, usually z-spun (sometimes combined with s-spun in the other system – fig. 2), and tabby-woven. However, the thread diameters and counts vary quite a lot – usually between 0.2 mm and 0.8 mm, 8 and 20 per cm.

In most cases, the mineralised textiles (fig. 2) were only preserved on one side of the pellet bell, often on the upper part. These likely derive from the person's clothing, often found near the hips of the wearer. Interestingly, as has been observed for other Avar period textiles found in the hip area, some of these exhibit folds (Pomberger et al. 2023, 48), indicating loosely cut clothing gathered with a belt. Multiple layers of different textiles could also be observed, likely representing layers of clothing. However, not all textiles derive from clothing. Beddings or wrappings – of the body or the pellet bell itself – should also be considered, which in one case might indicate the symbolic placement of a pellet bell inside a small pouch (Pomberger et al. 2023, 47).

Experimental recreations of ensembles with garments and idiophones

In addition to the analyses on the idiophones and textiles from the Iron Age, Roman Period and Early Medieval Avar period, costumes including ring pendants and pellet bells were recreated. The term "recreation" is deliberately used here (Saunderson et al. 2022, 98), as there is hardly any evidence of more or less complete garments from the geographical

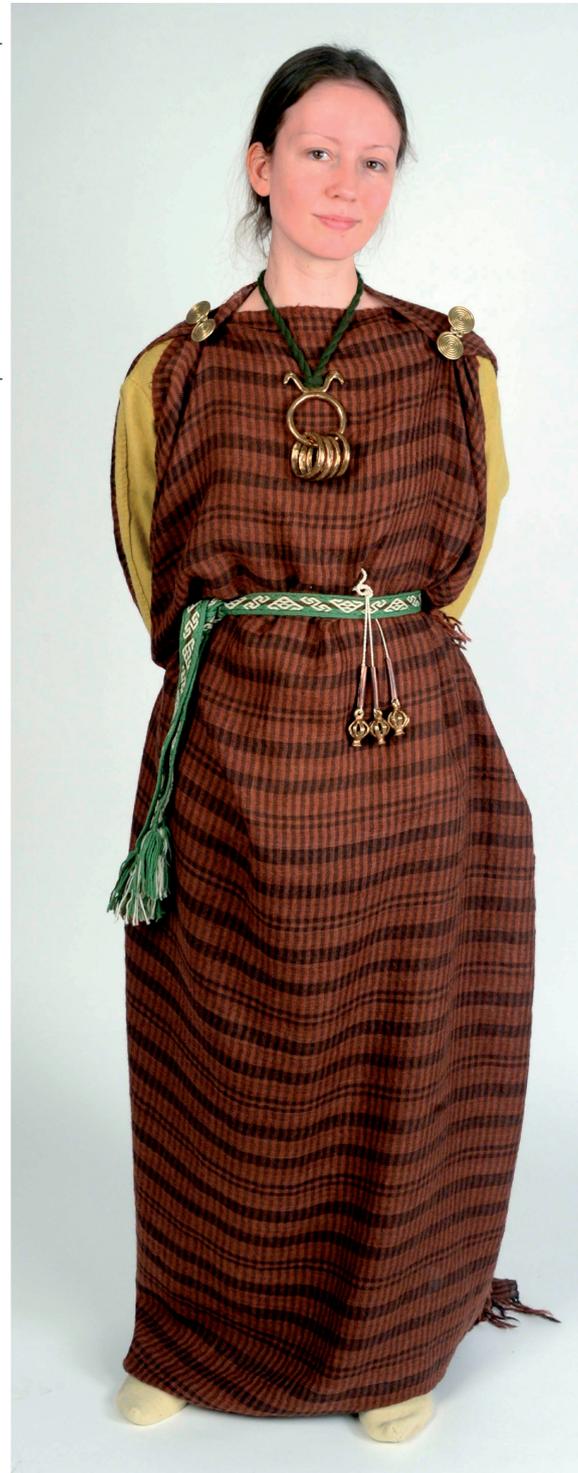
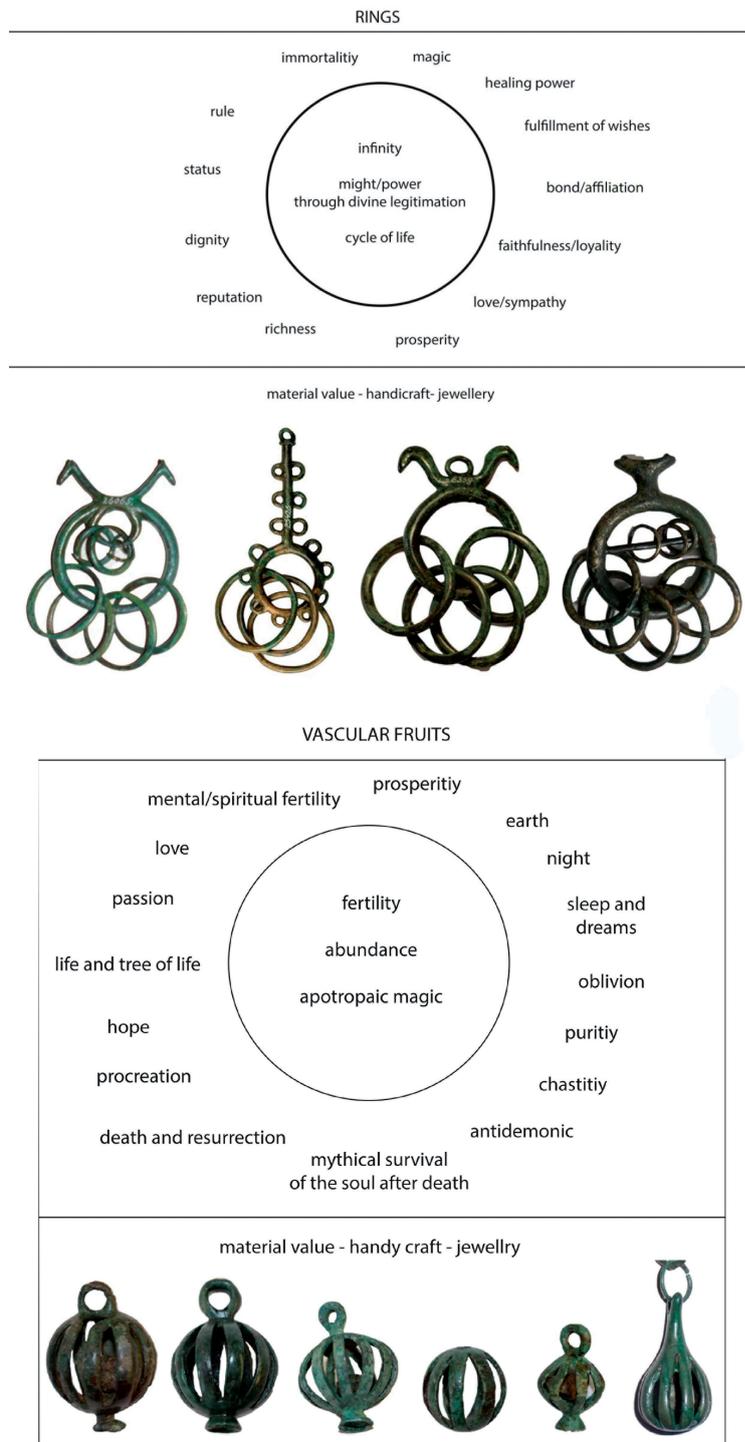


Fig. 3: Symbolic meanings of pellet bells and ring pendants and a recreation of a costume of the Hallstatt culture (Images: left: Beate Maria Pomberger; right: Reconstruction: Karina Grömer and Kayleigh Saunderson; Image: Alice Schumacher, NHM Vienna)



Fig. 4: Bacchus cult dancers with bells depicted on Roman sarcophagi from Sardinia, kept at the Museo Archeologico Nazionale di Cagliari and the Vatican Museum/Loggia scoperta and reconstruction by Kayleigh Saunderson (Images: left and middle: after Pesce 1957, figs. 9 and 13; right: Alice Schumacher, NHM Vienna)

region and time periods of our studies, and a lot of interpretation is involved, incorporating finds from other regions.

Hallstatt period pellet bells and ring pendants

Women's graves in the geographical area of the Hallstatt culture sometimes also contain sounding elements. The fibulae with rattling pendants have been widely discussed (Grömer 2016, fig. 240; Grömer and Pomberger 2023). Other idiophones from burials of females are pellet bells and ring pendants, as found e.g. in Hallstatt and Býčí skála (Pomberger et al. 2020). Their sound is distinctive, and they also hold various symbolic meanings (fig. 3 left) (Pomberger in print). The recreation of Hallstatt period garments is usually based on a combination of textiles, as found in the salt mines of Hallstatt and graves, complete garments from other geographical regions and pictorial sources (Grömer 2016, 379–403). In the case of the recreation for the pellet bells and ring pendants, the interactions between rich wool cloth and the idiophones were tested when worn on the body (fig. 3 right).

Bells on dancers' costumes for the cult of Bacchus

Iconographic representations on Roman sarcophagi in Sardinia show dancers with bells – probably shepherds – participating in the cult of the god Bacchus. They wear either *fasciae* wrapped around

their upper body or *loricae* with six to eighteen bells attached. The ringing of the bells is thought to drive the powers of evil away and promote the fertility of the fields (Pesce 1957).

One of these bell costumes was recreated using 18 bells attached to strong leather straps with hemp strings, based on the depiction on a sarcophagus, kept in the Loggia scoperta, Vatican Museum (Pesce 1957, fig. 13) (fig. 4 middle). The bells are based on bell Fn. 89 from Ovilava (Wels, Austria), a Roman bell type 1/var A (Pomberger et al. 2022a). The result is extraordinarily loud, even when the wearer is only moving slightly.

Recreations of Avar period costume

A life-sized costume recreation was made of the Avar-Gepid grave 2357 of Zamárdi Réti földek, at Lake Balaton in modern day Hungary (fig. 5). The woman was buried in the so-called *Gehängegürteltracht* (Garam 2011), a costume with a characteristic belt with a long hanging strap with tools and clapping objects attached to it, found across multiple cultures of the Early Medieval era. In this case a pellet bell, two iron keys, and two bronze discs were attached to it. She also wore an earring and multiple rows of glass beads and amulets on her chest, as well as fittings on her belt.

For the recreation of the textile garments, the finds from eighth to tenth century burials of Moshchevaja

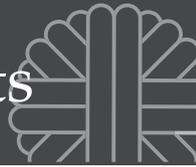


Fig. 5: Recreation of an eighth century sounding costume based on the finds from Zamárdi grave 2357 (Images: Simon Dupper)

Balka in the Northern Caucasus (Ierusalimskaja 1996) were used as models. Although these garments belong to the Alanic culture, their cuts were considered to be the best basis for Avar period garments, as this culture also exhibits steppe traditions, dates to the eighth century, and may have common origins.

The recreation consists of a madder-red linen underdress, based on a red linen or hemp textile fragment from Frohsdorf (Scharrer-Liška and Klatz 2010, 136). The wool overdress combined caftans from the Caucasus and western (Alemannic, Bavarian, Francian, etc.) sources, such as the short, wide sleeves in the Stuttgart Psalter (Württembergische Landesbibliothek first half ninth century, fol. 83v top) and dresses that were open at the front (Bartel and Knöchlein 1993).

The belt created many different sounds when in movement, with the strap end clapping against one of the belt fittings and the iron and bronze objects clapping against each other and the pellet bell. For the purpose of science communication within the

framework of the metallic idiophones project, three fabric dolls (female, male, and small child), up to 25 cm in height, were created (fig. 6). Their garments were again based on the Moshchevaja Balka finds, where doll garments in the same style as the clothing worn by the dead were found. Outer garments made from linen were found in both the Alanic and Avar burials, and were also recreated for the dolls.

The caftan garment, worn by the male and child doll, is worn in multiple Moshchevaja Balka burials and is also depicted on an Avar period graffito (Vida 2017, fig. 63.3). The belt components, clasps, beads, and pellet bell locations were based on typical Avar finds.

Use of reconstructions for science communication

These costumes are employed as visualisations but also for acoustic demonstrations and experiments concerning their production as well as use. They represent a useful tool for public science communication, as an experience to be viewed, heard, and also touched.

The dolls are used for demonstrations of Avar clothing and to show how their pellet bells might have been worn. The dolls are quite robust, and their garments can be taken on and off, showing how multiple layers could have been worn.

The costumes were made to fit many sizes, so that many people can experience wearing them. Although they are understood through modern perspective, people's experiences of wearing such clothing are to be noted, along with the impressions of other people hearing and viewing the costume. For example, the Zamárdi costume was worn for two days at an open-air museum in July 2023, one wearer described it as a very unfamiliar experience with such "loud" clothing. The impressions from craftspeople working at the museum at this time were all quite similar, describing how the wearer could be recognised from afar by their sound, creating an acoustic identity and sound field for the individual wearer.

The acoustics of this recreations are yet to be analysed further, investigating the interplay of the clapping metal elements as well as the influence different clothing textiles may have on the sound.

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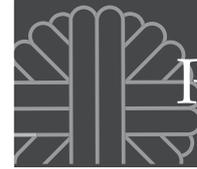


Fig. 6: Dolls in recreated Avar period costumes (Image: Beate Maria Pomberger)

objects, and Nicolas Loy for the iron objects. We also want to thank Sirko Galz for the recreation of some of the textiles.

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