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DISC BROOCHES OF THE ROMAN IRON AGE FROM THE *TARAND* CEMETERIES OF ESTONIA AND NORTH LATVIA

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Disc brooches from the Roman Iron Age are very diverse in style and execution throughout Europe. Their diversity in the tarand cemetery areas of modern day Estonia and North Latvia is also very high, with many unique traits and some multidirectional influences being observable. Therefore, regionality in the tarand cemetery areas will be studied through these diverse brooches in order to see whether some motifs, typological groups, or alloys were more preferred in some areas than in others. A typological and compositional approach has been adopted for this. Based on the distribution of certain groups of disc brooches, their surface treatment, and the direction of the influences, two distinct areas can be seen: Northeast Estonia and Southeast Estonia–North Latvia. The study shows how people in the tarand cemetery areas adopted foreign techniques and stylistic features in accordance with local preferences and used them in their local culture.

Keywords: disc brooches, Roman brooches, *tarand* cemeteries, Roman Iron Age, Baltic archaeology.

Romėniškojo laikotarpio apskritos segės visoje Europoje pasižymi didele stilistine ir gamybos įvairove. Dabartinės Estijos ir Šiaurės Latvijos teritorijoje esančiame tarand kapinynų paplitimo areale ši įvairovė taip pat yra didelė, čia pastebima daug unikalių bruožų bei kai kurios daugiakryptės įtakos. Todėl regioniniai tarand kapinynų ypatumai nagrinėjami remiantis šių segių įvairove, siekiant įžvelgti, ar kurie nors motyvai, tipologinės grupės, lydiniai dominavo atskirose teritorijose. Tyrime naudojami tipologinis ir sudėties analizės metodai. Atsižvelgiant į atskirų apskritų segių grupių pasiskirstymą, segių paviršiaus apdirbimą ir įtakos kryptis, išskiriamos dvi teritorijos: Šiaurės rytų Estijos bei Pietryčių Estijos – Šiaurės Latvijos. Tyrimas atskleidžia, kaip tarand kapinynų paplitimo arealo bendruomenės perėmė segių gamybos techniką ir stiliaus bruožus, juos pritaikė ir integravo į vietos kultūrą.

Reikšminiai žodžiai: apskritos segės, romėniškos segės, *tarand* kapinynai, Romėniškasis laikotarpis, Baltijos regiono archeologija.

INTRODUCTION

This study focuses on the disc brooches found in the *tarand* cemetery area of Estonia and North Latvia. Such cemeteries were a common burial practice in the Roman Iron Age (AD 50–450 in Estonia, AD 1–400 in Latvia), and are found across a wide area covering Southwest Finland and Ingria (Ingermanland), as well as the area included in our study (Fig. 1). So far, no specific study has been dedicated to these disc brooches as they have mainly been included in the broader research of the material culture from different countries or regions (Tallgren 1922; Moora 1938; Vassar 1943; Шмидехельм 1955; Laul 2001). Furthermore only a few have been discussed in papers dealing with brooches from the Baltic area (Vaska 2013; Khomiakova 2015). Up to now little discussion has occurred in respect to the different

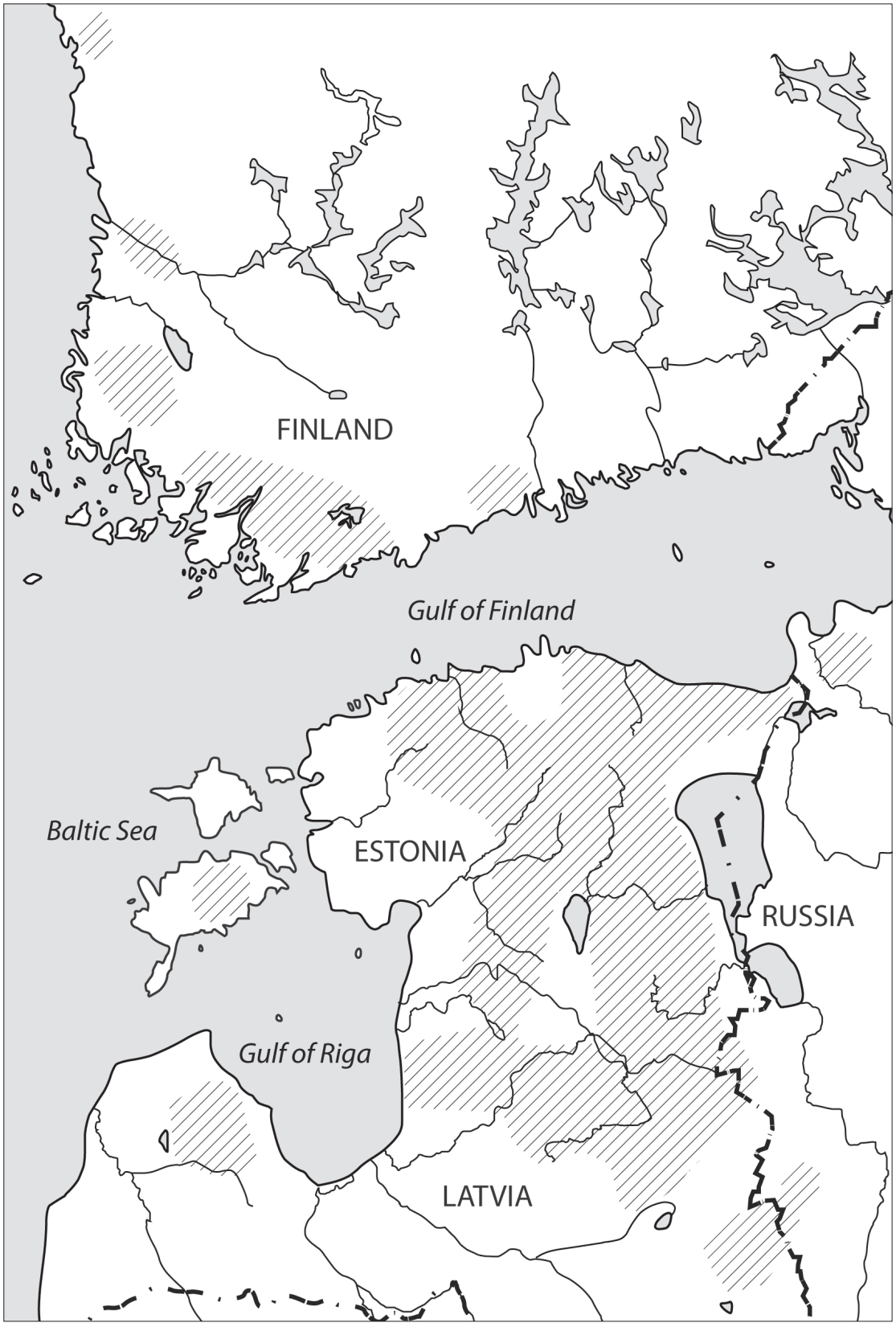

Fig. 1. The distribution area of *tarand* cemeteries in the Roman Iron Age. *Drawing by M. Olli* after Lang 2018, p.175, Fig. 5.10.

subgroups within the broader disc brooch category and no compositional analysis has been conducted to study their production. (For the purposes of this study, the term, 'disc brooches' includes not only round examples, but also rectangular and cruciform ones, as is customary in the research tradition (see Bos 2007/2008, p.709).)

The aim of this paper was to conduct a detailed study of these disc brooches, with a focus on regional differences within the study area. In order to see whether some motifs, typological groups, or alloys were preferred in some regions more than in others. If such distinctions are observed, then it may be possible to say something about variations in regional culture. In addition, cultural contacts with regions outside the *tarand* cemetery area are also considered in order to identify local and non-local influences in the disc brooch styles and in brooch production. The various motifs used to decorate many disc brooches will also be discussed together with their possible meanings.

This article combines a study of the stylistic and typological features of these brooches and their production. But first it re-examines and compares the existing typology and chronology to those outside regions thought to be the most influential for the forms found in the study area: West Lithuania and the northern Roman provinces (Moora 1938, pp.100–105). In addition, it groups and compares the stylistic features to motifs used in these outside regions. Handheld X-Ray florescence spectrometry (HHXRF) was also employed using a qualitative, non-destructive approach, to study the composition of the alloy from which they were made. This was undertaken in order to see whether it was possible to identify any standardised alloy choices for the sub-groups and to better understand the nature of any surface treatments.

The article presents some new insights into the variations in typological groups, then identifies any regional preferences and looks at the influences behind any groupings in relation to the rest of Europe, which would appear to be worlds apart from such a distant, northerly area. Lastly it discusses the organisation behind their production.

HISTORY OF THE TYPOLOGICAL RESEARCH

The disc brooches from the *tarand* cemetery area have been studied in combination with other Roman Iron Age brooches since the early 20th century. Initially, the evolutionary aspects were the main focus, which resulted in the hypothesis that disc brooches evolved naturally from a simple form into more complex ones over time. This focus subsequently led to the creation of a broad chronology (Tallgren 1922, pp.100–102). In addition, the connections between those from the *tarand* cemetery area and those from the northern Roman provinces and Lithuania were first outlined (Moora 1938, pp.100–105). To this day, latter forms a well-known argument, recognised by many researchers (Banytė-Rowell, Bitner-Wróblewska 2005; Vaska 2013; Banytė-Rowell *et al.* 2016). The disc brooches from various Estonian regions, together with many other finds from the period, have been studied by different scholars: Marta Schmiedehelm (Шмидехельм 1955, pp.146, 199) created a chronology for those in Northeast Estonia, dating them mainly to the 3rd–4th centuries. Artur Vassar (1943, pp.70–71) concentrated on the Central Estonian examples, Harri Moora (1938, pp.100–105) on the North Latvian ones. Silvia Laul (2001, pp.108–114) focused on those from Southeast Estonia and contributed to their typology and chronology. Because two disc brooches were found in Finland's *tarand* cemetery area but not in exclusively *tarand* cemeteries, their precise find contexts are unfortunately unknown (Kivikoski 1973, pp.31–32) and they were not included in this study. Also no disc brooches have as yet been found in the Ingrian *tarand* cemeteries (Юшкова 2011) so they could also not be included.

These earlier works mainly emphasise the typological and chronological issues of the time. Disc brooches as well as many other types of brooches and artefacts have also been connected to smaller ethnic groups from different regions (Jaanits *et al.* 1982, pp.244–246), a viewpoint that has recently

been disputed in the light of new research approaches (Lang 2018, p.224).

Baiba Vaska (2013, pp.88–110) studied openwork ornamentation on Latvian finds and subsequently discussed the disc brooches found in *tarand* cemeteries. She regrouped them and proposed some new chronological aspects; in addition, she discussed the meaning and origin of the motifs. The meaning behind the diverse motifs on disc brooches has also been discussed by various Estonian and Latvian researchers. These researchers connected them mainly with solar symbolism (Zemītis 2004, pp.206–207; Vasks 2006; Jonuks 2009, pp.227–230; Olli 2013, p.113).

Disc brooches have been widely studied across the Baltic area. Around 30 disc brooches from Lithuania that date to the C_{1b}–C_3 period (220–350) have been studied by Mykolas Michelbertas (1986, pp.122–124) and Rasa Banytė-Rowell (2001; 2009; Banytė-Rowell *et al.* 2016). Olga Khomiakova (2015) examined the various disc brooches from the Dollkeim-Kovrovo culture area (Sambian Peninsula), revising their dating mainly to the B_2, B_2/C_1 and C_{1b} periods (ca 1–225). Although the two areas are neighbours, their disc brooch styles differ chronologically and typologically (Banytė-Rowell 2001).

Enamelled disc brooches have also been studied in combination with other enamelled items from Eastern Europe (Корзухина 1978).

HISTORY OF ROMAN ALLOY RESEARCH

Ancient artefacts and their composition have been the subject of scientific interest for well over two centuries now. Roman brooches in particular have been one of the most popular artefact groups, attracting such attention mainly because they are found in large numbers and are relatively easy to categorise. A great deal of work has already been done in understanding the production methods and technical decisions of the artisans. For copper-alloy brooches, the composition choices (with tin, with zinc, or both, with or without lead) allow the complex relationship between typology and composition to be studied and their origin to be debated (Dungworth 1997, p.902; see also Smythe 1938; Craddock 1988, 1990; Unglick 1991).

One technique available for the study of an item's composition is X-Ray fluorescence spectrometry (XRF), which has been around for decades. The device was initially a bulky, immobile, laboratory apparatus, which, thanks to advances in miniaturisation, became increasingly portable; some models can now even be easily carried to museums or excavation sites (see Gigante *et al.* 2005; Shugar, Mass 2012). Another benefit of these portable, handheld (HHXRF) devices is that they are non-destructive in their approach. Other methods have traditionally required an object to be damaged through drilling or scraping in order to obtain a sample for measuring. In the case of a copper-alloy brooch, for example, the patina would typically be scraped off in order to reach a clean subsurface. Such damaging procedures are plainly contrary to modern conservation practices and result in the greatly-reduced availability of various collections. HHXRF avoids this problem because it can be deployed as a surface measurement technique, but in this role it is important to recognise its limitations. The X-rays only penetrate a fraction of a millimetre below the surface of a copper-alloy object. This means that the measurements are nearly always taken on a surface that has been altered by corrosion processes. Previous research has shown that this process involves the leeching of copper (decuprification) and, to a lesser degree, zinc (dezincification), both of which contribute to the formation of the outer patina (Robbiola *et al.* 1998, p.2108; Chiavari *et al.* 2007). It is, therefore, important to ask the right research questions, which, in this case, involves measuring large numbers of typologically similar items in order to distinguish between the basic compositional groups (see Bayley, Butcher 2004; Martinón-Torres *et al.* 2014; van Thienen, Lycke 2017).

The alloy properties of disc brooches from Northwest Europe were studied in detail by Justine

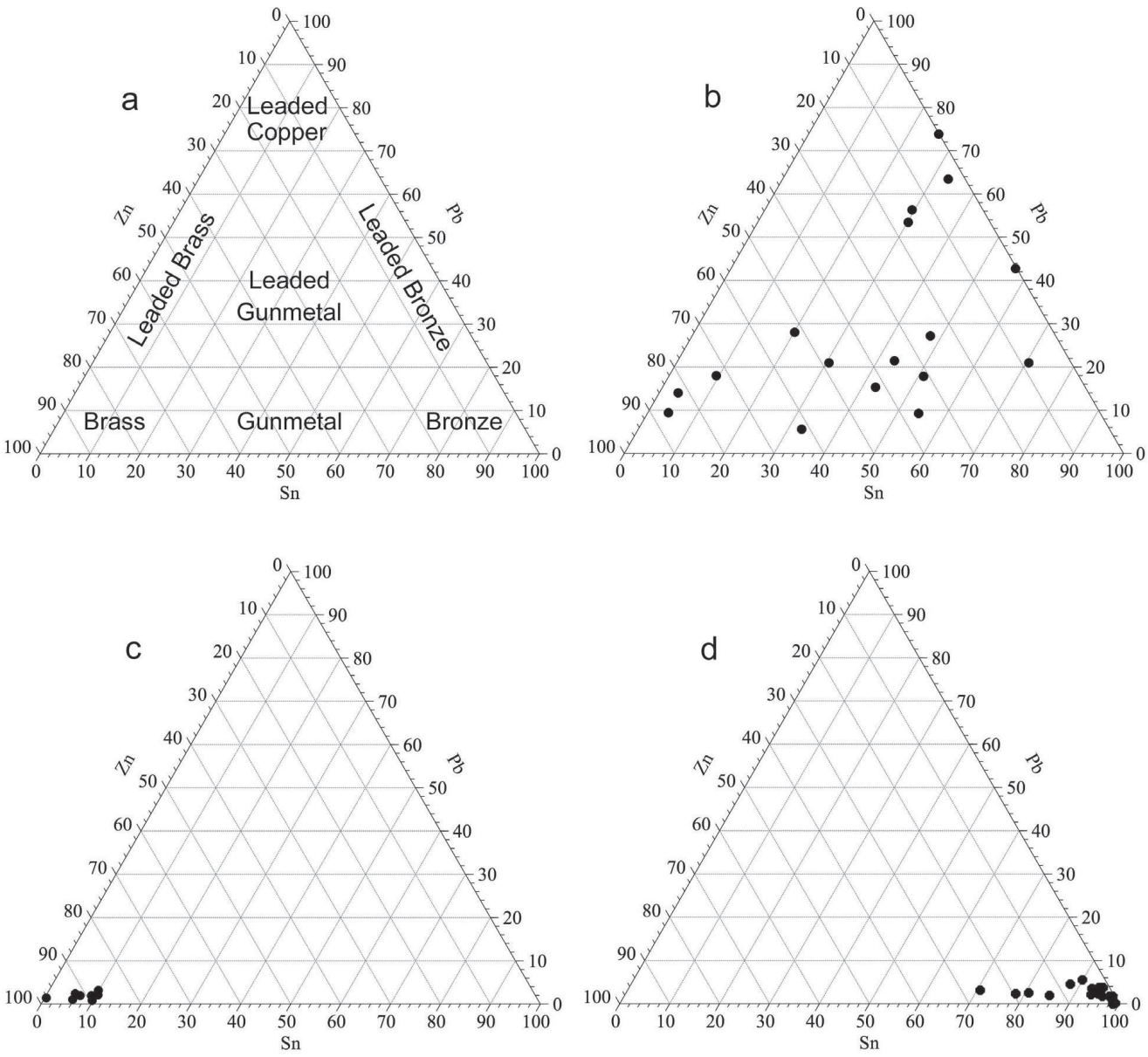

Fig. 2. Ternary diagrams displaying: a – the classification scheme (after Bayley, Butcher 2004, p.24, Fig. 7); b – 'continental disc brooches' of Northwest Europe (after Bayley, Butcher 2004, p.176, Fig. 151); c – eye-series brooches (after Bayley, Butcher 1995, p.115, Fig. 4:1); d – wire type A46 brooches (after Roxburgh *et al.* 2017, p.252, Fig. 5.3.16). *Drawing by M. A. Roxburgh.*

Bayley and Sarnia Butcher (2004, p.176) using the same XRF principles as were employed for this paper. Their results suggested that whilst there was a standardisation of design and surface decoration, which is suggestive of well organised, large-scale production, the alloy choice varied greatly (see Fig. 2:b). This high variation was found to substantially differ with the results for many other brooch types published in the same and more recent studies (see Bayley, Butcher 1995; 2004; Roxburgh *et al.* 2017). Bayley and Butcher's (2004 p.145) measurements on nearly 3,500 brooches suggested that individual brooch types were usually made of a specific alloy, typically a bronze, brass, or gunmetal, which is a mixture of the two (see Fig. 2:c and d for examples). Great variation in the alloy choice was also

suggested as evidence for manufacturing items from whatever scrap metal was available at a particular moment (Dungworth 1997, p.903). A highly varied distribution was likewise shown by a number of other brooch types, including head-stud brooches (Bayley, Butcher 2004, p.165), some of which were enamelled, and sheath-footed brooches (Bayley, Butcher 2004, p.183), which had been decorated using tinning or mercury gilding techniques. Stijn Heeren and Laurens van der Feijst (2017, p.155) suggested that enamelled disc brooches are found across all the western Roman provinces and whilst evidence for their production centres is still missing, they proposed that there was some regional variation. Little has been proposed about the production location of openwork disc brooches, other than that there may be a military connection as many of the motifs appear on army equipment (Heeren, van der Feijst 2017, p.162). There is, however, a disc brooch subtype (type 60) with a two-piece spring construction and applied decoration that Heeren and van der Feijst (2017, p.165) suggest was likely produced in the Germanic areas north of the Rhine.

The compositional analysis of Estonian Roman Iron Age artefacts is not new (see Черных *et al*. 1969), but a combined approach that includes both typological and compositional analyses has only recently emerged (Roxburgh *et al*. 2018). A compositional analysis of some Roman Iron Age artefacts has also been conducted in Lithuania (e.g. Volkaitė-Kulikauskienė, Jankauskas 1992) but it has seldom been combined with a typological analysis (Simniškytė 2002).

Enamelling, i.e. using the *champlevé* technique, was a common decorative technique at this time and was applied to many disc brooches. It has also been suggested that tin was sometimes applied to the areas around the enamel fields (Bayley, Butcher 2004, p.46). The earliest reference to tinning used as a decorative technique was given by Pliny in his *Natural History*. It was considered to have been widespread through the Roman world (Meeks 1986, p.134) and was also used in the eastern Baltic (Volkaitė-Kulikauskienė, Jankauskas 1992; Bitner-Wróblewska, Stawiarska 2009). Tinning at this time would have involved either dipping the object in a bath of molten tin or rubbing the hot object with a tin or pewter rod (Bayley, Butcher 2004, p.43). A close relationship between lead and enamel has also been suggested when considering these decorative techniques (see Bateson, Hedges 1975). Not only is lead present in enamel, it was also used as a wetting agent to form a stronger bond between the enamel and the metal.

HHXRF METHODOLOGY

As mentioned earlier, a handheld X-Ray florescence spectrometer (HHXRF) was chosen for collecting the compositional data. This surface measurement device had the advantage of being easy to transport to the archives containing the bulk of the Roman disc brooches. Whilst these devices can be operated in a 'point and shoot' manner, they frequently come with a portable test bench, which, although reminiscent of the earlier, bulkier portable machines, allows for a more stable working environment (for further reading see Potts, West 2008; Shackley 2011; Smit 2012). A *Bruker Tracer IIIsd* machine was used in this study and, as per the manufacturer's standard operating guide, was fitted with a yellow filter (position 1), which is recommended for a dry atmosphere and the high mass elements found in copper-alloys, and was set at 40kev-10um. Trial testing was then conducted and the signal was found to be stable at 60 second intervals. These settings remained unchanged during the full data-gathering phase. The output for each measurement was saved as a PDZ file from which a spectrograph could be viewed. These graphs were then individually checked for inconsistencies using the manufacturer's own *S1PXRF* software. Two manufacturer-supplied copper-alloy calibrations were used (Cu1 and, for high lead levels, Cu3) to convert the spectra data into quantitative chemical weights (expressed as a %). The elements subsequently measured using

these calibrations were Mn, Fe, Co, Ni, Cu, Zn, As, Pb, Bi, Zr, Nb, Ag, Sn, and Sb.

One measurement per brooch was taken, typically on the front face but if impractical, along a relatively flat edge. Once the weights were available, an external normalisation of the dataset took place using *Microsoft Excel*™. This had the effect of correcting the dataset for soil contamination and other residues from light elements. Then the main elements that make up copper-alloys, namely copper (Cu), zinc (Zn), tin (Sn), and lead (Pb), were normalised on an iron (Fe) and light element free basis.

This research method was developed in line with a scheme published by Bayley and Butcher (2004, p.24) who used ternary diagrams to visually display the three component metals: tin (Sn), zinc (zn), and lead (Pb) in their results. This visualisation method is particularly useful as it allows clusters of results to be compared to one another (see Fig. 2:a).

To aid repeatability, the Bruker machine's calibration was checked by comparing its results to those of a *Niton XL3t GOLDD* XRF analyser (with the kind assistance of the Cultural Heritage Agency of the Netherlands) using a shared set of copper-alloy samples. The results of this analysis are presented in Table 1 and while a small variation between their measurements can be seen, it is insufficient to impede the approach employed in this paper.

As mentioned earlier, the approach required non-destructive measurements to be taken on uncleaned surfaces, an approach that is consistent with previously published research (Tate 1986; Lutz, Pernicka 1995; Bayley, Butcher 2004; Roxburgh *et al.* 2016) and that is effective in the basic identification of trends in bulk alloy types (Tate 1986, p.23). Once this stage is achieved, however, the results are analysed interpretively rather than through the use of destructive testing. And so, the reconnaissance role of HHXRF is complete at that point.

For the HHXRF study, 69 brooches were selected from the full dataset on the basis of their availability as many items were not easily accessible. This represents 64% of the known brooches and can therefore be considered a representative sample of the full dataset.

Table 1. *Niton* analyser versus *Bruker* analyser, a comparison?

Sample	**Cu (av.)**	**Sn (av.)**	**Zn (av.)**	**Pb (av.)**
Niton analyser				
Bronze	79.0	15.0	0.0	5.5
Brass	84.0	0.0	12.0	4.5
Gunmetal (+Sn)	80.5	10.0	4.5	5.5
Gunmetal (+Zn)	79.5	6.0	8.0	6.5
Bruker analyser				
Bronze	76.0	16.5	0.0	7.5
Brass	82.5	0.5	12.0	5.5
Gunmetal (+Sn)	79.0	10.0	12.0	6.5
Gunmetal (+Zn)	79.5	5.5	8.0	7.0

MATERIAL

At least 110 disc brooches have been found in this paper's research area (Moora 1938, p.100; Vassar 1943, p.71; Laul 2001, p.108) and 108 were included in the typological study (see the Appendix). They are housed in the Tallinn University Archaeological Research Collection, the University of Tartu Archaeological Collection, the Estonian History Museum, the National History Museum of Latvia, and in various Estonian county museums. Any brooches, which could not be physically located and for which no picture or drawing was available, were excluded[1].

The majority of the disc brooches were recovered from stone-lined burial areas, known as 'typical' and 'single' *tarand* cemeteries, which are the main cemetery type for the Roman Iron Age (Lang 2007, p.192; 2018, pp.174–178). These cemeteries

[1] One was found at Essu, Haljala, Virumaa and was supposed to have been cruciform (Moora 1938, p.115); the other is from an unknown find spot and should have had a spoked central motif (Laul 2001, p.109).

are monumental, above-ground, communal places where fragmented, cremated, and uncremated bones were scattered together with burnt and unburnt grave goods, mostly ornaments, tools, and pottery (Lang 2007, p.203, p.206; Kivirüüt, Olli 2016; Olli, Kivirüüt 2017). Intact burials are rare and the commingled nature of the cemeteries makes the creation of a relative or absolute chronology for local items difficult (Lang 2007, p.206; Vaska 2013, p.97).

TYPOLOGY AND CHRONOLOGY

The typology used in this paper is a combination of previous classifications (Laul 2001, pp.108–114; Banytė-Rowell 2009; Vaska 2013) and new observations. Although the brooches do not form a series (Vaska 2013, p.97), they have been grouped on the basis of similar features, namely decoration, size, pin attachment, and production technology. A subgroup was created if there were at least two similar specimens.

Four types of pin constructions were used for disc brooches. For some of the brooches, no construction has survived but for the most the type could be determined (see the Appendix). The majority of the disc brooches in the study area had an eye-and-hook construction (Fig. 3:a), which is not very common in the Baltic region, but does appear on some Sambian Peninsula disc brooches dating to the first centuries (Banytė-Rowell 2009, p.21; Khomiakova 2015, p.18) as well as on enamelled disc brooches in the Kiev culture area (Обломский 2007, pp.302–303, 314, рис. 150.7, 151.3, 162.1) but not, for example, in the northern Roman provinces. It was also used in the Lower Rhine area, but at a much later date, i.e. during the 8th century (Heeren, van der Feijst 2017, p.265). The eye-and-hook construction appears to have been a local version of a hinged pin, which consists of two cast lugs, each with a hole that holds one end of the axial bar on which the pin rotates (Fig. 3:b). Eight disc brooches from the study area have hinged pins. In the Roman world, this type of mechanism is widely used for early, 1st-century plate brooches as well as enamelled plate brooches from the second half of the 2st – late 3rd century (Heeren, van der Feijst 2017, pp.110, 113, 155).

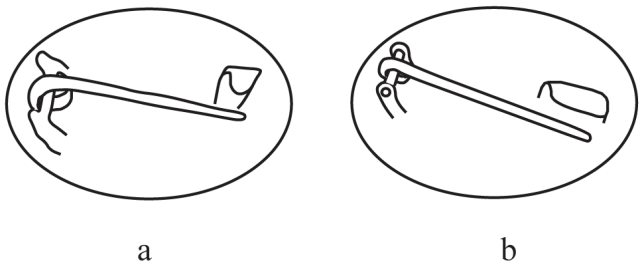

Fig. 3. Pin attachment constructions: a – eye-and-hook pin construction, b – two cast lugs each having a hole that holds an axial bar to which the pin is attached. *Drawing by M. Olli.*

One brooch has a tube construction that hides the hinge (tubular variant) where the axial bar, around which the pin was wound, was located in a tube. Another enamelled brooch has a spring mounted on a single lug, a construction used for 3rd century enamelled plate brooches from the northern Roman frontier as well as other types of brooches (Heeren, van der Feijst 2017, pp.137, 139, 155, 158). Tubular variants were also used for some cross ribbed brooches (sometimes also referred to as ladder brooches, three-crossbar brooches or *Dreisprossenfibeln*), likewise found in the *tarand* cemetery area (Laul 2001, p.105) and were widely used elsewhere for various types of Roman brooches (see Heeren, van der Feijst 2017, pp.106, 108).

It is possible to distinguish nine main disc brooch groups as well as many subgroups (Fig. 4, 5; Appendix). While the dates for some groups were possible to revise, some problems existed with dating most of the locally-made brooches, especially on the basis of relative chronology (no phasing having been undertaken for items from *tarand* cemeteries). To create such a chronology, the accompanying items need to be restudied and their dating compared to that of other similar items in *Barbaricum*, but this research is outside the limits of this paper.

The brooches of the **first group** (16 items) are decorated with a beaded rim and a central knob. The

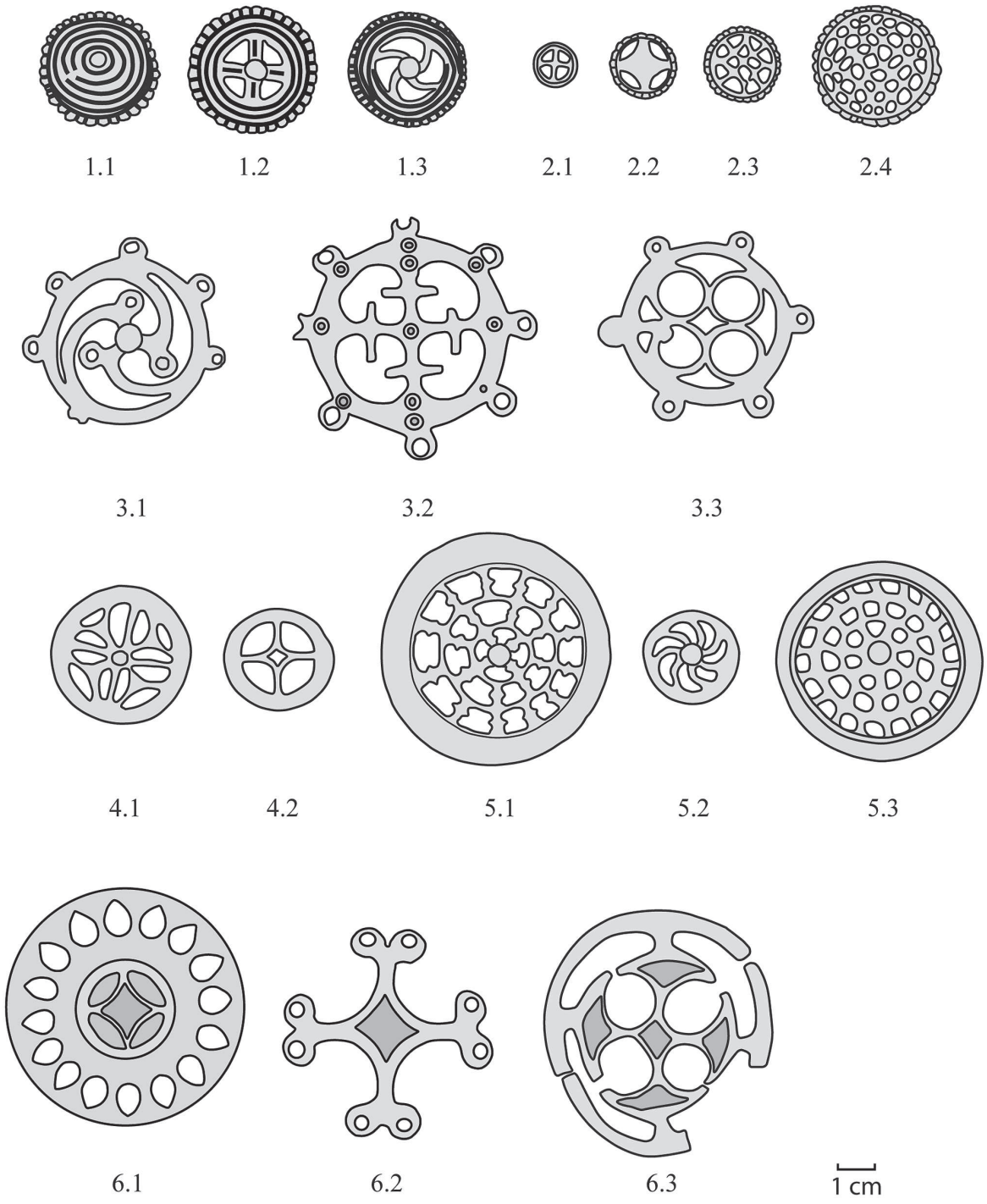

Fig. 4. Disc brooches from groups 1–6. *Drawing by M. Olli.*

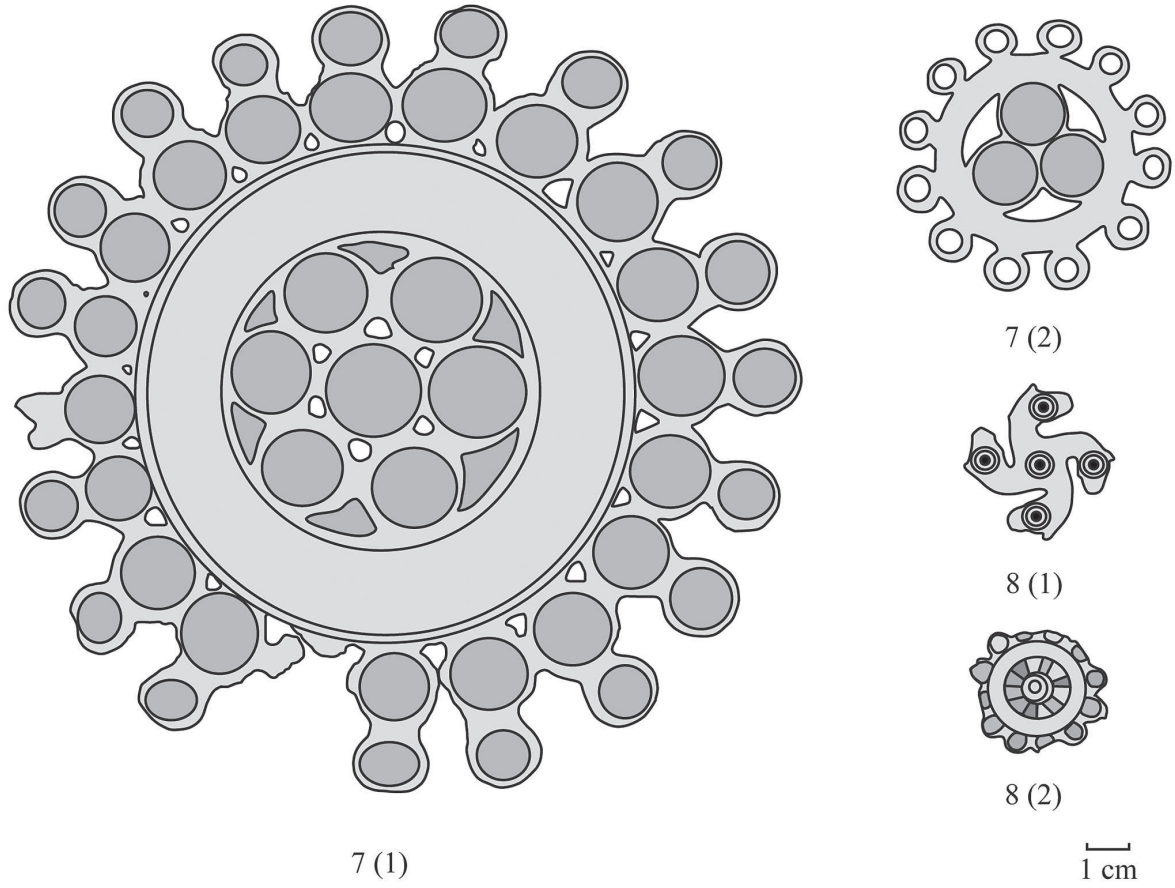

Fig. 5. Disc brooches from groups 7 and 8. *Drawing by M. Olli.*

subgroups are distinguished by the design around the central knob. The first subgroup (1.1) has circles around the knob and no openwork, the second (1.2) an openwork cross in the middle, and the third (1.3) either an openwork swastika or spokes in the middle. All of them have an eye-and-hook pin construction. They are fairly evenly distributed across Southeast Estonia and North Latvia and one has been found in Northeast Estonia. This group has not been previously distinguished, having instead been included with the spoked type by Laul (2001, pp.108–109) but because the brooches are too similar to each other, a new subgroup was distinguished. They are dated to the 4th–5th centuries (Laul 2001, p.114).

The brooches of the **second group** (27 items) are small in size (17–25 mm in diameter, one being 36 mm) and have a raised centre, a rim that is usually beaded, and a primary motif that is mainly an openwork rhombus. Four subgroups can be distinguished: the first (2.1) has simple openwork cross motif in the middle, the second (2.2) an openwork rhombus, the third (2.3) an openwork rhombus combined with a cross, and the fourth (2.4) an openwork sieve decoration. This group includes one other brooch, which is closed and lacks a beaded rim and central motif, but is small in size. The brooches of the first subgroup (2.1) lack small knobs on the rim, which could make them typologically earlier. All of the brooches of this group have an eye-and-hook pin construction, except for one in subgroup 2.3 which has a tubular variant. It could be a copy of the eye-and-hook group, especially as it was found at a location outside the typical distribution area. This group has been previously distinguished by both

Laul (2001, pp.108–109) and Vaska (2013, p.100). These brooches are thought to have been developed locally in Southeast Estonia, which is also the main area where they are found (Laul 2001, p.110). These brooches are dated to the 4th–5th centuries (Laul 2001, p.114). However, considering the dating of North Estonian and North Latvian disc brooches, an earlier dating (3rd–4th centuries) might be possible for the disc brooches of groups 1 and 2 but further research into the accompanying finds needs to be done to confirm that.

The brooches of the **third group** (16 items) have sparsely placed knobs on the rim and an openwork circulating motif in the middle. Three subgroups have been distinguished on the basis of the motif: triskele (3.1), closed cross (3.2) and four circles (3.3). Three of them have a different central motif: a whirlpool, a swastika with curved arms, and a wheel with openwork circles. Their main area of distribution is Northeast Estonia but some have been found in North Latvia and one in Northwest Estonia. This group has also been distinguished by Vaska (2013, pp.98–99), who pointed out that the Latvian decoration differs from the Estonian (Vaska 2013, p.99), which has also been confirmed by this study. The Latvian brooch, which has a wheel motif, resembles the group 4 brooches found in Latvia (below). Brooches of this group mainly date to the 3rd century, but subgroup 3.2 to the 4th century (Шмидехельм 1955, pp.146, 199). Two of the brooches have a hinged pin fixed between two lugs but the others have an eye-and-hook construction. The former could have an earlier date and perhaps be a copy, albeit crude, of the hinged pin found in the Roman world. However, in the absence of an exact find context in the cemetery, a more precise dating would be difficult. The sparse knobs on the rim connect this group stylistically with provincial Roman examples (e.g. Exner 1939, Taf. 13; Riha 1994, Taf. 51, type 3.15). The same can be said of their motifs, as the triskele is a Celtic motif used on Roman brooches in 1st-century Britain (Bayley, Butcher 2004, p.173). The brooches from the second subgroup are similar to 2nd–3rd-century openwork brooches that match ones from various parts of the Roman Empire (Exner 1939, Taf. 15; Hattatt 1989, pp.345, 357). The same four-circle-motif is also present on 2nd–3rd-century plate brooches found in all the western provinces of the Roman Empire (Heeren, van der Feijst 2017, p.155). The brooch with openwork circles (A 110: 33) also resembles Rhine-area enamelled brooches with similarly placed circles (Exner 1939, Taf. 13, 1. III 21).

The brooches of the **fourth group** (seven items) have openwork decoration, often have a side turned in, and lack knobs on the rim. They bear only one decorative element. Three brooches have a compass decoration (4.1), two almost identical ones an openwork rhombus (4.2), and two others a swastika and a rhombus combined with a cross. The compass decoration of the first subgroup is more elaborate than the Latvian one (another has been found in Latvia but at an unknown location (see Vaska 2013, p.106). The brooches of the second subgroup have a centre identical to that of an enamelled disc brooch from Slavēka Cemetery in North Latvia (AI 1194: 39), where another of this subgroup's brooches was found (AI 1194: 38). It can, therefore, be suggested that they were made in one batch or at least to the same production standard, possibly near Slavēka, and perhaps based on the example of brooches from Masuria or the Sambian Peninsula. This is because almost identical brooches have been found there, but with a different pin construction and an earlier date: 150–250 or a bit later (Khomiakova 2015, p.25). The cemetery at Jaagupi in Southeast Estonia stands out as the main find spot for this group, but they were probably made in North Latvia from an original design or in imitation of a design from elsewhere and brought to Estonia as a result of close contact between the two areas. Furthermore, all of the brooches have an eye-and-hook pin construction. The compass decoration has been dated to the 3rd century (Vaska 2013, p.106). In Estonia, the brooches of this group have a broader date to the 4th–5th centuries (Laul 2001, p.114) but subgroup 4.1 could be earlier (3rd century), based on the dating of

the decoration. If it is true that the brooches of subgroup 4.2 are copies of Sambian Peninsula brooches, then a slightly earlier date: late 2nd–4th century can be suggested. The other brooches of this group may likewise date to the 3rd–4th centuries.

The brooches of the **fifth group** (13 items) are characterised by decoration surrounding a central knob or opening. A higher rim may or may not be present around the openwork decoration. While they are quite diverse in design, only three subgroups were distinguished: a baluster motif (4.1), a whirlpool motif (4.2), and a wheel motif (4.3). One brooch also has an openwork cross motif. Their main distribution area is North Latvia, but a few have been found in Southeast Estonia and isolated specimens in East and Northeast Estonia. All but one have an eye-and-hook pin construction. In Latvia these brooches date to the second half of the 3rd–first half of the 4th century (Vaska 2013, p.99), but in Estonia to the 4th–5th centuries or even later (Laul 2001, p.114). The wheel and baluster motifs are common among Lithuanian disc brooches where they date more closely to 220–350 (Michelbertas 1986, p.122). It is possible that brooches with these motifs existed at the same time as the Lithuanian ones and subgroup 5.2 may date earlier to the 3rd–4th centuries, which would correspond to the dating of the other group 5 brooches. The style of these first three subgroups is also present in other ornaments from Latvia, Lithuania, and the Sambian Peninsula (Bitner-Wróblewska 2009, pp.385–399; Vaska 2013, p.106; Banytė-Rowell 2001, annex II, pav. 70–72). It seems that the brooches of this group, especially subgroups 5.1 and 5.2, are stylistically more connected to the Baltic region and they are also found in North Latvia, which is on the edge of the *tarand* cemetery tradition.

The sixth group consists of enamelled disc brooches (17 items), which, although quite different in style, are linked by their enamelling. The three subgroups (9 items): with a rhombus (6.1), cruciform (6.2), and four circles (6.3) motif are stylistically similar and found only in the *tarand* cemetery area, which means they could be of local origin. Most of the enamelled brooches were discovered in Eastern Estonia and North Latvia. Subgroup 6.3, which occurs only in Northeast Estonia and dates to the 3rd–4th centuries (Шмидехельм 1955, pp.100, 120), is stylistically connected to subgroup 3.2, which is also found in the same area. It can likewise be suggested that the brooches of subgroups 6.3 and 3.2 were all made locally in a unique Northeast Estonian style. One subgroup 6.3 brooch has a hinged pin, fixed between two lugs, which, in combination with its difference in style to the subgroup's other brooches, means it could have a slightly earlier date. The three brooches with a rhombus motif (6.1) are, however, all very similar. While brooches like those of the cruciform subgroup (6.2) occur in almost every part of the Roman Empire in contexts dating to the 1st–3rd centuries, they differ from the *tarand* cemetery specimens in size (Roman examples being smaller) and decorative elements (Böhme 1972, p.38; Riha 1994, p.154). It is thought that this subgroup originated with Roman brooches brought to the *tarand* cemetery area via sea routes without Baltic mediators (Banytė-Rowell *et al.* 2016, p.144). Although a Roman origin can be attributed to no other brooches from this area, the cultural ideas behind the motifs could have travelled as knowledge instead of as physical brooches. The enamelled brooches in Southeast Estonia date to broadly the 4th–5th centuries or even later (Laul 2001, p.114; Vaska 2013, p.99).

While the other eight brooches of this group are stylistically different and do not form subgroups, they have many similar stylistic elements, such as rotating motifs (swastikas, whirlpools, and wheels), lace and rhombus decorations, and the style of edge decoration, many of which are common among Eastern European enamelled disc brooches (Корзухина 1978). The brooches with four swastikas (RDM I 2746, AI 5101: CVIII: 1) are very similar in design to each other and to brooches found in the Dnieper area (Kiev culture area, modern day Ukraine) (Левада 2010, p.583, рис. 22). It is, there-

fore, likely that they originated in this area or were strongly influenced by that culture. The style, execution, and pin construction of one enamelled brooch (A 92: 5), which has an enamelled rhombus motif in the middle, a single lug pin construction, and a riveted catch, are not typical for *tarand*-cemetery brooches, which leads to the suggestion that it may have originated in the Dnieper area (Шмидехельм 1955, pp.217–219). Nevertheless other Eastern European regions should not be excluded as the only confirmed production site for enamelled objects is located in Northern Belarus (Bitner-Wróblewska 2011, pp.19–20 and the cited literature). The composite, enamelled disc brooch is likewise unique among the *tarand* cemetery brooches (AI 1918: 23) but the technique it exhibits is not uncommon in the Dnieper area (Левада 2010, pp.580–584). The brooch with a central enamelled rhombus (AI 1260: 5) surrounded by lace decoration has turned-in sides, which is a common element of some *tarand*-cemetery disc brooches (e.g. group 4). Another enamelled brooch (AI 2626) demonstrates several elements from different influences: the baluster motif found in subgroup 4.1 and the lace decoration and whirlpool motif exhibited by many Dnieper-area enamelled brooches. A Dnieper-area origin has already been suggested for it (Tamla, Kiudsoo 2009, p.18). Nevertheless its origin remains open owing to its hybrid nature: local style elements such as baluster and lace decoration and its extreme similarity to a brooch fragment that was a stray find in Finland (Kivikoski 1973, p.44).

The brooches of the **seventh group** (two items) are decorated with small, semispherical depressions. Both were found in Nurmsi *tarand* cemetery in Central Estonia. The bigger, slightly more elaborate brooch has a hinged pin fixed between two lugs (Fig. 5:7 (1)) while the smaller one has widely spaced knobs on the rim and an eye-and-hook pin construction (Fig. 5:7 (2)). Both date to the 3rd century (Vassar 1943, p.71). The knobs and pin construction of the smaller brooch connect it to the third disc brooch group and might therefore be a local version of a bigger brooch. As no exact parallels exist for comparison, it is thought that they were made locally in imitation of an older Pre-Roman Iron Age style (Vassar 1943, pp.70–71). A couple of non-brooch artefacts that exhibit similar depressions date to the Roman Iron Age: a disc from the *tarand* cemetery at Mūsina, Latvia (AI 1252: 1) and an item with a central part similar to a rosette tutulus brooch (see below) from the *tarand* cemetery at Jäbara, Northeast Estonia (AI 2617: 56). A local origin is possible for these brooches as they could be a hybrid between the rosette tutulus form from the Sambian Peninsula (see the ninth group below) and local traditions.

The eighth group contains two brooches from the Roman Empire. The first dates to the 3rd century and belongs to a type of swastika brooches with horsehead terminals (Fig. 5:8 (1), Buora 2005, p.117). It was a stray find in a secondary context at an excavation at the Livonian Order castle in Viljandi (Olli 2016). The second is a plate brooch with a central knob decorated with red, turquoise, and blue enamel (Fig. 5:8 (2)). It belongs to Exner group III of enamelled brooches, which come from the northern Roman provinces in the Rhine area and date to the second quarter of the 2nd–early 3rd century (Exner 1939, pp.63, 103–105). Both have a hinged pin fixed between two very finely made lugs. This level of fineness is unlike anything found on similar brooch pin constructions from the *tarand* cemetery area, an observation that also reflects their Roman origin.

The ninth group likewise consists of two rosette-shaped tutulus brooches (for an image, see Шмидехельм 1955, p.160, рис. 43:2). This type is common for West Lithuania in the Late Roman Iron Age (Banytė-Rowell 2009, pp.40–41). However, the ones found in North Estonia are from the so called Samland-style, which dates to the late 1st–early 2nd century. It is interesting that this style has not been found in either Lithuania or Latvia (Banytė-Rowell 2009, p.41), which suggests direct contact between the Sambian Peninsula and Northeast Estonia (Banytė-Rowell, Bitner-Wróblewska 2005, pp.112–113). They have an eye-and-two-hook pin construc-

tion, the second hook probably being for fastening a chain across the chest.

Five brooches do not belong to any of these nine groups owing to their design or shape. Several reasons could explain this. First, wider variation occurs in individually produced items. Second, under certain circumstances, a craftsman may have had the freedom to design ornaments in accordance with a customer's wishes, but they were still designed in the style of the era and thus could have not differed drastically from other disc brooches. Third, they could be imports. If an artefact has an incongruous style or the technology involved in its production is foreign to the area, this may infer a non-local origin or production during a different time period.

COMPOSITIONAL RESULTS

The following ternary diagram (Fig. 6) visualises the alloy ratios of all 69 analysed brooches. This enables a direct comparison to the published results on disc brooches from Northwest Europe as published by Bayley and Butcher (2004, Fig. 151) (Fig. 2:b). Table 2 also provides the normalised Cu, Zn, Sn, Pb values for each measurement. Each dot represents

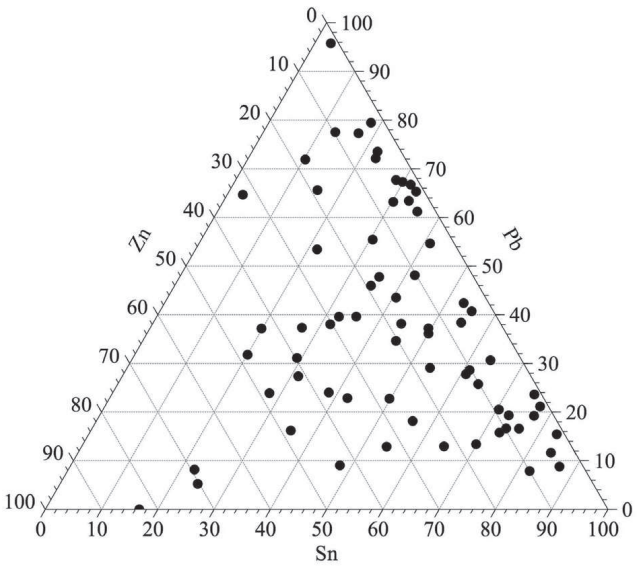

Fig. 6. Ternary diagram displaying the Sn-Zn-Pb alloy ratios. *Drawing by M. A. Roxburgh.*

Table 2. Table of Compositional Results (%).

No.	Find ID	Type	Cu	Zn	Pb	Sn
1	AI 4262: 30	1.1	77.5	8.5	5.5	8.5
2	A 349: 71	1.2	83	6	6.5	4.5
3	A 7991: 23	1.2	59.5	3	8	29.5
4	A 17:92	1.2	88	3.5	4.5	4
5	A 10876: 20	1.2	62.5	2	29	6.5
6	AI 1239: 4	1.2	87.5	5.5	1	6
7	AI 2339: 8	1.2	31	1	45	23
8	AI 4262: 303	1.2	69.5	5	4	21.5
9	AI 3236: 291	1.3	57.5	0.5	41	1
10	AI 4161: 642	1.3	74	2.5	6.5	17
11	AI 1702: 2	2.0	64.5	1	28	6.5
12	AI 4262: 69	2.1	82	3	5	9.5
13	AI 1996: 45	2.1	79.5	3	7.5	10.5
14	AI 4262: 34	2.2	68	2	20	9.5
15	TÜ 320:177	2.2	68.5	3	5	23
16	AI 1996:159	2.2	79.5	3	9	8.5
17	AI 3235: 203	2.2	70.5	1.5	9	19
18	AI 1995: 43	2.2	63.5	1	24.5	11
19	AI 2901: 2	2.2	82.5	2.5	6.5	8.5
20	AI 1995: 62	2.2	27	2.5	44.56	26
21	TÜ 2668: 8	2.2	51.5	2.5	35	11
22	AI 4262: 88	2.2	85.5	5	2	8
23	TÜ 2668: 9	2.3	70.5	2.5	6	20.5
24	AI 3235: 202	2.3	76.5	8	5.5	10
25	AI 1993: 17	2.3	87.5	6	2	4.5
26	AI 4262: 403	2.3	77	4	9	10.5
27	AI 4262: 413	2.3	74.5	3	7	15.5
28	AI 2339: 11	2.3	35	1	43.5	20.5
29	AI 2415c: 4	2.3	32	5	11.5	52
30	AI 1996:103	2.4	89	3	2.5	5.5
31	A 9966: 72	2.4	74	2.5	7.5	16
32	A 110: 32	3.0	91	0.5	1.5	7
33	AI 1195: 138	3.0	86	2.5	6.5	5
34	AI 2655: 358	3.1	84	11.5	1.5	3.5
35	AI 3447: 3	3.2	86.5	5.5	3.5	4.5
36	AI 618	3.3	85.5	2.5	7	5
37	A 25: 4	3.3	91	2.5	3.5	3
38	AI 2655:104	3.3	92.5	6.5	0	1.5

Continuation of Table 2

No.	Find ID	Type	Cu	Zn	Pb	Sn
39	AI 1702: 33	4.0	54	2	25	19
40	AI 3236:75	4.0	65	6.5	23	5.5
41	RDM I 2745	4.1	82.5	1	6.5	9.5
42	AI 1702: 35	4.1	42	2.5	24.5	31
43	AI 3236: 250	4.1	91.5	1.5	6.5	1
44	RDM I 102	5.1	86	3.5	5.5	5
45	RDM I 2713	5.1	88.5	0.5	1.5	10
46	RDM I 103	5.2	88	5	4	3.5
47	AI 3236: 275	5.2	86.5	1.5	6.5	5.5
48	TÜ 2668:10	5.2	76.5	2.5	3.5	17
49	AI 1252:12	5.2	78	4.5	7.5	10
50	AI 1195: 124	5.2, 5.3	87	0	3	9.5
51	AI 1195: 107	5.3	84.5	0.5	6.5	8.5
52	AI 1237:1	6.0	46	2.5	39.5	12
53	AI 1918 23	6.0	88	4	8	0.5
54	AI 1260: 5	6.0	91.5	2	4.5	2
55	A 235: 12	6.0	88	6	4	2.5
56	AI 5101: CVIII: 1	6.0	81	8	7	3.5
57	TÜ 2410: 416	6.1	35	2.5	5.5	56.5
58	AI 1237:9	6.1	51.5	2	31	16
59	AI 1194: 39	6.1	56.5	4.5	3.5	35.5
60	AI 4262: 804	6.2	58	6	23.5	13
61	AI 2604:161	6.3	89.5	7.5	0.5	2.5
62	AI 2655: 179	6.3	88.5	3	2	6.5
63	AI 2486: 169	7.0	64	1.5	24.5	10
64	AI 2486: 23	7.0	70	7	4	19.5
65	AI 3791: 3	8.0	24.5	7.5	58.5	9.5
66	AI 2013: 3	9.0	70	0.5	4.5	25
67	AI 2013: 4	9.0	83	0.5	3.5	13
68	A 313: 5	no group	91.5	4	2	2.5

a single measurement on each of the disc brooches and the results are very dispersed, populating the bronze, leaded bronze and leaded gunmetal areas of the graph as shown in Fig. 1a. Conversely the distribution pattern of the results is not comparable to the clustered examples given in Figs. 2:c and 2:d.

DISCUSSION

Production of disc brooches

The alloy choices used in the production of the disc brooches appear to be highly varied (see Fig. 6). This result is a close match to those disc brooches measured from continental Northwest Europe and subsequently published by Bayley and Butcher (2004, p.176; also see Fig. 2:b). They proposed that the level of design standardisation was very suggestive of large-scale production, but the high variation in the alloys suggests the opposite to a degree, or at least that no standardisation existed in alloy choice for disc brooches. There are many bow brooch types where the alloy choice seems to have been strictly controlled (see Fig. 2:c, d for examples). This, however, was not the case for disc brooches, whose alloys range from brass, through gunmetal, to bronze, with varying degrees of added lead in most cases. It can, therefore, be suggested that the production organisation that led to this variable alloy use was the same as for those found in Northwest Europe. Perhaps large numbers of scrap copper-alloy items were available to craftsmen at this time, allowing the production of disc brooches to be an outlet for recycled material.

A different hypothesis for this wide variation in the alloy may be related to the nature of the non-destructive, surface measurement technique employed by HHXRF and the original surface treatments employed by the craftsmen. As discussed above, both tin and lead were applied to the surface of brooches for various reasons. Tinning and lead wetting are two techniques to be considered in particular, as well as the lead that would have been present on enamelled areas. These past techniques, when applied to the outer surfaces, would have been the first part of a brooch to corrode after deposition in the ground. In most cases, the visual evidence of these outer surface treatments will have long disappeared into the surface corrosion. The HHXRF technique, which measures these corroded outer surfaces, may therefore record variable levels of additional tin and

lead, left behind by the vanished surface treatment. This has a twofold effect on the interpretation of the disc brooch results. First, any attempt to measure the brooch's actual alloy composition becomes highly problematic because the additional lead and tin caused by vanished surface treatments would mask brass and gunmetal results in particular and create artificially high tin bronze results as well. Whilst this could be considered as a negative if the purpose was to estimate a brooch's basic alloy type, it can be seen as a positive in that it could infer that more than one metallic colour could have been visible on newly decorated disc brooches. All uncorroded copper-alloy items have a bronze-like metallic colour that can have a reddish, yellowish, or silvery tint. The surface application of tin changes the area of application to a white shiny metal colour, perhaps simulating silver to some degree, while a lead or a lead-tin mix would create a duller grey metallic colour.

A possibility, therefore, exists that a large percentage of the disc brooches had a white metal 'silvery' appearance, either in part or in whole, when they were new and the highly variable HHXRF results are due to the varying amounts of these surface colour treatments that have survived on the corroded surface. These colour treatments would certainly have set them apart from other copper-alloy brooches, whose colour perhaps remained bronze-like. A visual inspection of all the brooches in this study identified 21 that still had fragmentary patches of 'silvery' tin on their surfaces (20%). This is unlikely to have been the total number to have received this treatment as visible signs of tinning are inclined to disappear during the corrosion process. Furthermore this does not include the number of brooches that have been over cleaned of all outer patina (see the Appendix).

Decoration

Two main groups of motifs were used to decorate the disc brooches: rhombus and rotating motifs, but other designs also occur on occasion.

The rhombus is the most commonly used motif on the disc brooches, mainly the small Southeast Estonian brooches (group 2) but is also a central motif on many of the enamelled brooches. It was combined with a rotating motif of four circles where a rhombus is surrounded by the circles and other decorative elements. It also adorned other types of contemporaneous ornaments: mostly pendants but also other brooch types, neck rings, and bracelets (Olli 2013, pp.63, 71–72, 110). Thus, it was a very popular motif in Southeast Estonia at that time (Olli 2013, p.110). Disc brooches with a rhombus motif were likewise in use in the Roman Empire, Britain, Gaul, and the Rhine area during mainly the 1st century (Feugére 1985, Planche 147; Riha, 1994, p.154; Bayley, Butcher 2004, p.155, Fig. 121). In addition, a few disc brooches with an openwork rhombic centre are known from the Sambian Peninsula and date to the 1st–2nd centuries (B_2/C_1 and C_{1a}) (Khomiakova 2015, p.25). In Latvia and Lithuania, it was used to decorate various ornaments, but not so much disc brooches (Vaska 2013, pp.102–104). Thus the rhombus, as the dominant motif of many disc brooches, can be considered inherent to the local *tarand* cemetery area.

All the rotating motifs, including standard and curved swastika, triskele, wheel, spiral, and four circle motifs, share the common feature of seeming to rotate within the disc. They were also used to decorate Roman Iron Age disc brooches throughout Europe (see previous chapters).

All of the rhombus and rotating motifs are common in Roman, Germanic, Dnieper area, and Baltic ornamentation. This means that the motifs were international to an extent, with some additional local preferences. It could be argued that certain cosmopolitan motifs were fashionable and that people wanted to reproduce and refine them locally. They were then adopted by the local culture because they were aesthetically pleasing and fashionable at that time. The symbolic meaning, however, has yet to be determined but some motifs may have been more suitable for the local cultural system than others.

Brooches, as a new form of clothing fastener, spread into the *tarand* cemetery area in the early Roman Iron Age (Lang 2007, p.206). Many of the motifs depicted on disc brooches were likewise new in the region as they do not have traceable origins in the local material culture (Olli 2013, p.84). Therefore a possibility exists that the beliefs connected to the motifs and brooches themselves were also adopted because they suited the local context. However, it is very likely that only the motifs that suited the needs of the local culture were taken in and the elements that did not hold any meaning among the locals were left aside (e.g. for a rosette form which was popular among the Balts, see Vaska 2013, pp.106–107; for popular types of Roman provincial brooches, see Riha 1994, Taf. 51). It is known that the barbarians in general reworked selected Roman item forms, in addition to materials and techniques, for their own purposes (Hakenbeck 2011, p.54 and the cited literature). They also sometimes combined them with local traditions, thereby creating new meaning (Ekengren 2009). The people of the *tarand* cemetery area likewise reworked selected Roman and Baltic forms (and perhaps some others?), adopted new techniques, and created new items in their own style, imbuing them with their own meaning.

Regionality in disc brooches

When brooch colour and groupings were examined, two regions came to the fore: Northeast Estonia and Southeast Estonia–North Latvia.

Most of the disc brooches were surface treated, giving them a 'silvery' look, except in Northeast Estonia where the bronze-like look predominated among the locally produced items. The choice to keep the bronze-like colour was probably deliberate and cannot be associated with technological limitations because other types of contemporaneous brooches still bear visible signs of previous ('silvery') surface treatments (e.g. a head-shield brooch from Erra *tarand* cemetery in Northeast Estonia, A 313: 3, 3rd century). Unlike with the bronze-like Northeast disc brooches, the 'silvery' look predominated among the Southeast Estonian and North Latvian disc brooches.

Differences likewise exist in the geographic distribution of the various disc brooch groups (Fig. 7). Group three brooches are mainly distributed on the Northeast Estonian coast. Southeast Estonia is strongly distinguished by its small disc brooches (second group), which have almost exclusively been found in the western part of the region. North Latvia and Southeast Estonia have many similarities to each other, as the first, fourth, and fifth groups are represented in both of these modern regions. The fifth group however is mainly confined to North Latvia. It is remarkable that these disc brooch groups are found only in certain regions and are absent in other areas where *tarand* cemeteries occur.

Enamelled disc brooches seem to be distributed across the entire area where disc brooches occur, but if the design is taken into consideration, it appears that certain motifs are concentrated in smaller regions: the four-circle motif in Northeast Estonia and the rhombus in Southeast Estonia and North Latvia; these motifs and associated regions are also connected to other disc brooch groups. The enamelling technique may well have been known by local craftsmen and not just reserved for imported items as it has been used on local brooches. According to Anna Bitner-Wróblewska (2011, p.21), identical or very similar ornaments in one region may reflect the presence of a local workshop or a craftsman who travelled on a local scale. The skill level of the local craftsmen was very likely to have been quite high if most of the enamelled brooches were made locally.

Disc brooches of a similar style are clearly concentrated in small regions, where they were probably produced in local workshops together with other copper alloy items. Similar brooches that have been found outside of these concentrations are probably the result of travelling, trade, and other similar connections, which could also be how rare, non-local types of disc brooches reached Finland, Central Estonia, and Northwest Estonia. The disc brooches of

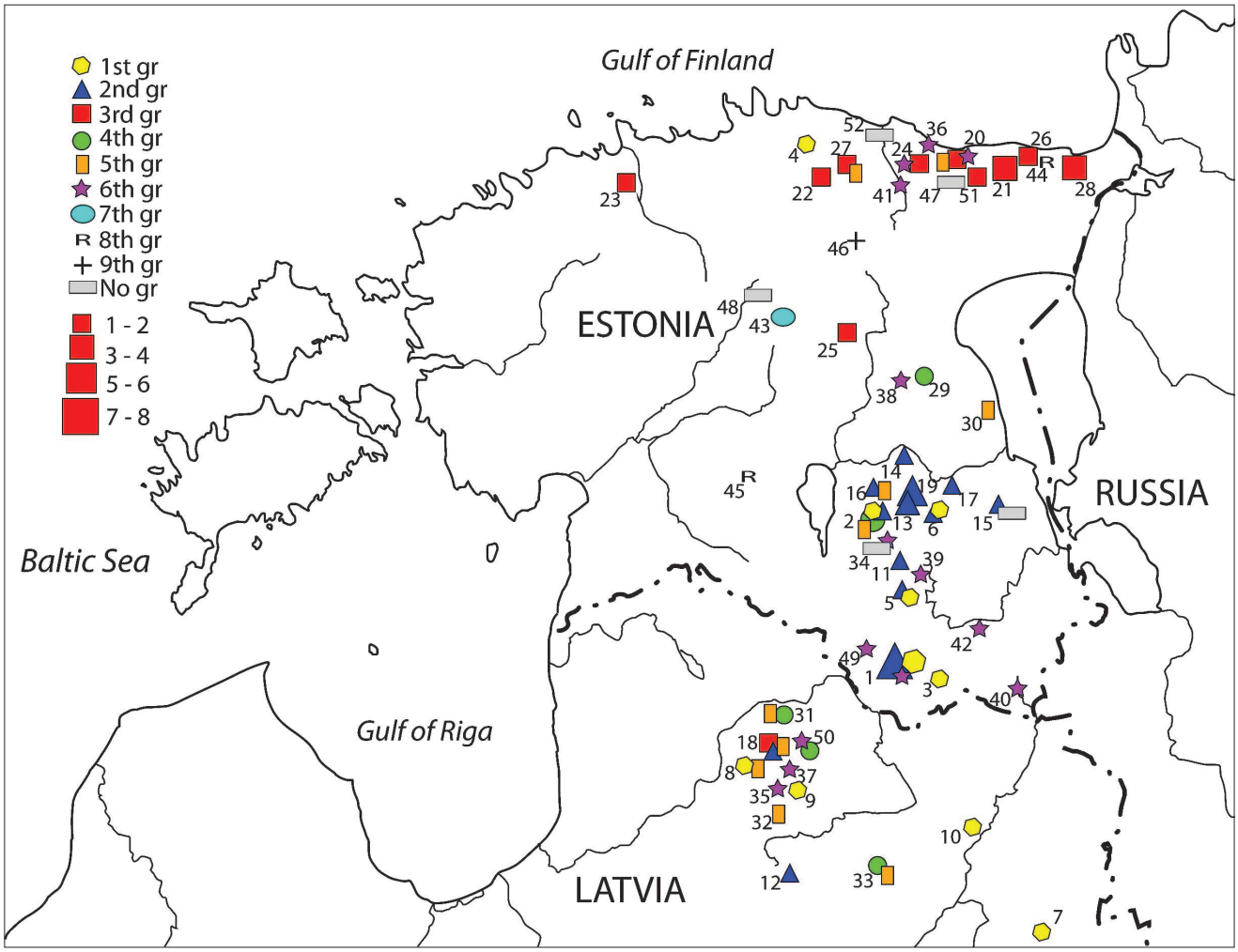

Fig. 7. Disc brooch distribution in the *tarand* cemetery area: 1 – Virunuka, 2 – Jaagupi, 3 – Sadrametsa, 4 – Hõbeda, 5 – Truuta, 6 – Tatra, 7 – Salenieki, 8 – Mūri, 9 – Vīksnas Kapusils, 10 – Leški, 11 – Ala-Pika, 12 – Gailiši, 13 – Kambja, 14 – Kardla, 15 – Kõnnu, 16 – Meeri, 17 – Paali, 18 – Slavēka, 19 – Unipiha, 20 – Jäbara, 21 – Kukruse, 22 – Laanemõisa, 23 – Lagedi, 24 – Pada, 25 – Ripuka, 26 – Toila, 27 – Tõrma, 28 – Türsamäe, 29 – Kõrenduse, 30 – Lahepera, 31 – Libriti, 32 – Mūsina, 33 – Jaunzemji, 34 – Aakre, 35 – Jauntēvēns, 36 – Kalvi, 37 – Kaugars II, 38 – Kärde, 39 – Pikkjärve, 40 – Siksälä, 41 – Ulvi, 42 – Vagula, 43 – Nurmsi, 44 – Künnapuu, 45 – Viljandi, 46 – Triigi, 47 – Erra, 48 – Tarbja, 49 – Kirbu, 50 – Velna Kravanda, 51 – Järve, 52 – Malla. *Drawing by M. Olli.*

the first and second groups are quite homogeneous in their style and manufacturing technique and so could have been made for local use in larger numbers. Conversely the more elaborate brooches of the other groups may have been produced in smaller numbers, probably on a bespoke basis by specific members of the community. The wearing of a disc brooch inherent to a specific region might have communicated the wearer's ties to that region as well as other possible social identities.

A noticeable distinction seems to exist between the coastal area of Northeast Estonia and Southeast Estonia–North Latvia. The regional variation in certain ornaments is one marker for localised production along the lines of regional identities (see Swift 2000, pp.232–233; Hakenbeck 2011, p.54). Although style in itself cannot define cultural groups *per se*, it provides a context for where they were active. It is also important to compare both style and production elements because together they form a whole

(Conkey 1993, p.15). As the differences between these two geographic areas (Northeast Estonia and Southeast Estonia–North Latvia) are noticeable in many ways, the existence of two cultural groups can be proposed. Such a division can also be seen in the occurrence of the Roman Iron Age pottery types, in particular, the textile-impressed pottery in Southeast Estonia and North Latvia, and the Nurmsi-style pottery in Northern, Western, and Central Estonia (Lang 2018, pp.242–243). The South-North difference is also observable in the direction of long distance contacts.

Contacts with other areas

Thanks to the Amber Road, an ancient route connecting the coastal areas of the Southeast Baltic Sea with the distant Mediterranean, trading was intense during the first centuries (Nowakowski 1996, p.107). People very likely came from far and wide to the southeast shore of the Baltic Sea to trade and exchange ideas. Because of this connection with the wider world, crafts, skills, people, and fashion must have spread throughout the region. In addition to amber, other goods were exchanged among the Balts, Germanic peoples, Romans, and others, who came there to trade (Sidrys 2001, pp.167–168). The different cultures and traditions met, and favoured elements were taken back home with the traders. Many trade routes existed (Sidrys 2001, p.160) and the existence of fixed trade relations between certain groups of people from different areas is possible. People knew what they needed for their local market and for the people from the *tarand* cemetery area it was not foreign ornaments, it was scrap and raw metal (amongst other things) and the know-how of different techniques (enamelling, tinning, etc.) to support local needs. This was mainly due to the lack of locally sourced raw materials which forced the importation of all copper-alloy related metals. The creation and maintenance of trade relations played an important role in satisfying these needs.

This analysis clearly shows that influences from various directions were present at that time. Northeast Estonian disc brooches differ from other disc brooches, both in the *tarand* cemetery area and the Southeast Baltic area. They have more in common stylistically with provincial Roman brooches than the Baltic or Dnieper area variants (although contacts also existed in those directions as well). It is likely that the connections were via sea routes and therefore more directly with Germanic peoples or even traders from beyond the Roman frontier. Maybe in some trading centres along the southeast shore of the Baltic Sea, new ideas were acquired and it is not impossible that the traders from these distant regions reached the shores of Northeast Estonia.

Similarities very clearly exist between West Lithuanian disc brooches and the Southeast Estonian and North Latvian examples, these being especially evident in brooches from group five, which mostly occur in North Latvia. Contacts between the two areas were probably via land and river routes. Direct connections must have existed as the decorative motifs reaching the *tarand* cemetery areas where adapted and subsequently applied to locally produced disc brooches. It is also evident in examples of other brooch types (Banytė-Rowell, Bitner-Wróblewska 2005, pp.114–116).

Judging by some of the enamelled brooches, contact not only occurred with Western Europe, but also areas further east, e.g. the Kiev culture area, where brooches and other artefacts have been found with similar decorations (Шмидехельм 1955, pp.218–219; Корзухина 1978; Левада 2010). The existence of close ties between the Eastern European enamelling centres has already been suggested on the basis of the many similarities in the design and technological elements (Bitner-Wróblewska 2011, p.15) and been confirmed by this study, which has shown that some foreign stylistic elements were also used on locally produced artefacts. Many brooches, for example, share a similar edge decoration (group 6.1 brooches, A 235:12, AI 2616, RDM I 2746, AI 5101: CVIII: 1).

CONCLUSIONS

Disc brooches from all around Roman Iron Age Europe are very diverse, which has led to the identification of many regional differences. The Roman Iron Age disc brooches found in the *tarand* cemetery area of Estonia and North Latvia were studied to detect further regional differences based on typology, motifs, and composition. Contact with other areas was also explored to identify influences from various non-local directions. The typology of the brooches was re-examined and nine groups were subsequently distinguished. A large number of the disc brooches were also analysed using handheld X-Ray florescence spectrometry (HHXRF).

Two geographic areas came to the fore as a result of this study: Northeast Estonia and Southeast Estonia–North Latvia. Thus the presence of two cultural groups can be suggested on the basis of the distribution of the typological groups, styles, and surface treatments and the direction of the long distance trade. The people living in the vicinity of the *tarand* cemeteries were in active contact with others both near and far and traded with them. Due to this contact, the craftsmen were technologically skilled and mastered many techniques including surface treatments and enamelling methods. They created local brooches based on foreign ideas and imported examples, but with a unique local touch. Access to raw material was limited and therefore only production on a local scale was possible, which may have been targeted at and/or ordered by the local elite or specific groups of people.

Acknowledgements

Thanks go to Dr Rasa Banytė-Rowell (Lithuanian Institute of History) for consultation on Lithuanian disc brooches and also to Dr Jānis Ciglis (National History Museum of Latvia) for letting us use his personal archive.

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APPENDIX. LIST OF BROOCHES INCLUDED IN THIS STUDY.

Find ID	Find Location	Hinge construction	Group	Subgroup	Visible tin	Motif	Diameter, mm	Area	Reference of dating	Dating	New dating
AI 4161: 591	Virunuka, Rõuge, Võrumaa	?	1	?	no		?	Southeast Estonia	Laul 2001, p.114	4th–5th c.	
AI 3236: 215	Jaagupi, Nõo, Tartumaa	eye-and-hook?	1	1.1	no		35	Southeast Estonia	Laul 2001, p.114	4th–5th c.	
AI 4262: 30	Virunuka, Rõuge, Võrumaa	eye-and-hook	1	1.1	no		30	Southeast Estonia	Laul 2001, p.114	4th–5th c.	
A 10876: 20	Salenieki, Makašānu, Rēzekne	eye-and-hook	1	1.2	yes	cross	34	North Latvia	Laul 2001, p.114	4th–5th c.	
A 17:92	Sadrametsa, Rõuge, Võrumaa	eye-and-hook	1	1.2	no	cross	29	Southeast Estonia	Laul 2001, p.114	4th–5th c.	
A 349 :71	Hõbeda, Kadrina, Virumaa	eye-and-hook	1	1.2	no	cross	29	Northeast Estonia	Laul 2001, p.114	4th–5th c.	
A 7991: 23	Mūri, Baižkalna, Cēsis	eye-and-hook	1	1.2	yes?	cross	36	North Latvia	Laul 2001, p.114	4th–5th c.	
AI 1239:4	Vīksnas Kapusils, Branti, Cēsis	eye-and-hook	1	1.2	no	cross	37	North Latvia	Laul 2001, p.114	4th–5th c.	
AI 1993: 21	Truuta, Urvaste, Võrumaa	eye-and-hook	1	1.2	no	cross	35	Southeast Estonia	Laul 2001, p.114	4th–5th c.	
AI 1993: 22	Truuta, Urvaste, Võrumaa	?	1	1.2	?	cross	?	Southeast Estonia	Laul 2001, p.114	4th–5th c.	
AI 2339: 8	Tatra, Kambja, Tartumaa	eye-and-hook	1	1.2	yes	cross	30	Southeast Estonia	Laul 2001, p.114	4th–5th c.	
AI 4262: 303	Virunuka, Rõuge, Võrumaa	eye-and-hook	1	1.2	no	cross	33	Southeast Estonia	Laul 2001, p.114	4th–5th c.	
?	Leški, Litenes, Madona	eye-and-hook	1	1.3	?	whirlpool	?	North Latvia	Laul 2001, p.114	4th–5th c.	
AI 3236: 291	Jaagupi, Nõo, Tartumaa	eye-and-hook	1	1.3	no	whirlpool	36	Southeast Estonia	Laul 2001, p.114	4th–5th c.	
AI 4161: 642	Virunuka, Rõuge, Võrumaa	eye-and-hook	1	1.3	no	swastica	31	Southeast Estonia	Laul 2001, p.114	4th–5th c.	
AI 4252: 27	Sadrametsa, Rõuge, Võrumaa	eye-and-hook	1	1.3	no	swastica	32	Southeast Estonia	Laul 2001, p.114	4th–5th c.	

CONTINUATION OF APPENDIX

Find ID	Find Location	Hinge construction	Group	Subgroup	Visible tin	Motif	Diameter, mm	Area	Reference of dating	Dating	New dating
AI 1702: 2	Jaagupi, Nõo, Tartumaa	eye-and-hook	2		no		19	Southeast Estonia	Laul 2001, p.114	4th–5th c.	
AI 1996: 45	Kambja, Kambja, Tartumaa	eye-and-hook	2	2.1	no	cross	19	Southeast Estonia	Laul 2001, p.114	4th–5th c.	
AI 4262: 69	Virunuka, Rõuge, Võrumaa	eye-and-hook	2	2.1	no	cross	25	Southeast Estonia	Laul 2001, p.114	4th–5th c.	
AI 4447: 1	Kõnnu, Võnnu, Tartumaa	eye-and-hook	2	2.1	no	cross	18	Southeast Estonia	Laul 2001, p.114	4th–5th c.	
AI 1995: 43	Unipiha, Nõo, Tartumaa	eye-and-hook	2	2.2	no	rhombus	19	Southeast Estonia	Laul 2001, p.114	4th–5th c.	
AI 1995: 62	Unipiha, Nõo, Tartumaa	eye-and-hook	2	2.2	no	rhombus	19	Southeast Estonia	Laul 2001, p.114	4th–5th c.	
AI 1996:159	Kambja, Kambja, Tartumaa	eye-and-hook	2	2.2	no	rhombus	19	Southeast Estonia	Laul 2001, p.114	4th–5th c.	
AI 2901: 2	Unipiha, Nõo, Tartumaa	eye-and-hook	2	2.2	no	rhombus	20	Southeast Estonia	Laul 2001, p.114	4th–5th c.	
AI 3235: 203	Paali, Kambja, Tartumaa	eye-and-hook	2	2.2	no	rhombus	20	Southeast Estonia	Laul 2001, p.114	4th–5th c.	
AI 4161: 34	Virunuka, Rõuge, Võrumaa	?	2	2.2	no	rhombus	16	Southeast Estonia	Laul 2001, p.115	4th–5th c.	
AI 4262: 34	Virunuka, Rõuge, Võrumaa	eye-and-hook	2	2.2	no	rhombus	17	Southeast Estonia	Laul 2001, p.114	4th–5th c.	
AI 4262: 88	Virunuka, Rõuge, Võrumaa	eye-and-hook	2	2.2	no	rhombus	19	Southeast Estonia	Laul 2001, p.114	4th–5th c.	
TÜ 2668: 8	Meeri, Nõo, Tartumaa	eye-and-hook	2	2.2	yes	rhombus	20	Southeast Estonia	Laul 2001, p.114	4th–5th c.	
TÜ 320:177	Ala-Pika, Kanepi, Võrumaa	eye-and-hook	2	2.2	yes	rhombus	18	Southeast Estonia	Laul 2001, p.114	4th–5th c.	
AI 1195: 65	Slavēka, Rauna, Cēsis	tubular	2	2.3	no	rhombus	27	North Latvia			4th–5th c.
AI 1993: 17	Truuta, Urvaste, Võrumaa	eye-and-hook	2	2.3	no	rhombus	24	Southeast Estonia	Laul 2001, p.114	4th–5th c.	
AI 1995: 77	Unipiha, Nõo, Tartumaa	eye-and-hook	2	2.3	?	rhombus	26	Southeast Estonia	Laul 2001, p.114	4th–5th c.	

CONTINUATION OF APPENDIX

Find ID	Find Location	Hinge construction	Group	Subgroup	Visible tin	Motif	Diameter, mm	Area	Reference of dating	Dating	New dating
AI 1996: 66	Kambja, Kambja, Tartumaa	eye-and-hook	2	2.3	?	rhombus	?	Southeast Estonia	Laul 2001, p.114	4th–5th c.	
AI 2339: 11	Tatra, Kambja, Tartumaa	eye-and-hook	2	2.3	yes	rhombus	20	Southeast Estonia	Laul 2001, p.114	4th–5th c.	
AI 2415c: 4	Kardla, Nõo, Tartumaa	eye-and-hook	2	2.3	no	rhombus	21	Southeast Estonia	Laul 2001, p.114	4th–5th c.	
AI 3235: 202	Paali, Kambja, Tartumaa	eye-and-hook	2	2.3	no	rhombus	25	Southeast Estonia	Laul 2001, p.114	4th–5th c.	
AI 4262: 1164	Virunuka, Rõuge, Võrumaa	?	2	2.3	no	rhombus	?	Southeast Estonia	Laul 2001, p.114	4th–5th c.	
AI 4262: 403	Virunuka, Rõuge, Võrumaa	eye-and-hook	2	2.3	no	rhombus	21	Southeast Estonia	Laul 2001, p.114	4th–5th c.	
AI 4262: 413	Virunuka, Rõuge, Võrumaa	eye-and-hook	2	2.3	no?	rhombus	21	Southeast Estonia	Laul 2001, p.114	4th–5th c.	
TÜ 2668: 9	Meeri, Nõo, Tartumaa	eye-and-hook	2	2.3	no	rhombus	18	Southeast Estonia	Laul 2001, p.114	4th–5th c.	
A 9966: 72	Gailīši, Taurenes, Cēsis	eye-and-hook	2	2.4	possibly?	sieve	36	North Latvia	Laul 2001, p.115	4th–5th c.	
AI 1996:103	Kambja, Kambja, Tartumaa	eye-and-hook	2	2.4	no	sieve	23	Southeast Estonia	Laul 2001, p.114	4th–5th c.	
A 110: 32	Kukruse, Jõhvi, Virumaa	two lugs	3		no	whirlpool	48	Northeast Estonia	Шмидехельм 1955, p.199	3rd c.	
A 110: 33	Kukruse, Jõhvi, Virumaa	?	3		no?	circles	60	Northeast Estonia	Шмидехельм 1955, p.199	3rd c.	
A 111: 48	Järve, Jõhvi, Virumaa	eye-and-hook?	3		?	swastica with curved arms	45	Northeast Estonia			3rd c.
AI 1195: 138	Slavēka, Rauna, Cēsis	eye-and-hook	3		no	wheel	50	North Latvia	Шмидехельм 1955, p.199	3rd c.	
A 110: 31	Kukruse, Jõhvi, Virumaa	eye-and-hook	3	3.1	no	triskele	59	Northeast Estonia	Шмидехельм 1955, p.199	3rd c.	
AI 2012: I: 13	Türsamäe, Vaivara, Virumaa	eye-and-hook	3	3.1	no	triskele	55	Northeast Estonia	Шмидехельм 1955, p.199	3rd c.	

CONTINUATION OF APPENDIX

Find ID	Find Location	Hinge construction	Group	Subgroup	Visible tin	Motif	Diameter, mm	Area	Reference of dating	Dating	New dating
AI 2655: 358	Pada, Viru-Nigula, Virumaa	eye-and-hook	3	3.1	no	triskele	58	Northeast Estonia	Шмидехельм 1955, p.199	3rd c.	
AI 3953: 1	Toila, Jõhvi, Virumaa	?	3	3.1	?	triskele	56	Northeast Estonia	Шмидехельм 1955, p.199	3rd c.	
AI 2012: I: 14	Türsamäe, Vaivara, Virumaa	?	3	3.2	no	closed cross	?	Northeast Estonia	Шмидехельм 1955, p.146	4th c.	
AI 2488: 9	Tõrma, Rakvere, Virumaa	eye-and-hook	3	3.2	no	closed cross	65	Northeast Estonia	Шмидехельм 1955, p.146	4th c.	
AI 3447: 3	Laanemõisa, Rakvere, Virumaa	eye-and-hook	3	3.2	no	closed cross	51	Northeast Estonia	Шмидехельм 1955, p.146	4th c.	
AI 3735: 4	Jäbara, Lüganuse, Virumaa	?	3	3.2	?	closed cross	47	Northeast Estonia	Шмидехельм 1955, p.146, 199	4th c.	
A 25: 4	Lagedi, Jüri, Harjumaa	two lugs	3	3.3	no	4 circles, rhombus	62	Northwest Estonia	Шмидехельм 1955, p.199	3rd c.	
AI 2012: II: 13	Türsamäe, Vaivara, Virumaa	eye-and-hook	3	3.3	no	4 circles	62	Northeast Estonia	Шмидехельм 1955, p.199	3rd c.	
AI 2655: 104	Pada, Viru-Nigula, Virumaa	eye-and-hook	3	3.3	no	4 circles, rhombus	55	Northeast Estonia	Шмидехельм 1955, p.199	3rd c.	
AI 618	Ripuka, Laiuse, Tartumaa	eye-and-hook	3	3.3	no	4 circles, rhombus	67	East Estonia	Шмидехельм 1955, p.199	3rd c.	
AI 1702: 33	Jaagupi, Nõo, Tartumaa	eye-and-hook	4		in the centre	swastica	38	Southeast Estonia	Laul 2001, p.114	4th–5th c.	3rd–4th c.
AI 3236: 75	Jaagupi, Nõo, Tartumaa	eye-and-hook	4		no?	rhombus?	39	Southeast Estonia	Laul 2001, p.114	4th–5th c.	3rd–4th c.
AI 1702: 35	Jaagupi, Nõo, Tartumaa	eye-and-hook	4	4.1	no	compass	43	Southeast Estonia	Laul 2001, p.114	4th–5th c.	3rd c.
AI 3236: 250	Jaagupi, Nõo, Tartumaa	eye-and-hook	4	4.1	yes?	compass	41	Southeast Estonia	Laul 2001, p.114	4th–5th c.	3rd c.
RDM I 102	Dzelzava, Jaunzemji	eye-and-hook	4	4.1	yes	compass, rhombus	67	North Latvia	Laul 2001, p.114	4th–5th c.	3rd c.
AI 1194: 38	Velna Kravanda, Rauna, Cēsis	eye-and-hook	4	4.2	yes	rhombus	29	North Latvia	Laul 2001, p.114	4th–5th c.	(2nd) 3rd–4th c.

CONTINUATION OF APPENDIX

Find ID	Find Location	Hinge construction	Group	Subgroup	Visible tin	Motif	Diameter, mm	Area	Reference of dating	Dating	New dating
AI 4866: 261	Kõrenduse, Maarja-Magdaleena, Tartumaa	eye-and-hook	4	4.2	no	rhombus	28	East Estonia	Laul 2001, p.114	4th–5th c.	(2nd) 3rd–4th c.
VM VMT 91: 6	Unknown	eye-and-hook	5		no	cross	31	unknown	Laul 2001, p.114	4th–5th c.	
AI 1195: 107	Slavēka, Rauna, Cēsis	two lugs?	5	5.1	yes?	baluster	48	North Latvia	Laul 2001, p.114	4th–5th c.	3rd–4th c.
AI 2604: 262	Jäbara, Lüganuse, Virumaa	eye-and-hook	5	5.1	yes	baluster	59	Northeast Estonia	Шмидехельм 1955, p.100	5th c.	3rd–4th c.
RDM I 2713	Libriti, Trikāta, Valka	eye-and-hook	5	5.1	yes, surface is cleaned	baluster	59	North Latvia	Laul 2001, p.114	4th–5th c.	3rd–4th c.
A 7991: 53	Mūri, Baižkalna, Cēsis	?	5	5.1, 5.2	?	whirlpool and baluster	?	North Latvia	Laul 2001, p.114	4th–5th c.	3rd–4th c.
AI 1252: 12	Mūsina, Rauna, Cēsis	eye-and-hook	5	5.2	no	whirlpool	42	North Latvia	Laul 2001, p.114	4th–5th c.	3rd–4th c.
AI 2488: 10	Tõrma, Rakvere, Virumaa	eye-and-hook	5	5.2	yes	whirlpool	63	Northeast Estonia	Laul 2001, p.114	4th–5th c.	3rd–4th c.
AI 3236: 275	Jaagupi, Nõo, Tartumaa	eye-and-hook	5	5.2	no	whirlpool	49	Southeast Estonia	Laul 2001, p.114	4th–5th c.	3rd–4th c.
TÜ 2668: 10	Meeri, Nõo, Tartumaa	eye-and-hook	5	5.2	yes	whirlpool	28	Southeast Estonia	Laul 2001, p.114	4th–5th c.	3rd–4th c.
AI 1195: 124	Slavēka, Rauna, Cēsis	eye-and-hook	5	5.2, 5.3	no	whirlpool, wheel	51	North Latvia	Laul 2001, p.114	4th–5th c.	3rd–4th c.
AI 1984: 3	Lahepera, Kodavere, Tartumaa	two lugs	5	5.3	no	circle and wheel	35	East Estonia			3rd–4th c.
RDM I 103	Jaunzemji, Dzelzava, Madona	eye-and-hook	5	5.3	no, surface is cleaned	wheel	53	North Latvia	Laul 2001, p.114	4th–5th c.	3rd–4th c.
RDM I 2745	Libriti, Trikāta, Valka	eye-and-hook	5	5.3	yes?	wheel, zigzag	82	North Latvia	Vaska 2013, p.106	4th c.	3rd–4th c.
A 235: 12	Ulvi, Viru-Nigula, Virumaa	eye-and-hook	6		no	whirlpool	60	Northeast Estonia			

CONTINUATION OF APPENDIX

Find ID	Find Location	Hinge construction	Group	Subgroup	Visible tin	Motif	Diameter, mm	Area	Reference of dating	Dating	New dating
A 92: 5	Kalvi, Viru-Nigula, Virumaa	one lug	6		no?	rhombus	53	Northeast Estonia			
AI 1237: 1	Kaugars II, Rauna, Cēsis	eye-and-hook	6		yes	cross, wheel	70	North Latvia	Vaska 2013, p.99	4th c.	
AI 1260: 5	Pikkjärve, Kanepi, Võrumaa	eye-and-hook	6		possibly?	rhombus, lace	71	Southeast Estonia	Laul 2001, p.114	4th–5th c.	
AI 1918 23	Kärde, Laiuse, Tartumaa	eye-and-hook	6		yes		47	Central Estonia	Laul 2001, p.114	4th–5th c.	
AI 2616	Vagula, Rõuge, Võrumaa	eye-and-hook	6		yes	baluster, lace, whirlpool	120	Southeast Estonia	Laul 2001, p.114	4th–5th c.	
AI 5101: CVIII: 1	Siksälä, Vastseliina, Võrumaa	eye-and-hook	6		no	swastica	99	Southeast Estonia	Laul 2001, p.114	4th–5th c.	
RDM I 2746	Libriti, Trikāta, Valka	?	6		?	swastica	?	North Latvia	Vaska 2013, p.107	4th c.	
TÜ 2264	Kirbu, Karula, Võrumaa	?	6		no	triskele	31	Southeast Estonia	Laul 2001, p.114	4th–5th c.	
AI 1194: 39	Velna Kravanda, Rauna, Cēsis	eye-and-hook	6	6.1	yes	rhombus	52	North Latvia	Vaska 2013, p.99	4th c.	
AI 1237: 9	Kaugars II, Rauna, Cēsis	eye-and-hook	6	6.1	yes	rhombus	58	North Latvia	Vaska 2013, p.99	4th c.	
TÜ 2410: 416	Aakre, Rõngu, Tartumaa	eye-and-hook	6	6.1	yes	rhombus	63	Southeast Estonia	Laul 2001, p.114	4th–5th c.	
AI 1253: 2	Jauntēvēns, Rauna, Cēsis	eye-and-hook	6	6.2	?	cross	50	North Latvia	Vaska 2013, p.107	4th–5th c	
AI 4262: 613	Virunuka, Rõuge, Võrumaa	?	6	6.2	?	cross	54	Southeast Estonia	Laul 2001, p.114	4th–5th c.	
AI 4262: 804	Virunuka, Rõuge, Võrumaa	eye-and-hook	6	6.2	yes	cross	54	Southeast Estonia	Laul 2001, p.114	4th–5th c.	
RDM 2719	Libriti, Trikāta, Valka	?	6	6.2	yes	cross	?	North Latvia	Vaska 2013, p.107	4th–5th c	
AI 2604: 161	Jäbara, Lüganuse, Virumaa	eye-and-hook	6	6.3	no	4 circles, rhombus	55	Northeast Estonia	Шмидехельм 1955, p.100	4th c.	

CONTINUATION OF APPENDIX

Find ID	Find Location	Hinge construction	Group	Subgroup	Visible tin	Motif	Diameter, mm	Area	Reference of dating	Dating	New dating
AI 2655: 179	Pada, Viru-Nigula, Virumaa	two lugs	6	6.3	no	4 circles, rhombus	60	Northeast Estonia	Шмидехельм 1955, p.199	3rd c.	
AI 2486: 169	Nurmsi, Peetri, Järvamaa	two lugs	7		no		100	Central Estonia	Vassar 1943, p.71	3rd c.	
AI 2486: 23	Nurmsi, Peetri, Järvamaa	eye-and-hook?	7		yes		63	Central Estonia	Vassar 1943, p.71	3rd c.	
AI 3791: 3	Künnapuu, Jõhvi, Virumaa	two lugs	8	Roman	no		33	Northeast Estonia	Exner 1939 p.63	125–200 AD	
VM 11501 A	Viljandi, Viljandi, Viljandimaa	two lugs	8	Roman	no		35	Southwest Estonia	Buora 2005, p.117	3rd (4th–5th) c.	
AI 2013: 3	Triigi, Väike-Maarja, Virumaa	eye and 2 hooks	9	Rosette tutulus	no		78	Northeast Estonia	Banytė-Rowell 2009, p.41	1st–2nd c.	
AI 2013: 4	Triigi, Väike-Maarja, Virumaa	eye and 2 hooks	9	Rosette tutulus	no		80	Northeast Estonia	Banytė-Rowell 2009, p.41	1st–2nd c.	
AI 4447: 15	Kõnnu, Võnnu, Tartumaa	eye-and-hook	no group	Rosette	no	rosette	164	Southeast Estonia	Banytė-Rowell 2001, p.46	3rd–4th c.	
A 313: 5	Erra, Lüganuse, Virumaa	eye-and-hook?	no group		no	circles	35	Northeast Estonia	Шмидехельм 1955, p.199	3rd c.	
AI 2011: 2	Aakre, Rõngu, Tartumaa	two lugs	no group		no		24	Southeast Estonia	Laul 2001, p.117	4th–5th c.	
AI 690	Tarbja, Paide, Järvamaa	eye-and-hook	no group		no, surface is cleaned		58	Central Estonia			
?	Malla, Viru-Nigula, Virumaa	?	no group		?	four loops	?	Northeast Estonia			

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ABBREVIATIONS

AB – Archaeologia Baltica
AL – Archaeologia Lituana
JAS – Journal of Archaeological Science
LA – Lietuvos archeologija
MT – Muinasaja teadus

ROMĖNIŠKOJO LAIKOTARPIO APSKRITOS SEGĖS IŠ ESTIJOS IR ŠIAURĖS LATVIJOS *TARAND* KAPINYNŲ

Maarja Olli, Marcus Adrian Roxburgh

Santrauka

Straipsnio objektas yra dabartinės Estijos ir Šiaurės Latvijos teritorijoje *tarand* kapinynų paplitimo areale aptinkamos Romėniškojo laikotarpio (50–450 m. po Kr. Estijoje ir 1–400 m. po Kr. Latvijoje) apskritos segės. Iki šiol šioje teritorijoje rastos apskritos segės nebuvo tyrinėtos, dažniausiai jos buvo platesnių įvairių šalių ir regionų materialinės kultūros tyrinėjimų sudėtinė dalis.

Straipsnio tikslas – nuodugniai ištirti Romėniškojo laikotarpio *tarand* kapinynų paplitimo areale aptinkamas apskritas seges, didžiausią dėmesį skiriant regioniniams skirtumams. Siekiama nustatyti, ar kurie nors motyvai, tipologinės grupės, lydiniai dominavo atskirose teritorijose, ir *tarand* kapinynų paplitimo areale identifikuoti galimas kultūrines grupes. Be to, mėginant nustatyti vietos ir išorės įtaką apskritų segių stiliams ir gamybai, atsižvelgiama ir į kultūrinius santykius su išoriniais regionais.

Straipsnis sujungia stilistinius ir tipologinius apskritų segių bei jų gamybos bruožų tyrimus. Tyrimų metu buvo patikrinta esama segių tipologija ir chronologija bei palyginta su kitų, spėjama, didžiausią įtaką aptariamojoje teritorijoje rastų segių formoms turėjusių regionų (pirmiausia Vakarų Lietuvos ir Ro-

mos provincijų) duomenimis. Pagal segių puošybą, jų dydį, adatos tvirtinimo būdą ir gamybą buvo išskirtos devynios grupės. Lydinio, iš kurio pagamintos segės, sudėtis buvo analizuojama rankiniu rentgeno spindulių fluorescenciniu spektrometru (HHXRF) kokybiniu nedestrukcinu metodu, siekiant išsiaiškinti galimus tipologinių grupių ir lydinio sudėties dėsningumus, taip pat įgyti žinių apie paviršiaus apdirbimo pobūdį.

Remiantis tyrimais, išskirtos dvi teritorijos: 1) Šiaurės rytų Estijos, 2) Pietryčių Estijos ir Šiaurės Latvijos. Šios dvi kultūrinės grupės išryškėjo pagal segių grupių paplitimą, stilių, paviršiaus apdorojimą ir ilgo nuotolio prekybos kryptis. Romėniškojo laikotarpio *tarand* kapinynų paplitimo areale gyvenę žmonės aktyviai prekiavo ir bendravo tiek su kaimyninių, tiek su tolimesnių regionų gyventojais. To rezultatas buvo aukštas amatininkų technologinis lygis, įvairių paviršiaus apdorojimo technikų, tokių kaip alavavimas ir dengimas emaliu, išmanymas. Segių kūrimas buvo grindžiamas išorės idėjomis ir prototipais, suteikiant dirbiniams vietinių bruožų. Nors iš kitų regionų importuotų vario lydinių apskritų segių nėra daug, vietos segių stilistikoje ir gamybos technikoje juntama baltų, Romos provincijų, Germanijos ir Dniepro arealo įtaka. Kadangi žaliavos prieinamumas buvo ribotas, buvo gaminama nedideliu mastu, tik vietos naudojimui, produkcija greičiausiai buvo skirta ir/ar užsakoma vietos elito ar kitų žmonių grupių. Žvelgiant į vietoje pagamintų segių paplitimą matyti, kad jos buvo naudojamos lokaliai, žmonių, laidotų *tarand* kapinynuose.

PRIEDAS

Šioje studijoje aptariamų segių sąrašas.

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1 lent. Analizės rezultatų palyginimas („Niton“ ir „Bruker“ analizatoriai).

2 lent. Sudėties analizės rezultatai (%).

ILIUSTRACIJŲ SĄRAŠAS

1 pav. *Tarand* kapinynų paplitimo arealas Romėniškuoju laikotarpiu. *M. Olli brėž.* pagal Lang 2018, p.175, Fig. 5.10.

2 pav. Trijų komponentų diagrama: a – klasifikacijos schema (pagal Bayley, Butcher 2004, p.24, Fig. 7); b – „žemyninės apskritos segės“ Šiaurės vakarų Europoje (pagal Bayley, Butcher 2004, p.176, Fig. 151); c – akinės segės (pagal Bayley, Butcher 1995, p.115, Fig. 4:1); d – A46 tipo segės (pagal Roxburgh *et al*. 2017, p.252, Fig. 5.3.16). *M. A. Roxburgh brėž.*

3 pav. Adatos tvirtinimo konstrukcija: a – kilputės ir kabliuko konstrukcija, b – dvi auselės su skylutėmis, laikančiomis ašį, prie kurios pritvirtinta adata. *M. Olli pieš.*

4 pav. 1–6 grupių apskritos segės. *M. Olli pieš.*

5 pav. 7, 8 grupių apskritos segės. *M. Olli pieš.*

6 pav. Sn-Zn-Pb lydinio proporcijų trijų komponentų diagrama. *M. A. Roxburgh brėž.*

7 pav. Apskritų segių paplitimas *tarand* kapinynų areale: 1 – Virunuka, 2 – Jaagupi, 3 – Sadrametsa, 4 – Hõbeda, 5 – Truuta, 6 – Tatra, 7 – Salenieki, 8 – Mūri, 9 – Vīksnas Kapusils, 10 – Leški, 11 – Ala-Pika, 12 – Gailiši, 13 – Kambja, 14 – Kardla, 15 – Kõnnu, 16 – Meeri, 17 – Paali, 18 – Slavēka, 19 – Unipiha, 20 – Jäbara, 21 – Kukruse, 22 – Laanemõisa, 23 – Lagedi, 24 – Pada, 25 – Ripuka, 26 – Toila, 27 – Tõrma, 28 – Türsamäe, 29 – Kõrenduse, 30 – Lahepera, 31 – Libriti, 32 – Mūsina, 33 – Jaunzemji, 34 – Aakre, 35 – Jauntēvēns, 36 – Kalvi, 37 – Kaugars II, 38 – Kärde, 39 – Pikkjärve, 40 – Siksälä, 41 – Ulvi, 42 – Vagula, 43 – Nurmsi, 44 – Künnapuu, 45 – Viljandi, 46 – Triigi, 47 – Erra, 48 – Tarbja, 49 – Kirbu, 50 – Velna Kravanda, 51 – Järve, 52 – Malla. *M. Olli brėž.*

Vertė J. Žukauskaitė

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