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## REGIONS AND COMMUNICATION IN SOUTH-EAST ESTONIA AND NORTH LATVIA IN THE 3RD AND 4TH CENTURIES BASED ON LOCAL ORNAMENTS

Local ornaments of the 3rd and 4th century AD in south-east Estonia and north Latvia are inherent to the region and mostly found from there. In this paper, intraregional interaction, the main routes of communication, and whether different sub-regions were present is studied on the basis of the distribution of local ornaments. Methods from network science are adopted to achieve this. Based on the results of chi-squared similarity metric and degree centrality measure, sub-regions where different types of local ornaments were preferred stand out. This preference could suggest the expressions of some regional ideas. Items in local style could have, more or less intentionally, marked the similarities within the region, setting it apart from other regions. Central areas could have been the ones with higher degree centrality values, whereas these areas could be interpreted to form the main axis of communication which maintained similarities between those sites. The main interaction routes were water ways which connected distant areas and maintained unity within sub-regions. Being situated near bigger water routes is what determined the importance of areas. This study shows the patterns of interaction between, and the formation and expression of, culturally uniform sub-groups based on local ornaments of the 3rd and 4th centuries found from south-east Estonian and north Latvian stone cemeteries.

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### Introduction

The 3rd and 4th centuries AD are the period in the Roman Iron Age<sup>1</sup> when local forms of some types of personal ornaments emerged in south-east Estonia and north Latvia based on the prototypes from the eastern shore of the Baltic Sea (Laul 2001, 183). Those items are commonly found from stone cemeteries called *tarand* cemeteries which were the main form of burials in Estonia and in north Latvia at the time, whereas some are also distributed on the coast of south-west

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<sup>1</sup> Roman Iron Age in Estonia is considered to be from AD 50 to 450 (Lang & Kriiska 2001) and in Latvia from AD 1 to 400 (Vasks 2001 in LSV, 187).

Finland (Moora 1938, 17) and in western Ingria (Yushkova 2011, fig. 102). Based on the similarity of the distributed items, mostly on local ornaments of the 3rd and 4th centuries, south-east Estonia and north Latvia seemed to have had close connections (Laul 1982 in EE, 245 f., plate XIV). Those regions have been chosen in this paper because they have been previously described as culturally relatively uniform (Laul 1982 in EE, 243; Laul 2001, 110, 215, 223). However, how these geographically distant areas communicated with each other to maintain that cultural uniformity has not been studied in detail.

The aim of this paper is to take a new look at local ornaments from the named regions using modern methods and approaches to study the intraregional communication patterns based on the distribution of local ornaments from cemeteries. What were the main communications routes that the flow of items could have gone through, and were there any central sites or areas within larger unities present with lively interaction and sharing a similar material culture? If so, on what basis could they have been formed and do they correspond to the groups outlined in previous research (Laul 1982 in EE, 245 f., plate XIV)? Items included in this study are south-Estonian and north-Latvian cross-ribbed brooches, disc brooches, late profiled brooches and pendants, most of which have previously been referred to as being local in the study area (Laul 2001, 95, 183). It has been proposed that some sub-types of those items were preferred in many areas in the study region (*ibid.*, 103, 110), however, the distribution of all items has not been studied together in depth. In this paper, these items, or personal ornaments, have been restudied and their typology and chronology revised. Items from 34 stone cemeteries from south-east Estonia and north Latvia have been included in the study (Fig. 1). The study area has been divided into four sub-regions – the northern part of south-east Estonia, the southern part of south-east Estonia, central Vidzeme (the central part of north Latvia) and north / central Latgale (north-east Latvia) (Laul 1982 in EE, 245 f., plate XIV).

The similarities between the cemeteries are explored using methods from network science. Network science in general has its roots in social psychology, sociology and anthropology (Brandes et al. 2013, 3). In recent years, the methods have also been widely used in archaeology in order to study and understand relationships between material culture and groups (see for further reading: Knappett 2013; Collar et al. 2015; Brughmans et al. 2016). In this paper, a chi-square similarity measure is used to study and visualise the similarities of grave furnishings. Degree centrality values are calculated to explore the characteristics of the network.

This study gives new insights into the relationships within south-east Estonia and the northern parts of east Latvia during the 3rd and 4th centuries based on the similarities of local ornaments. The main interaction routes between sites and central areas through which communication took place are distinguished. Areas of similar grave goods are also outlined which could reflect past communities with different degrees of frequency of social interaction that may refer to the presence of culturally uniform sub-regions.



Fig. 1. Study area and the cemeteries included in network analysis.

### Stone cemeteries

Most of the items from the studied time period have been found from stone cemeteries. There are approximately 180 stone cemeteries in the research area; since the end of the 19th century many of these have been excavated to a different extent (Laul 2001; Vasks 2006, 99). In Estonia, these cemeteries are called typical *tarand* cemeteries<sup>2</sup>, which are monumental stone burial places consisting of one or up to over ten stone enclosures (called *tarands*); these cemeteries are

<sup>2</sup> Speaking of the Roman Iron Age, there are also single *tarand* cemeteries but not distributed in the research area.

often located in groups (Lang 2007, 192). The deceased were buried cremated or uncremated, whereas the fragmented bones were scattered over the grave area where they have commingled with grave goods; intact burials are very rare (ibid., 203 ff.). Sometimes it has been recorded that bones and personal items are concentrated more in the centre of the stone enclosures (for example: Moora 1933, 2; Kivirüüt & Olli 2016) but no stratigraphic order is evident. Therefore it is difficult to create a relative chronology for locally produced items (Lang 2007, 206); it has been noted that items with earlier dating are in the enclosures that were built first and later artefacts in enclosures built later, but it is not always like that (Moora 1938, 6; Laul 2001, 66 ff.; Kivirüüt & Olli 2016).

There are typical *tarand* cemeteries in north Latvia (for example: Salenieki, Slavēka, Kaugars) but some stone graves do not have a classical *tarand* structure, being construction-less (incl. one in Salenieki) or having round stone enclosures (for example Velna Kravanda) (Moora 1938, 3 ff.). Fully preserved stone cemeteries are relatively rare mainly due to agricultural works or because the stones have been removed for using them somewhere else, whereby their shape and structure has been destroyed (ibid., 4). Stone cemeteries in north Latvia which do not have a typical *tarand* structure, could still be interpreted as being a part of the same burial cultural sphere as *tarand* cemeteries (Laul 2001, 195) because their distribution area is the same, inventory is similar and both have a commingled nature of items and bones. It could be suggested that the differences in structure could just be regional variations or that the stones which were enclosure walls were not recognized during the excavations and they had a *tarand* structure.

The research for this paper considers ornaments from those stone cemeteries that have been excavated or that have provided a significant amount of items. The scientific level of excavations has been very different. As stated above, many of the central Vidzeme's as well as few south-east Estonian cemeteries were excavated at the end of the 19th century (see Moora 1929; 1938; Laul 2001 for the list of excavation times) when excavation standards were different from the ones we have now. Therefore, we cannot be sure that all artefacts or even artefact groups were collected. Because of that we cannot assess whether there are artefacts that were not put into the grave during their usage time, or whether they were simply not collected during the excavations because they were not noticed. Another issue is that when there are many cemeteries in one group, not all were excavated. Also some cemeteries had been damaged to a different extent prior to the excavations. Therefore, it is most likely that we do not have the full picture of all the artefacts put into the cemeteries. Since the nature of archaeological record in general is incomplete, researches have to make conclusions based on the fragmented material, and that is why the networks identified as a result of this research should be interpreted with precaution and should be tested against future excavations and discoveries.

### Finds from the cemeteries

Usual finds from *tarand* cemeteries are pottery shards and personal ornaments, while bigger tools and weapons are rare (Lang 2007, 206). Personal ornaments in the study region are similar to those distributed in the south-eastern shore of the Baltic Sea (ibid.) and therefore this is the only group of finds that can be more precisely dated since one can rely on the dates of the items from the south-eastern shore of the Baltic Sea. The differences in dates should not exceed 50 years as the living adopt living fashions (Banytė-Rowell 2011, 85 f.). However, the fashion changes could be delayed when prestigious forms of fashion of an older generation from a distant land are adopted (ibid.). This should be kept in mind when dating local forms (or ‘imitations’) so as not to date the items too far away from the originals (ibid.). The dates of those local forms of ornaments under study are restudied by comparing these to similar items from the Baltic areas, especially from Lithuania, as it is the area influencing the material culture of the study area the most (Laul 2001, 183 f.; Banytė-Rowell & Bitner-Wróblewska 2005, 114 ff.; Olli & Roxburgh 2018). Also, comparing the use of some decorative or technological elements with the same from neighbouring areas can help to date local items.

Cross-ribbed brooches of the north-east Baltic group, disc brooches of groups one, two, four and five, late-profiled brooches and cross, rhombus and round pendants are included in the study because in previous research most of these are referred to as local ornaments (Laul 2001, 95, 141, 183 ff.). The local origin of the items has been suggested due to their focal distribution in the research area; some are found from other areas but not many (Vassar 1943, 69 f.; Laul 2001, 183 ff.). Therefore their distribution areas are relatively closed physical spaces with only slight influences from outside regions; thus, intraregional communication can be studied. The corrected chronology (see below) suggests that those items are contemporaneous. This is important because including items which cover long periods of time increases the risk including sites and items that were not used at the same time; therefore this can lead to a false interpretation of the network (Peeples et al. 2016, 67). Including foreign items would not allow the assemblage to show the real interactions within and between regions. Items under study were by no means only local items in the region. It is likely that many other ornaments such as bracelets, finger rings, copper alloy beads, etc. were also of local origin. The problem with these is that for example, possible local bracelets date from the 2nd to 5th centuries (Laul 2001, 147 ff.) which makes it difficult to associate these with other items used during a shorter time period. Similar finger rings and copper alloy beads were distributed in most of the areas where *tarand* cemeteries are and in other regions as well (for example in Lithuania) (Michelbertas 1986, 105); therefore it is difficult to say which ones are inherent to the research area.

Although personal ornaments have been found from cemeteries, much more than just assumptions about burial customs can be made based on these. Wearing local personal ornaments in life could have had many functions, for example: expressing social status, wealth, personal taste, fashion, they were aesthetically

pleasing. Although in case of a person's death, those items may have obtained other meanings (Ekengren 2013), most of the items were probably still the same ones used during the person's lifetime and therefore represent to some extent also the world of the living. It can be assumed that people lived in the vicinity to where they were buried and that the items they wore and owned during their lifetime are likely to have been the same they were buried with. It may be that not only the items of the dead were put into the graves, but also items belonging to the mourners as an act of gift exchange with the dead during the burial ritual or some other follow-up rituals (Olli & Kivirüüt 2017, 287). Therefore the local community can also be seen behind the burial rituals. Although we must keep in mind that *tarand* cemeteries could have been burial places for people of the higher social strata (ibid., 273 and the cited literature), meaning that we can study mostly the elite of the community. Still, this gives valuable insights into what kinds of items were associated with these communities, what types of ornaments were used in which areas and, based on the similarity of items, how connected different areas were.

### Items included in the study

Items of clear typological distinction are included in the study (see Appendix), atypical items and non-identifiable fragments are left aside. The typology for the network analysis is not very detailed because if a new type is brought in merely based on a small difference in style, it might completely change the outcome of the network analysis (Habiba et al. 2018, 67). Small deviations in style should not determine the typological groups, instead these refer to the skills and choices of the craftsman. Not all similarities may be of the same importance and therefore the researcher has to judge which markers are the most important in the dataset (Östborn & Gerding 2014, 83 f.). Types are included into network analysis when in total 10 or more specimens have been found in at least 4 cemeteries. Artefact types that are not included in the network analysis are included in the discussion part.

Cross-ribbed brooches (sometimes also referred to as ladder brooches, crossbar brooches or *Sprossenfibeln*) are the first series of Almgren group V and are very numerous in the whole eastern Baltic region, whereas various regional developments are present (Hauptmann 1998). These come to record in the phase B2/C1–C1a (ca AD 150–220) among the Balts in north-east Poland (Bitner-Wróblewska 2010, 157). In west Lithuania, their main period of use was the phase C1 (ca AD 150–260) (Banytė-Rowell 2001, 44). In the *tarand* cemetery area, the earliest are so-called early cross-ribbed brooches (*Wulstfibeln*) which are considered to be the prototype for the north-east Baltic group of cross-ribbed brooches and date to the second half of the 2nd century or to the beginning of the 3rd century (Moora 1938, 86 f.), corresponding to the phase B2/C1–C1a. The north-east Baltic group of cross-ribbed brooches is divided into two subgroups: A and B, the first includes two series – 1) north Estonian, 2) south Estonian and

north Latvian (Schmiedehelm 1923; Moora 1938, 86 ff.; Laul 2001, 103 ff.). The first series is scarce in the study area, only one item being found (Valk et al. 2018, fig. 8: 3). The latter series are considered local for the research area and are included in the network analysis. These are grouped into two variants – south Estonian or Latvian (Fig. 2: 1a–b, 2a–b) – the former having a so-called ‘neck’ between the head and the first rib, whereas for the latter, no neck is present (Laul 2001, 103). There are also brooches with knobs in the ends of the ribs and a three-pronged foot (Fig. 2: 3a), possibly an intermediate form to the brooches with triangular head and three-pronged foot (subgroup B). These are included to the brooches of subgroup B in the network analysis as they represent the same style, both called brooches with a three-pronged foot. Subgroup B brooches (Fig. 2: 3b) have a triangular head, narrow ribs, knobs in the end of the ribs and a three-pronged foot with knobs at the ends (Moora 1938, 91 f.; Laul 2001, 107). Two types of pin attachment constructions are used for cross-ribbed brooches – a) tubular (Fig. 2: 1a, 2a, 4a) and b) a rod around which a needle pivots (Fig. 2: 1b, 2b, 4b). The former is typologically earlier, dated to the 3rd and going into 4th centuries, whereas the latter type is dated to the 4th century (Moora 1938, 93). Some bigger cross-ribbed brooches have also been found together with 5th century items (Moora 1938, 93) but these are not numerous and not included in the study.

Disc brooches of groups one to six are represented in the study area (Olli & Roxburgh 2018). There are also many sub-groups present (Olli & Roxburgh 2018) but because these are distinguished only by small stylistic deviations, the main

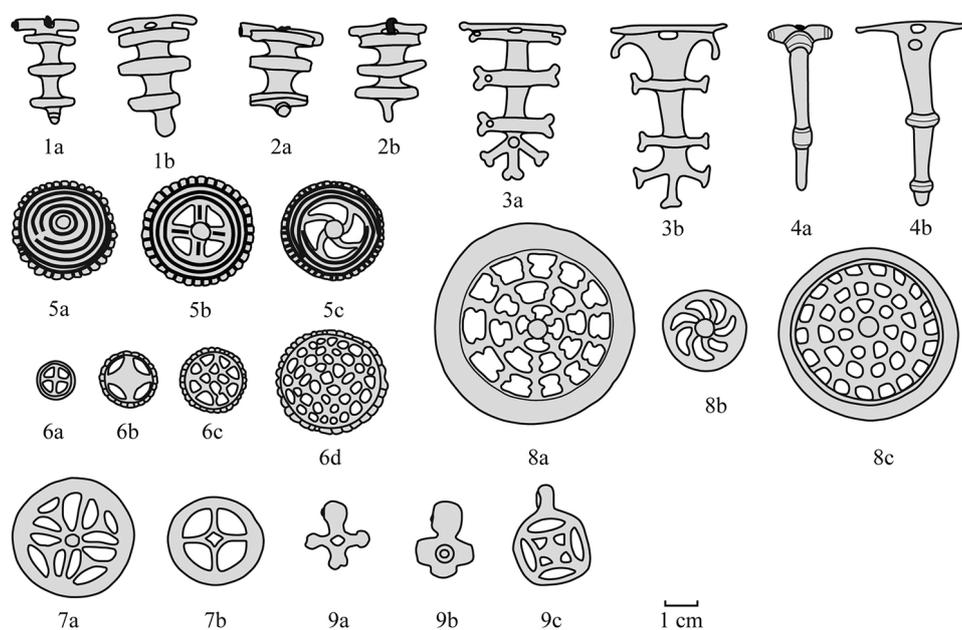


Fig. 2. Items included in the study (drawings of disc brooches 5–8 after Olli & Roxburgh 2018).

groups are included in this study. Disc brooches of groups one to five<sup>3</sup> (Fig. 2: 5a–8c) date to the 3rd, going into the 4th century AD. Previously all disc brooches found from south-east Estonia were dated to the 4th and 5th centuries (Laul 2001, 114), but because most other disc brooches from the other areas of *tarand* cemeteries (except enamelled ones) date to the 3rd and 4th centuries (Olli & Roxburgh 2018) and the pendants of the same openwork design and many group two brooches are now dated to the 3rd century (see below), a similar date could apply to all disc brooches. As the custom to make and wear disc brooches was also inherent to the 3rd century in Lithuania (phase C1b–C2) (Michelbertas 1986, 122), it is possible that the fashion was simultaneous over a larger area.

There are also brooches that are called late profiled brooches (Fig. 2: 4a–b); these are considered to be locally produced as there are no parallels to these in other regions. Most have a similar pin construction system as the second variant of cross-ribbed brooches and are dated to the 4th and 5th centuries, whereas the ones with a tubular pin construction (Fig. 2: 4a) system could be a little younger (Laul 2001, 95). However, as these share many stylistic and technological similarities to the second variant cross-ribbed brooches (*ibid.*), their date could start from the late 3rd century and end with the 4th century.

Different types of pendants have been found from the *tarand* cemeteries in the study region. These have been worn in necklaces or attached to copper alloy beads. Triangular, double spiral, lunula and round pendants are considered non-local and originating from southern Baltic areas (Laul 2001, 141). Cross, rhombus and round pendants with openwork rhombus in the middle are considered of local origin (Fig. 2: 9a–c) (*ibid.*). However, rhombus pendants are also known from the North Lithuanian Barrow Cemetery in Pakalniškiai where burials are dated to the end of the phase B2 (Sawicka & Grižas 2007). The local production of those pendants that are found from *tarand* cemeteries cannot be ruled out but it is likely that Baltic pendants were examples of the development of the local ones. It is seen on other artefacts that the concave sided rhombus rooted in the local style which was in accordance with the overall style of the wider eastern Baltic region. Lunula pendants date to the 3rd century, whereas at the beginning of the 4th century these became unpopular, disappearing in the middle of the 4th century; these pendants were much preferred among the Balts (Simniškytė 2002). Fairly popular were also triangular pendants, which are numerous among the Balts in Latvia and in Lithuania, where they date to the 3rd and 4th centuries (Moora 1938, 243 ff.). Some double spiral pendants are also present but these are more numerous in Lithuania where they date around the turn of the 4th century (Moora 1938, 256). Round openwork pendants with a cross and knobs which developed in west Lithuania are commonly found from the area between the rivers Nemunas and Daugava and date from the end of phases B2 and B2/C1 to the end of phase C1b (end of the 2nd to the first half of the 3rd century) (Bliujienė 2009, 250). Round pendants with an openwork rhombus are probably locally made as the openwork

<sup>3</sup> Group three disc brooch is not included in the network analysis because it is only a single specimen and inherent to north-east Estonia (Olli & Roxburgh 2018).

rhombus was a popular motif in south-east Estonia (see disc brooches of group 2) and can be dated to the 3rd century on the example of the Lithuanian items. Other types of pendants include small rhombus and cross shaped pendants, some are made in openwork technique, usually the pendants are attached to a copper alloy bead. It seems that in general, pendants were used during the 3rd century, few until the end of the first half of the 4th century in the study area.

### Similarity networks

The similarity/distance metric used to explore the similarities in cemetery item assemblages is chi-square distance, it is defined as:

$$x_{jk} = \sqrt{\sum \frac{1}{c_j} (x_j - y_j)^2},$$

$k$  = all categories;  $c_j$  =  $j$ <sup>th</sup> element of the average row profile;  $x_i$  and  $y_i$  =  $j$ <sup>th</sup> elements of the row profiles for two sites under comparison (see Peeples 2017).

This metric compares the categories (types of items) of each site (cemetery) and takes into account the abundance of items when defining distance between sites (more similarities shared, closer nodes are to each other on the graph), meaning that it stresses rare categories when defining distances between sites (Peeples 2017). The data is organized by the principle that cemeteries are nodes, connected by edges representing the number of different types of items that the cemeteries have in common. Chi-square metric is chosen because it is suitable for this data as it is difficult to compare the proportions of types of items from cemeteries since the level and amount of excavations is different. Therefore, we cannot really compare the proportions of categories as it would be in case of Brainerd-Robinson similarity metric, which is a widely used method for network analysis in archaeology (Habiba et al. 2018, 64). For chi-square distance metric, categories which are rare but common between sites get the change to stand out. The metric has a minimum value of 0 and no upper limit, however, it is rescaled between 0, perfect similarity, and 1, no similarity, whereas the value is the weight of the edges (ties) between the nodes (cemeteries) and the edges are undirected, which means that no direction of the flows of items between cemeteries is known (see Peeples et al. 2016, 62; Peeples 2017). The binary networks (ties as present or absent) are created from weighted data to visualize the results, a threshold similarity value of 0.68 is used (the tie is present when cemeteries share more than 68% commonality) based on the criteria that all nodes in different brooch type networks must have at least one tie so no isolated nodes would be present. Same threshold is used for the network where both types of brooches are included, although then one isolated node is present. Using threshold values decreases the presence of ties of very low similarity value and brings out the most prominent ties so that the network is more readable. Fruchterman-Reingold graph layout is used to visualize the networks, it is a force-directed model (Fruchterman & Reingold 1991). On the graph, nodes which share more edges are closer (ibid.).

Degree centrality is also calculated and it is the sum of weights for a node's ties to every other node; weighted values are used as it allows more nuanced interpretations of network characteristics (for exact calculations, see Peeples & Roberts 2013, 3002, 3005; Opsahl et al. 2010). If a node has high degree centrality, it has a high number of possibly direct connections with other similar nodes and thus may be the most important node in the area (Collar et al. 2015, 20).

The analyses and graphs are conducted in RStudio, largely based on the tutorial by Matthew Peeples (2017).

## Results

The network of cross-ribbed brooches (Fig. 3) is very good in showing the presence of different cliques (subset of at least three nodes where every pair of nodes is connected by a tie, see Collar et al. 2015, 19). One is formed by only

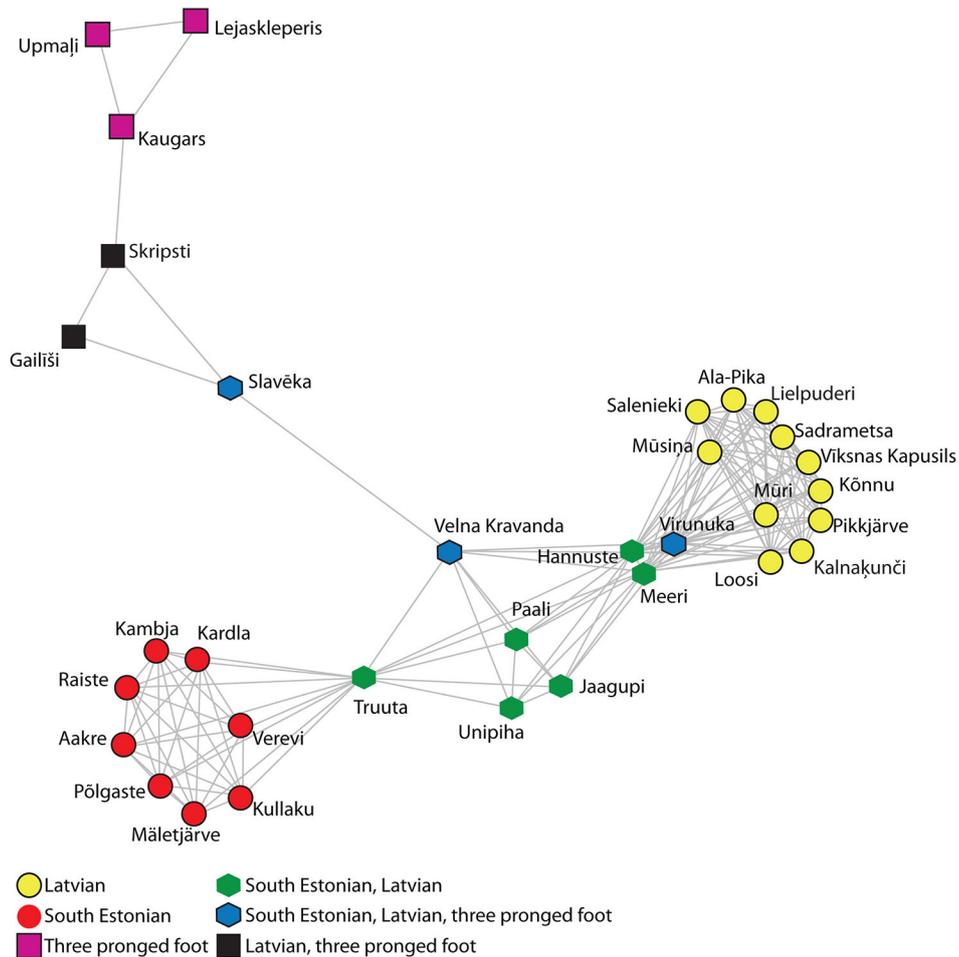


Fig. 3. Network of cross-ribbed brooches.

a south Estonian variant and these cemeteries are located in south-east Estonia, mostly in its northern part. The other is where a Latvian variant is distributed, mainly in the southern part of south-east Estonia, central Vidzeme and north / central Latgale in Latvia. There are also cemeteries where brooches of both types are present, and those cemeteries connect the two cliques. Brooches with a three-pronged foot seem to be isolated or more prevalent in sites where both Latvian and Estonian variants are distributed; although these brooches have mostly been found from cemeteries in Latvia. Those groups are also present based on degree centrality values (Table 1). The highest ones have cemeteries where Latvian and

**Table 1.** Degree centrality values of the three networks

Cemetery	All brooches	Cross-ribbed brooches	Disc brooches
Aakre	21.47	17.15	–
Ala-Pika	23.17	20.76	11.99
Gailīši	23.91	17.95	11.99
Hannuste	24.97	21.68	–
Jaagupi	24.91	20.6	11.9
Jaunzemji	7.87	–	6.08
Kalnaķunči	24.04	20.76	–
Kambja	21.56	17.15	11.99
Kardla	22.89	17.15	11.99
Kaugars	20.29	11.25	6.08
Kullaku	23.23	17.15	11.99
Kõnnu	24.54	20.76	11.99
Lejaskleperis	14.38	5.31	–
Leški	11.52	–	8.09
Libirtis	7.87	–	6.08
Lielpuderi	24.04	20.76	–
Loosi	24.04	20.76	–
Meeri	24.39	21.68	11.79
Mūri	21.09	20.76	10.1
Mūsiņa	19.27	20.76	–
Mäletjärve	21.47	17.15	–
Paali	23.68	21.29	11.99
Pikkjärve	24.04	20.76	–
Pölgaste	21.47	17.15	–
Raiste	21.47	17.15	–
Sadrametsa	23.1	20.76	8.09
Salenieki	24.52	20.77	8.09
Skripsti	22.02	16.31	–
Slavēka	24.34	18.92	9.68
Tatra	19.4	–	11.86
Truuta	23.51	20.24	10.96
Unipiha	24.87	21.29	11.99
Upmaļi	14.38	5.31	–
Velna	25.12	21.41	–
Kravanda	–	–	–
Verevi	21.47	17.15	–
Vīksnas	23.1	20.76	8.09
Kapusils	–	–	–
Virunuka	25.63	21.7	12.28

south-east Estonian brooches are present, in addition some also have brooches with a three-pronged foot. Cemeteries from which Latvian variant brooches have been found have slightly lower value, but are still relatively high. These are followed by south Estonian brooches. Cemeteries which only have three-pronged foot brooches have the lowest value.

The network of disc brooches (Fig. 4) is composed of groups one, two and five because these were found in sufficient numbers. The plotted graph shows some similar tendencies as for cross-ribbed brooches. Cemeteries where brooches of the second group are found form a clique are mostly distributed in the northern part of south-east Estonia. Disc brooches of the first group form another clique, cemeteries in the southern part of south-east Estonia, central Vidzeme and north / central Latgale in Latvia belong there, while Virunuka, Tatra and Truuta are the

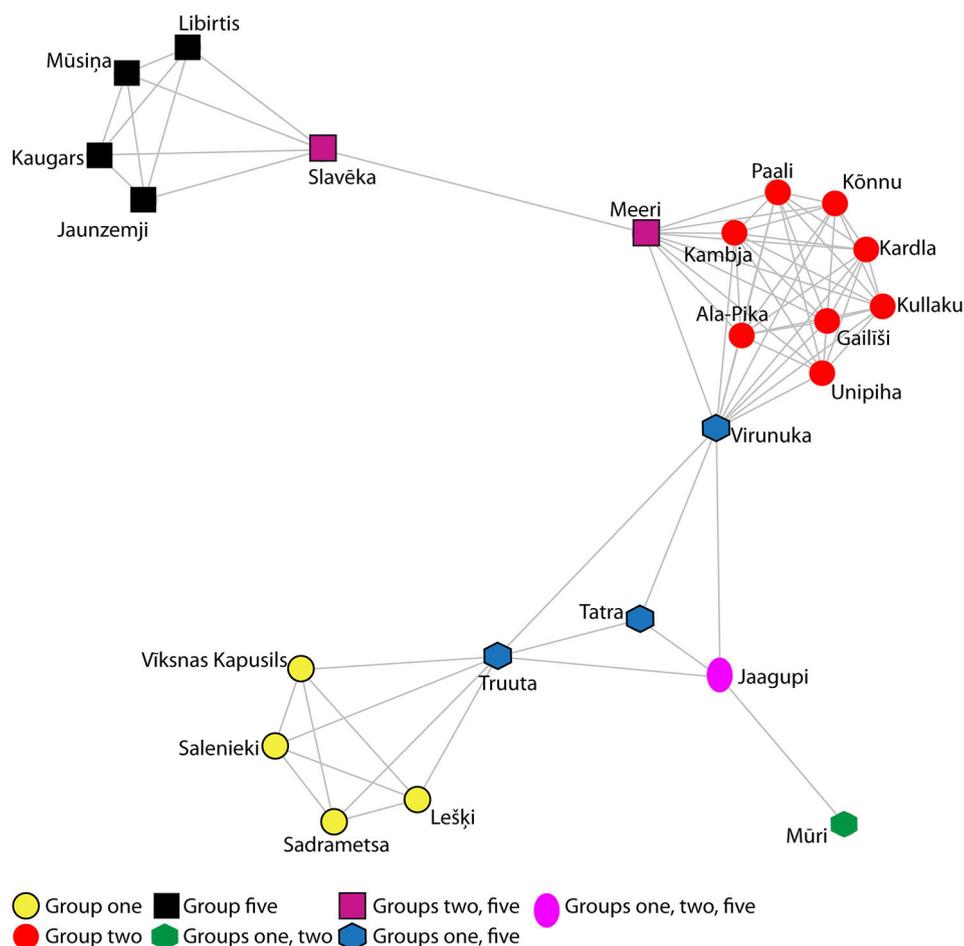


Fig. 4. Network of disc brooches.

cemeteries where both groups are present, and Jaagupi is the cemetery where all groups are present. The third clique is formed based on cemeteries in central Vidzeme and north / central Latgale in Latvia where disc brooches of group five are present. Mūri and Meeri are cemeteries where group five brooches are found together with a brooch of the first group for Mūri and brooches of the second group for Meeri. The degree centrality values (Table 1) are highest for cemeteries where group two brooches are in majority but also high for cemeteries where groups two with other groups have been found. This is followed by cemeteries where brooches of the first group have been found and last are Latvian cemeteries where brooches of group five have been found.

The network where cross-ribbed and disc brooches (Fig. 5) are studied together does not represent such clear groups as in previous networks. Distinctively similar are cemeteries where only south Estonian cross-ribbed brooches are found. Closest to these are most other south Estonian cemeteries. Tightly together in the centre of the graph are some Latvian and south-east Estonian southern part cemeteries. Many other Latvian cemeteries are connected to the central nodes by just one edge,

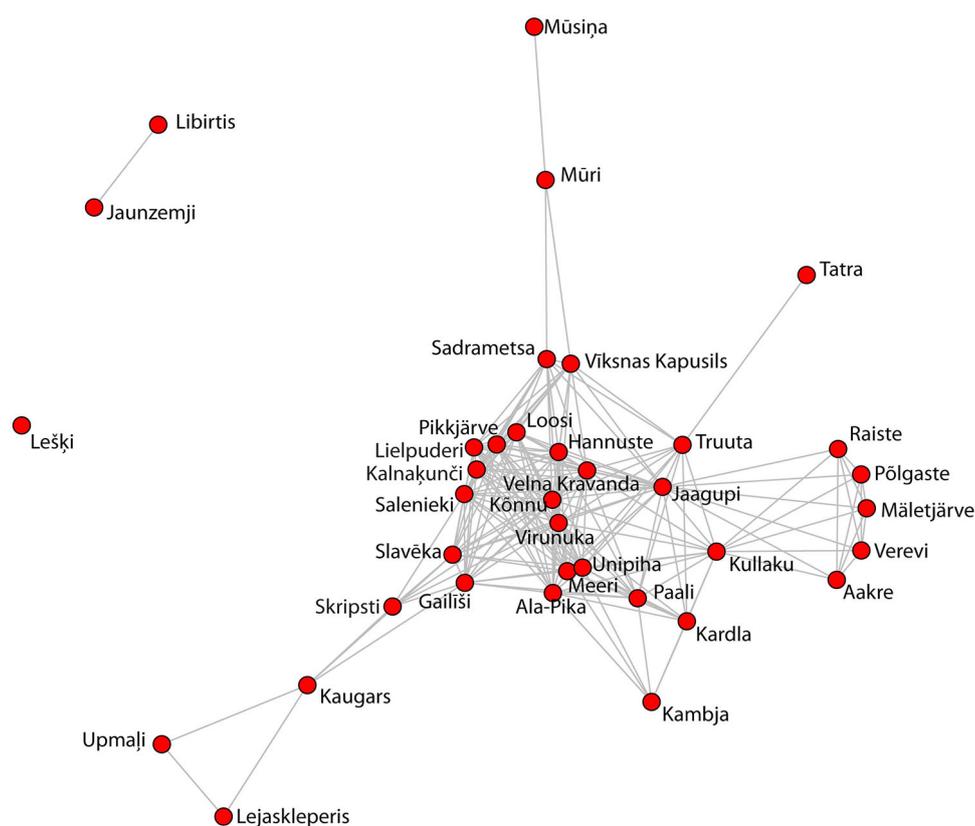


Fig. 5. Network of cross-ribbed and disc brooches.

whereas one group is formed by Kaugars, Lejaskleperis and Upmaļi. According to the degree centrality (Table 1), the cemeteries that are located in the central area of the graph have the highest values, and the value decreases for the cemeteries further away from the centre. The cemeteries with the highest degree value are located in all parts of the study region.

## Discussion

### *Similarities within the research area*

Similarity in this paper is considered to be the unity of some sites, whereas this unity could be based on cultural uniformity, frequent interaction, trade or overall cohesion. Similarity of local ornaments shows the similarity of these regions and we learn which areas communicated more frequently with each other. The plotted networks and degree centrality values show similar groups, but they were not isolated and for each type of brooches a little different, meaning that there was a lot of communication between the sites but some local preferences of items were present too.

Cross-ribbed brooches are the most numerous types of brooches in the study region (Laul 2001, 98). South Estonian and Latvian variants are in general quite small in size and not very masterfully crafted judging by their appearance. This could mean that these brooches were common and many could afford them. According to the network and degree values it seems that cemeteries where both variants were present had the key position in mediating south Estonian and Latvian variant brooches on a local scale. Those sites are located in concentrated areas of stone cemeteries and therefore communication with neighbouring areas would have been easier and more frequent. It is interesting that the Latvian variant occurs mostly in Latvia / south-east Estonia's southern part and the south Estonian variant in the northern cemeteries of south-east Estonia. The differences in the distribution could be connected to the areas which used to interact more and to main communication routes. This means that the main interaction route was between the cemeteries where both types were present. These are located on the axis which ran through the northern, central and southern areas of south-east Estonia, and central Vidzeme. Areas near that axis may have chosen brooches based on aesthetic preference or on some other reason. It is also possible that, for example, the south-Estonian variant was a local variation of the Latvian variant or *vice versa*. The brooches with a three-pronged foot are mainly connected to Latvia and the southern part of south-east Estonia. The association of these brooches with the named area could be explained through the overall abundance of cross-ribbed brooches there. It is possible that there was a demand for something more elaborate than just regular cross-ribbed brooches which meant that the craftsmen started to add knobs and pronged foot to the Latvian type brooches. This could have eventually evolved into a typologically younger second variant of cross-ribbed brooches.

In the distribution of disc brooches, many groups stand out: group inherent to central Vidzeme and north / central Latgale in Latvia (group five), to the northern part of south-east Estonia (group two), and to the southern part of south-east Estonia / central Vidzeme and north / central Latgale in Latvia (group one). The same goes for the disc brooches of group four which are found from only a few cemeteries in Estonia and Latvia. Disc brooches are fairly elaborate in terms of their aesthetics and craftsmanship (many are openwork, knobs are attached, many sub-groups exist based on their style), more so than most cross-ribbed brooches of the south Estonian and Latvian variant, especially compared to groups four and five of disc brooches. Based on their elaborate appearance and occurrence in smaller areas, it can be proposed that people with a special status in the society wore these brooches in order to stand out from the others. In general, wearing disc brooches could have been limited to people of the higher strata of the society in certain regions. Disc brooches of group two, which are numerous, could have been available to more people.

When the cross-ribbed and disc brooches are studied together, the differences are not so evident in their distribution and appearance. However, some tendencies are present based on the network and degree values. Central areas are the ones with higher degree values and those areas could be interpreted as the artery of close and frequent communication which created and maintained the similarity in those sites. This artery stretched from the northern part of the study area to central Vidzeme and to central Latgale, the latter area being very similar to the cemeteries in the southern part of south-east Estonia. Cemeteries that are on the periphery of the graph could not have played an active role in the communication within the research area, and concentrated more on the local scale of communication. Limited degree of excavation in some sites may also be a reason why these seem to be peripheral.

When including late profiled brooches and pendants into the discussion, it can be seen that these shared the same style with other local personal ornaments but are found in lesser numbers from fewer cemeteries. Late profiled brooches are thought to have evolved during the same time as cross-ribbed brooches (Laul 2001, 95), but were not so widely distributed, being present only in the cemeteries where the south Estonian variant or both variants were present. Perhaps these did not become as popular as cross-ribbed brooches and therefore the number and distribution was relatively low. These brooches could have been typologically simultaneous with the cross-ribbed brooches of the second variant, but not as elaborate in style and this could also have played a role in their small number and scarcer distribution. Local pendants are mostly found from cemeteries in the southern part of south-east Estonia and in Latvia. Wearing local pendants in necklaces alongside with brooches of similar style shows a cohesive local style.

Based on some types of brooches, the northern part of south-east Estonia is fairly cohesive, as are also the southern area of south-east Estonia / some cemeteries in central Vidzeme and north / central Latgale in Latvia, and some other cemeteries

in central Vidzeme. What could have been the basis for the uniformity of those areas? One answer could be the physical closeness for the northern part of south-east Estonia and also for central Vidzeme, as geographically closer areas have more opportunity to interact with each other than distant areas do. Physical closeness could be the basis for the cohesion in those areas. It is thought that among the Balts an important role of the unity of the *locus* was sharing the same territory (Bitner-Wróblewska & Rzeszotarska-Nowakiewicz 2018, 259). However, it does not apply to the southern part of south-east Estonia, central Vidzeme and north / central Latgale in Latvia, as many cemeteries are geographically far away from each other, even if networks show close communication. From those cemeteries Salenieki and Lielpuderi stand out as physically distant from both south-east Estonia and central Vidzeme. Nevertheless, they have high degree centrality values being central sites in that region. Therefore, communication had to be frequent with other similar areas. They are located on the edge of the distribution area of *tarand* cemeteries and perhaps people living in that area had to emphasize their belonging to the realm of people who buried into those cemeteries by wearing and depositing similar personal ornaments into the cemetery as well as being in frequent contact with other people in that realm. There are also some other cemeteries which are similar not to physically close areas but to distant areas, for example Kõnnu is similar to cemeteries in the southern area of south-east Estonia / central Vidzeme and north / central Latgale in Latvia which also shows far reaching contacts and influences.

When those areas are compared to the ones distinguished by Laul, some of these overlap but differentiating nuances can be outlined on the basis of local ornaments. The northern part of south-east Estonia and central Vidzeme in some cases stand out and those regions are also distinguished by Laul (1982 in EE, 245 f., plate XIV). Laul has distinguished the southern part of south-east Estonia as a separate group but this does not correlate to the results of this paper. Based on all types of items included in the study, the previously mentioned region can be included to the group of south-east Estonia / central Vidzeme and north / central Latgale. Also, Latgale does not stand out on its own as it belongs to the previously mentioned realm. Although there are some differences in the distribution of local ornaments, the whole study area is still fairly uniform in terms of type of cemeteries, burial customs, general nature of ornaments and grave goods.

In the Roman Iron Age, similar personal ornaments were worn over large areas and when these first reached the study area, local craftsmen acquired necessary skills to create similar ornaments based on those which meant the most in the local cultural realm. Those ornaments were still visually connected to their prototypes but a local touch was given to these. Therefore, the new ornaments carried some local meaning. Considering distribution and seeing where clear preferences of different types of local personal ornaments are visible, the meaning of the ornaments could be connected to some regional ideas. Local ornaments were used because these were more readily available and also met the demand of the local

market. In general, having a disparate style could have been an attempt of being “different” from other groups (Swift 2000, 11). Whether this really was the original idea behind the creation of those local ornaments cannot be proven, but these ornaments probably acquired such disparity. This leads me to believe that the items in local style were available for many and became there through the marker of stylistic uniformity in the region.

### *Communication routes*

Many concentration areas of the cemeteries under study are situated in the vicinity of rivers (Fig. 1). Therefore, it is very likely that water routes were the main ways of transportation and communication between those areas. This is not very surprising as there is a good system of rivers in the study region. Rivers are also good landmarks for orientation. The use of land routes is probable while travelling from one bigger river to another and moving within smaller areas. Based on networks and degree centralities, frequent communication was present on a local scale and between more distant areas. Comparing similarity networks on a geographical map can give some insights into how communication took place during the 3rd and 4th centuries.

The importance of the Gauja River has been previously underlined. It worked as a mediator between the people in south-east Estonia / north Latvia and the southern areas (Laul 2001, 183). However, in addition to the long distance connections, it also played an important role in intraregional communication, contributing to the interaction between central Vidzeme and the southern area of south-east Estonia. A possible communication route could have been from Vidzeme along the Gauja River to the north, and from there onwards to the Mustjõgi River which leads to the vicinity of Virunuka cemeteries. The latter is a possible central area in the region due to its high degree centrality values. While on the map central Latgale seems to be geographically isolated, network graphs show that it has many similarities with Vidzeme and the southern part of south-east Estonia. Communication with the latter could have taken place along the Pededze River, whereas the area of Vidzeme could have been reached by smaller waterways or by land.

Communication with the northern areas of the study region could have been from the southern part of south-east Estonia along the Võhandu River and further along the Elva River. Also, the Ahja River could have been used to reach the Kõnnu and Mäletjärve areas. Another possibility to reach the northern areas from Latvia is not to turn to the Mustjõgi River from the Gauja River but to go further north where one would have to travel by land to get to the Väike-Emajõgi River, and by turning to the Purtsi River which leads to the Aakre cemetery. By going north along Lake Võrtsjärv and then to the Emajõgi River, the northern part of the study area is well accessible by smaller rivers. Communication within the northern areas of south-east Estonia could have been taken place mainly by land as the distances

are not so great and smaller water ways that were not big enough for water travel could have been used for orientation. Some areas were also reachable by bigger rivers (Elva, Emajõgi, and Ahja).

It has been suggested that in south-east Estonia, the communication between different power centres during the Roman Iron Age took place via waterways, whereas local communication occurred by land (Veldi 2006, 92). An advantage for exercising power was to have a bigger waterway in the vicinity which helped to keep contact with distant areas, whereas the network of land routes for the interaction with close neighbours was just as important (*ibid.*, 92 ff.). This becomes also visible in the results of this paper. This is true especially in case of cemeteries with high degree values (for example: Virunuka, Jaagupi, Unipiha, and Velna Kravanda; see Table 1) that are situated near those rivers which probably were the bigger communication routes. Therefore, it seems that access to many important communication routes was essential for being an important centre in the region. Those centres were situated near logistically favourable places where it was convenient for people from faraway areas to travel to. This means that contact between two geographically distant areas could have taken place in these locations. Although it appears so on the network graph that those areas have ties, in reality, the connection may have not been direct as the exchange could have taken place, for example, in the Virunuka area. This could have been the case for cemeteries where items not inherent to their region have been found, for example Gailiši, located in Vidzeme, where one disc brooch of group two (inherent to cemeteries in Estonia) has been found. It could have reached to the place through communication which took place in some central area like somewhere in the vicinity of the Virunuka cemeteries. This, of course, does not rule out other possibilities such as movement of people or something else.

### Conclusions

Based on the distribution of local ornaments of the 3rd and 4th centuries, south-east Estonia and north Latvia have been considered to have been culturally uniform during the Roman Iron Age. In this paper, the named artefacts have been restudied using methods and approaches from network science. The aim of the study was to determine the main communication routes and central sites or areas within larger unities that interacted lively and shared a similar material culture. Also, the typology and chronology of the items was revised.

Based on the results of the chi-square distance metric and degree centrality, different regions stand out based on different types of local ornaments. Cross-ribbed brooches of the Latvian variant occur mostly in Latvia / the southern part of south-east Estonia, whereas the south-Estonian variant occurs in the northern part of south-east Estonia. There are also cemeteries where both variants were present and these areas could have had the key position in mediating those brooches, forming the main interaction route which ran through northern, central,

southern areas of south-east Estonia and central Vidzeme. Brooches with a three-pronged foot are mainly connected to Latvian areas and the southern part of south-east Estonia. These could have come to use due to a demand for something more elaborate than just cross-ribbed brooches but the brooches are still in the same local style. Among disc brooches many groups stand out: central Vidzeme and north / central Latgale in Latvia (group five), the northern part of south-east Estonia (group two), and the southern part of south-east Estonia / central Vidzeme and north / central Latgale in Latvia (group one). When cross-ribbed brooches could have been available on a larger scale, disc brooches, based on their number, visual appearance and craftsmanship, could have been limited to people of the higher strata of the society in the regions (excl. group two which is found in larger numbers). Based on the centrality values of sites with both types of brooches, the artery of communication could have been formed in areas with higher degree values. This artery stretched from the northern part of the study area to central Vidzeme and to central Latgale. Sites that are not on that artery may have not played a very active role in the interaction as long as local brooches were concerned. Late profiled brooches and local pendants shared the same style with other local personal ornaments but were not as common as other local ornaments. Wearing those ornaments alongside other local ornaments shows a cohesive local style by which people differed from those living in other areas. Therefore, it is possible that those items were the marker of similarity and unity in a region.

The studied sites are mainly located in the vicinity of rivers and it can be assumed that water routes were the main ways of transportation and communication. Water routes helped to connect geographically distant areas and due to frequent connection those areas maintained similar material culture and unity. Interaction between physically closer areas could also have taken place by land. Based on the networks and degree centralities, central areas had access to many water routes and were therefore situated in logistically favourable places where it was convenient for people from different areas to travel to.

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## APPENDIX

## List of items included in the paper

Archival No.	Site	Country	Item	Type	Subtype
TÜ 2410: 568	Aakre	Estonia	brooch	cross-ribbed	south Estonian
TÜ 320: 176	Ala-Pika	Estonia	brooch	cross-ribbed	Latvian
TÜ 320: 177	Ala-Pika	Estonia	brooch	disc	group 2
A 9966: 29	Gailiši	Latvia	brooch	cross-ribbed	Latvian
A 9966: 72	Gailiši	Latvia	brooch	disc	group 2
A 9966: 21	Gailiši	Latvia	brooch	cross-ribbed	Latvian
A 9966: 84	Gailiši	Latvia	brooch	cross-ribbed	Latvian
A 9966: 5	Gailiši	Latvia	pendant	cross	
A 9966: 5	Gailiši	Latvia	pendant	cross	
A 9966: 5	Gailiši	Latvia	pendant	cross	
A 9966: 5	Gailiši	Latvia	pendant	cross	
A 9966: 11	Gailiši	Latvia	brooch	cross-ribbed	three-pronged foot
A 9966: 25	Gailiši	Latvia	brooch	cross-ribbed	three-pronged foot
AI 2767: 2	Hannuste	Estonia	brooch	cross-ribbed	Latvian
AI 2767: 3	Hannuste	Estonia	brooch	cross-ribbed	Latvian
AI 2767: 1	Hannuste	Estonia	brooch	cross-ribbed	south Estonian
AI 1702: 14	Jaagupi	Estonia	brooch	cross-ribbed	Latvian
AI 3236: 581	Jaagupi	Estonia	brooch	cross-ribbed	Latvian
AI 3236: 589	Jaagupi	Estonia	brooch	cross-ribbed	Latvian
AI 3236: 756	Jaagupi	Estonia	brooch	cross-ribbed	Latvian
AI 3236: 215	Jaagupi	Estonia	brooch	disc	group 1
AI 3236: 291	Jaagupi	Estonia	brooch	disc	group 1
AI 1702: 2	Jaagupi	Estonia	brooch	disc	group 2
AI 1702: 33	Jaagupi	Estonia	brooch	disc	group 4
AI 1702: 35	Jaagupi	Estonia	brooch	disc	group 4
AI 1702: 35	Jaagupi	Estonia	brooch	disc	group 4
AI 3236: 250	Jaagupi	Estonia	brooch	disc	group 4
AI 3236: 75	Jaagupi	Estonia	brooch	disc	group 4
AI 3236: 275	Jaagupi	Estonia	brooch	disc	group 5
AI 3781: 1	Jaagupi	Estonia	brooch	cross-ribbed	Latvian
AI 3236: 329	Jaagupi	Estonia	brooch	cross-ribbed	Latvian
AI 3236: 456	Jaagupi	Estonia	brooch	cross-ribbed	Latvian
AI 3236: 626	Jaagupi	Estonia	brooch	cross-ribbed	Latvian
AI 3236: 280	Jaagupi	Estonia	brooch	late profiled	
AI 3236: 747	Jaagupi	Estonia	brooch	late profiled	
AI 3236: 615	Jaagupi	Estonia	brooch	cross-ribbed	south Estonian
AI 1702: 31	Jaagupi	Estonia	brooch	cross-ribbed	south Estonian
AI 1702: 4	Jaagupi	Estonia	brooch	cross-ribbed	south Estonian
AI 1702: 5	Jaagupi	Estonia	brooch	cross-ribbed	south Estonian
AI 3236: 233	Jaagupi	Estonia	brooch	cross-ribbed	south Estonian
AI 3236: 241	Jaagupi	Estonia	brooch	cross-ribbed	south Estonian
AI 3236: 279	Jaagupi	Estonia	brooch	cross-ribbed	south Estonian
AI 3236: 290	Jaagupi	Estonia	brooch	cross-ribbed	south Estonian
AI 3236: 545	Jaagupi	Estonia	brooch	cross-ribbed	south Estonian
AI 3236: 649	Jaagupi	Estonia	brooch	cross-ribbed	south Estonian

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APPENDIX. *Continued*

Archival No.	Site	Country	Item	Type	Subtype
AI 3236: 714	Jaagupi	Estonia	brooch	cross-ribbed	south Estonian
AI 3236: 730	Jaagupi	Estonia	brooch	cross-ribbed	south Estonian
AI 3236: 758	Jaagupi	Estonia	brooch	cross-ribbed	south Estonian
RDM I 102	Jaunzemji	Latvia	brooch	disc	group 4
RDM I 103	Jaunzemji	Latvia	brooch	disc	group 5
?	Kalnaķunči	Latvia	brooch	cross-ribbed	Latvian
AI 1996: 159	Kambja	Estonia	brooch	disc	group 2
AI 1996: 166	Kambja	Estonia	brooch	disc	group 2
AI 1996: 45	Kambja	Estonia	brooch	disc	group 2
AI 1996: 103	Kambja	Estonia	brooch	disc	group 2
AI 1996: 107	Kambja	Estonia	brooch	cross-ribbed	south Estonian
AI 1996: 161	Kambja	Estonia	brooch	cross-ribbed	south Estonian
AI 2415c: 4	Kardla	Estonia	brooch	disc	group 2
AI 2415c: 3	Kardla	Estonia	brooch	cross-ribbed	south Estonian
AI 1236: 21	Kaugars	Latvia	brooch	cross-ribbed	Latvian
AI 1236: 20	Kaugars	Latvia	brooch	disc	group 5
AI 1236: 46	Kaugars	Latvia	brooch	cross-ribbed	three-pronged foot
1789	Kaugars	Latvia	brooch	cross-ribbed	three-pronged foot
AI 1237: 2	Kaugars	Latvia	brooch	cross-ribbed	three-pronged foot
AI 1995: 43	Kullaku	Estonia	brooch	disc	group 2
AI 1995: 62	Kullaku	Estonia	brooch	disc	group 2
AI 1995: 77	Kullaku	Estonia	brooch	disc	group 2
AI 1995: 37	Kullaku	Estonia	pendant	rhombus	openwork
AI 1995: 27	Kullaku	Estonia	brooch	late profiled	
AI 1995: 55	Kullaku	Estonia	pendant	cross	
AI 1995: 54	Kullaku	Estonia	pendant	cross	
AI 1995: 54	Kullaku	Estonia	pendant	cross	
AI 1995: 1	Kullaku	Estonia	brooch	cross-ribbed	south Estonian
AI 1995: 26	Kullaku	Estonia	brooch	cross-ribbed	south Estonian
AI 1995: 11	Kullaku	Estonia	brooch	cross-ribbed	south Estonian
AI 1995: 56	Kullaku	Estonia	brooch	cross-ribbed	south Estonian
AI 1995: 69	Kullaku	Estonia	brooch	cross-ribbed	south Estonian
AI 4447: 3	Kõnnu	Estonia	brooch	cross-ribbed	Latvian
AI 4447: 4	Kõnnu	Estonia	brooch	cross-ribbed	Latvian
AI 4447: 7	Kõnnu	Estonia	brooch	cross-ribbed	Latvian
AI 4447: 17	Kõnnu	Estonia	brooch	cross-ribbed	Latvian
AI 4447: 6	Kõnnu	Estonia	brooch	cross-ribbed	Latvian
AI 4447: 1	Kõnnu	Estonia	brooch	disc	group 2
AI 1238:1	Lejaskleperis	Latvia	brooch	cross-ribbed	three-pronged foot
?	Lešķi	Latvia	brooch	disc	group 1
RDM I 2713	Libirtis	Latvia	brooch	disc	group 5
RDM I 2745	Libirtis	Latvia	brooch	disc	group 5
A 10823: 26	Lielpuderi	Latvia	brooch	cross-ribbed	Latvian
A 10823: 29	Lielpuderi	Latvia	brooch	cross-ribbed	Latvian
A 10904: 23	Lielpuderi	Latvia	brooch	cross-ribbed	Latvian
A 10904: 29	Lielpuderi	Latvia	brooch	cross-ribbed	Latvian
AI 4375: 80	Loosi	Estonia	brooch	cross-ribbed	Latvian
AI 4375: 81	Loosi	Estonia	brooch	cross-ribbed	Latvian

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APPENDIX. *Continued*

Archival No.	Site	Country	Item	Type	Subtype
AI 4375: 97	Loosi	Estonia	brooch	cross-ribbed	Latvian
AI 4375: 103	Loosi	Estonia	brooch	cross-ribbed	Latvian
AI 4375: 98	Loosi	Estonia	pendant	rhombus	
TÜ 2668: 4	Meeri	Estonia	brooch	cross-ribbed	Latvian
TÜ 2668: 5	Meeri	Estonia	brooch	cross-ribbed	Latvian
TÜ 2668: 8	Meeri	Estonia	brooch	disc	group 2
TÜ 2668: 9	Meeri	Estonia	brooch	disc	group 2
TÜ 2668: 10	Meeri	Estonia	brooch	disc	group 5
TÜ 2668: 6	Meeri	Estonia	brooch	cross-ribbed	south Estonian
V 7991: 3	Mūri	Latvia	brooch	cross-ribbed	Latvian
V 7991: 23	Mūri	Latvia	brooch	disc	group 1
A 7991: 53	Mūri	Latvia	brooch	disc	group 5
AI 1252: 2	Mūsiņa	Latvia	brooch	cross-ribbed	Latvian
AI 1252: 12	Mūsiņa	Latvia	brooch	disc	group 5
AI 3977: 16	Mäletjärve	Estonia	brooch	cross-ribbed	south Estonian
AI 3235: 76	Paali	Estonia	brooch	cross-ribbed	Latvian
AI 3235: 202	Paali	Estonia	brooch	disc	group 2
AI 3235: 203	Paali	Estonia	brooch	disc	group 2
AI 3235: 71	Paali	Estonia	brooch	cross-ribbed	south Estonian
?	Pikkjärve	Estonia	brooch	cross-ribbed	Latvian
A 17: 33	Põlgaste	Estonia	brooch	cross-ribbed	south Estonian
AI 2254: 2	Raiste	Estonia	brooch	cross-ribbed	south Estonian
A 17: 3	Sadrametsa	Estonia	brooch	cross-ribbed	Latvian
A 17: 89	Sadrametsa	Estonia	brooch	cross-ribbed	Latvian
AI 2525: 3	Sadrametsa	Estonia	brooch	cross-ribbed	Latvian
AI 2525: 2	Sadrametsa	Estonia	brooch	cross-ribbed	Latvian
A 17: 92	Sadrametsa	Estonia	brooch	disc	group 1
AI 4252: 27	Sadrametsa	Estonia	brooch	disc	group 1
AI 2525: 1	Sadrametsa	Estonia	brooch	late profiled	
A 10862: 19	Salenieki	Latvia	brooch	cross-ribbed	Latvian
A 10862: 31	Salenieki	Latvia	brooch	cross-ribbed	Latvian
A 10864: 66	Salenieki	Latvia	brooch	cross-ribbed	Latvian
A 10864: 72	Salenieki	Latvia	brooch	cross-ribbed	Latvian
A 10873: 17	Salenieki	Latvia	brooch	cross-ribbed	Latvian
A 10875: 80	Salenieki	Latvia	brooch	cross-ribbed	Latvian
A 10876: 18	Salenieki	Latvia	brooch	cross-ribbed	Latvian
A 10862: 26	Salenieki	Latvia	brooch	cross-ribbed	Latvian
A 10865: 44	Salenieki	Latvia	brooch	cross-ribbed	Latvian
A 10872: 13	Salenieki	Latvia	brooch	cross-ribbed	Latvian
A 10873: 56	Salenieki	Latvia	brooch	cross-ribbed	Latvian
A 10873: 70	Salenieki	Latvia	brooch	cross-ribbed	Latvian
A 10873: 81	Salenieki	Latvia	brooch	cross-ribbed	Latvian
A 10874: 22	Salenieki	Latvia	brooch	cross-ribbed	Latvian
A 10875: 42	Salenieki	Latvia	brooch	cross-ribbed	Latvian
A 10876: 38	Salenieki	Latvia	brooch	cross-ribbed	Latvian
A 10873: 73	Salenieki	Latvia	brooch	cross-ribbed	Latvian
A 10876: 20	Salenieki	Latvia	brooch	disc	group 1
A 10875: 86	Salenieki	Latvia	pendant	rhombus	

*Continued on the next page*

APPENDIX. *Continued*

Archival No.	Site	Country	Item	Type	Subtype
?	Skripsti	Latvia	brooch	cross-ribbed	Latvian
?	Skripsti	Latvia	brooch	cross-ribbed	three-pronged foot
AI 1195: 135	Slavēka	Latvia	brooch	cross-ribbed	Latvian
AI 1195: 111	Slavēka	Latvia	brooch	cross-ribbed	Latvian
AI 1195: 134	Slavēka	Latvia	brooch	cross-ribbed	Latvian
AI 1195: 56	Slavēka	Latvia	brooch	cross-ribbed	Latvian
AI 1195: 63	Slavēka	Latvia	brooch	cross-ribbed	Latvian
AI 1195: 64	Slavēka	Latvia	brooch	cross-ribbed	Latvian
AI 1195: 133	Slavēka	Latvia	brooch	cross-ribbed	Latvian
AI 1195: 65	Slavēka	Latvia	brooch	disc	group 2
AI 1195: 107	Slavēka	Latvia	brooch	disc	group 5
AI 1195: 124	Slavēka	Latvia	brooch	disc	group 5
AI 1195: 50	Slavēka	Latvia	pendant	round	openwork rhombus
AI 1195: 50	Slavēka	Latvia	pendant	round	openwork rhombus
AI 1195: 23	Slavēka	Latvia	brooch	cross-ribbed	south Estonian
AI 1195: 132	Slavēka	Latvia	brooch	cross-ribbed	three-pronged foot
AI 1195: 18	Slavēka	Latvia	brooch	cross-ribbed	three-pronged foot
AI 1195: 4	Slavēka	Latvia	brooch	cross-ribbed	three-pronged foot
AI 2339: 8	Tatra	Estonia	brooch	disc	group 1
AI 2339: 11	Tatra	Estonia	brooch	disc	group 2
AI 1993: 3	Truuta	Estonia	brooch	cross-ribbed	Latvian
AI 1993: 21	Truuta	Estonia	brooch	disc	group 1
AI 1993: 22	Truuta	Estonia	brooch	disc	group 1
AI 1993: 17	Truuta	Estonia	brooch	disc	group 2
AI 1993: 20	Truuta	Estonia	pendant	round	openwork rhombus
AI 1993: 20	Truuta	Estonia	pendant	round	openwork rhombus
AI 1993: 20	Truuta	Estonia	pendant	round	openwork rhombus
AI 1993: 20	Truuta	Estonia	pendant	round	openwork rhombus
AI 1993: 20	Truuta	Estonia	pendant	round	openwork rhombus
AI 1993: 20	Truuta	Estonia	pendant	round	openwork rhombus
AI 1993: 20	Truuta	Estonia	pendant	round	openwork rhombus
AI 1993: 20	Truuta	Estonia	pendant	round	openwork rhombus
AI 1993: 20	Truuta	Estonia	pendant	round	openwork rhombus
AI 1993: 2	Truuta	Estonia	brooch	cross-ribbed	south Estonian
AI 1993: 4	Truuta	Estonia	brooch	cross-ribbed	south Estonian
AI 1198: 1	Unipiha	Estonia	brooch	cross-ribbed	Latvian
AI 2901: 2	Unipiha	Estonia	brooch	disc	group 2
AI 1198: 13	Unipiha	Estonia	brooch	cross-ribbed	south Estonian
No.	Upmali	Latvia	brooch	cross-ribbed	three-pronged foot
AI 1194: 25	Velna Kravanda	Latvia	brooch	cross-ribbed	Latvian
AI 1194: 26	Velna Kravanda	Latvia	brooch	cross-ribbed	Latvian
AI 1194: 27	Velna Kravanda	Latvia	brooch	cross-ribbed	Latvian
AI 1194: 38	Velna Kravanda	Estonia	brooch	disc	group 4
AI 1194: 29	Velna Kravanda	Latvia	brooch	cross-ribbed	south Estonian
AI 1194: 28	Velna Kravanda	Latvia	brooch	cross-ribbed	south Estonian
AI 1194: 23	Velna Kravanda	Latvia	brooch	cross-ribbed	three-pronged foot
AI 2817: 182	Verevi	Estonia	brooch	cross-ribbed	south Estonian

*Continued on the next page*

APPENDIX. *Continued*

Archival No.	Site	Country	Item	Type	Subtype
AI 1239: 1	Viksnas Kapusils	Latvia	brooch	cross-ribbed	Latvian
AI 1239: 2	Viksnas Kapusils	Latvia	brooch	cross-ribbed	Latvian
AI 1239: 4	Viksnas Kapusils	Latvia	brooch	disc	group 1
AI 4161: 280	Virunuka	Estonia	brooch	cross-ribbed	Latvian
AI 4161: 369	Virunuka	Estonia	brooch	cross-ribbed	Latvian
AI 4161: 466	Virunuka	Estonia	brooch	cross-ribbed	Latvian
AI 4161: 469	Virunuka	Estonia	brooch	cross-ribbed	Latvian
AI 4161: 473	Virunuka	Estonia	brooch	cross-ribbed	Latvian
AI 4161: 509	Virunuka	Estonia	brooch	cross-ribbed	Latvian
AI 4161: 576	Virunuka	Estonia	brooch	cross-ribbed	Latvian
AI 4161: 587	Virunuka	Estonia	brooch	cross-ribbed	Latvian
AI 4161: 589	Virunuka	Estonia	brooch	cross-ribbed	Latvian
AI 4161: 601	Virunuka	Estonia	brooch	cross-ribbed	Latvian
AI 4161: 646	Virunuka	Estonia	brooch	cross-ribbed	Latvian
AI 4161: 666	Virunuka	Estonia	brooch	cross-ribbed	Latvian
AI 4262: 1005	Virunuka	Estonia	brooch	cross-ribbed	Latvian
AI 4262: 143	Virunuka	Estonia	brooch	cross-ribbed	Latvian
AI 4262: 147	Virunuka	Estonia	brooch	cross-ribbed	Latvian
AI 4262: 157	Virunuka	Estonia	brooch	cross-ribbed	Latvian
AI 4262: 229	Virunuka	Estonia	brooch	cross-ribbed	Latvian
AI 4262: 368	Virunuka	Estonia	brooch	cross-ribbed	Latvian
AI 4262: 40	Virunuka	Estonia	brooch	cross-ribbed	Latvian
AI 4262: 418	Virunuka	Estonia	brooch	cross-ribbed	Latvian
AI 4262: 470	Virunuka	Estonia	brooch	cross-ribbed	Latvian
AI 4262: 716	Virunuka	Estonia	brooch	cross-ribbed	Latvian
AI 4262: 813	Virunuka	Estonia	brooch	cross-ribbed	Latvian
AI 4262: 87	Virunuka	Estonia	brooch	cross-ribbed	Latvian
AI 4262: 923	Virunuka	Estonia	brooch	cross-ribbed	Latvian
AI 4161: 482	Virunuka	Estonia	brooch	cross-ribbed	Latvian
AI 4161: 390	Virunuka	Estonia	brooch	cross-ribbed	Latvian
AI 4161: 496	Virunuka	Estonia	brooch	cross-ribbed	Latvian
AI 4161: 520	Virunuka	Estonia	brooch	cross-ribbed	Latvian
AI 4161: 599	Virunuka	Estonia	brooch	cross-ribbed	Latvian
AI 4262: 120	Virunuka	Estonia	brooch	cross-ribbed	Latvian
AI 4262: 129	Virunuka	Estonia	brooch	cross-ribbed	Latvian
AI 4262: 162	Virunuka	Estonia	brooch	cross-ribbed	Latvian
AI 4262: 355	Virunuka	Estonia	brooch	cross-ribbed	Latvian
AI 4262: 553	Virunuka	Estonia	brooch	cross-ribbed	Latvian
AI 4262: 588	Virunuka	Estonia	brooch	cross-ribbed	Latvian
AI 4262: 63	Virunuka	Estonia	brooch	cross-ribbed	Latvian
AI 4262: 68	Virunuka	Estonia	brooch	cross-ribbed	Latvian
AI 4262: 711	Virunuka	Estonia	brooch	cross-ribbed	Latvian
AI 4262: 834	Virunuka	Estonia	brooch	cross-ribbed	Latvian
AI 4262: 97	Virunuka	Estonia	brooch	cross-ribbed	Latvian
AI 4161: 591	Virunuka	Estonia	brooch	disc	group 1
AI 4161: 642	Virunuka	Estonia	brooch	disc	group 1
AI 4262: 30	Virunuka	Estonia	brooch	disc	group 1
AI 4262: 303	Virunuka	Estonia	brooch	disc	group 1

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APPENDIX. *Continued*

Archival No.	Site	Country	Item	Type	Subtype
AI 4161: 34	Virunuka	Estonia	brooch	disc	group 2
AI 4161: 403	Virunuka	Estonia	brooch	disc	group 2
AI 4262: 1164	Virunuka	Estonia	brooch	disc	group 2
AI 4262: 34	Virunuka	Estonia	brooch	disc	group 2
AI 4262: 403	Virunuka	Estonia	brooch	disc	group 2
AI 4262: 412	Virunuka	Estonia	brooch	disc	group 2
AI 4262: 69	Virunuka	Estonia	brooch	disc	group 2
AI 4262: 88	Virunuka	Estonia	brooch	disc	group 2
AI 4161: 6	Virunuka	Estonia	brooch	late profiled	
AI 4161: 696	Virunuka	Estonia	brooch	late profiled	
AI 4262: 1070	Virunuka	Estonia	brooch	late profiled	
AI 4262: 287	Virunuka	Estonia	brooch	late profiled	
AI 4262: 36	Virunuka	Estonia	brooch	late profiled	
AI 4161: 533	Virunuka	Estonia	brooch	cross-ribbed	south Estonian
AI 4262: 1025	Virunuka	Estonia	brooch	cross-ribbed	south Estonian
AI 4262: 116	Virunuka	Estonia	brooch	cross-ribbed	south Estonian
AI 4262: 117	Virunuka	Estonia	brooch	cross-ribbed	south Estonian
AI 4262: 137	Virunuka	Estonia	brooch	cross-ribbed	south Estonian
AI 4262: 164	Virunuka	Estonia	brooch	cross-ribbed	south Estonian
AI 4262: 226	Virunuka	Estonia	brooch	cross-ribbed	south Estonian
AI 4262: 383	Virunuka	Estonia	brooch	cross-ribbed	south Estonian
AI 4262: 422	Virunuka	Estonia	brooch	cross-ribbed	south Estonian
AI 4262: 706	Virunuka	Estonia	brooch	cross-ribbed	south Estonian
AI 4161: 644	Virunuka	Estonia	pendant	cross	
AI 4161: 644	Virunuka	Estonia	pendant	cross	
AI 4161: 644	Virunuka	Estonia	pendant	cross	
AI 4161: 730	Virunuka	Estonia	pendant	cross	
AI 4161: 546	Virunuka	Estonia	pendant	cross	
AI 4161: 197	Virunuka	Estonia	brooch	cross-ribbed	three-pronged foot
AI 4161: 98	Virunuka	Estonia	brooch	cross-ribbed	three-pronged foot
AI 4161: 551	Virunuka	Estonia	brooch	cross-ribbed	three-pronged foot
AI 4161: 665	Virunuka	Estonia	brooch	cross-ribbed	three-pronged foot
AI 4344	Virunuka	Estonia	brooch	cross-ribbed	three-pronged foot
AI 4262: 93	Virunuka	Estonia	pendant	rhombus	
AI 4262: 93	Virunuka	Estonia	pendant	rhombus	

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## Maarja Olli

### SAMALAADSED PIIRKONNAD JA SUHTLUS KAGU-EESTIS NING PÕHJA-LÄTIS 3.–4. SAJANDIL KOHALIKE EHETE PÕHJAL

#### *Resüme*

3.–4. sajandil valmistati Kagu-Eestis ja Põhja-Lätis mitmeid kohalikke ehteid, mille eeskujud on Läänemere kagurannikul. Enamik ehetest on leitud tolleaegsetest matmispaikadest: tarandkalmetest. Varasemates töödes on kohalike ehte ja tarandkalmete leviku põhjal oletatud Kagu-Eesti ja Põhja-Läti tihedaid suhteid ning kultuurilist ühtekuuluvust. On eristatud nelja samalaadse materiaalse kultuuriga piirkonda: Kagu-Eesti põhjaosa, Kagu-Eesti lõunaosa, Vidzeme keskosa (Põhja-Läti keskosa) ja Põhja- ning Kesk-Latgale (Kirde-Läti).

Artikli eesmärk on uurida kohalikke ehteid (Lõuna-Eesti ja Põhja-Läti variandi kärbissõled, kolmeharulise jalaga kärbissõled, ketassõled, hilised profileeritud sõled ning ripatsid) uute meetoditega, et vaadelda regioonidevahelist suhtlust. Millised olid peamised suhtlusteed ja kas olid kesksed alad, mis suhtlesid tihedalt ning kus oli samalaadne materiaalne kultuur? Lisaks täpsustati esemete kronoloogiat ja tüpoloogiat. Kalmes inventaride sarnasust uuriti võrgustikanalüüsi meetoditega: hii-ruut-sarnasuse mõõdik (*chi-squared similarity measure*) ja tsentraliseerituse taseme väärtus (*degree centrality value*). Analüüsides jäid vähese arvukuse tõttu välja hilised profileeritud sõled ja ripatsid, aga need kaasati arutlusse.

Analüüsides tulemuste põhjal on näha, et eksisteerisid regioonid, kus eelistati osasid ehtetüpe. Põhja-Läti variandi kärbissõled levisid peamiselt Lätis ja Kagu-Eesti lõunaosas, Lõuna-Eesti variandi kärbissõled aga Kagu-Eesti põhjaosas. Kalmete piirkondadel, kus mõlemad variandid on esindatud, võis nende sõlgede vahendamisel olla oluline positsioon. Need alad võisid moodustada telje, mille kaudu toimus suhtlus. Kolmeharulise jalaga kärbissõled olid levinud peamiselt Läti aladel ja Kagu-Eesti lõunapoolses osas. Ketassõlgede põhjal on näha, et viienda grupi ketassõled olid levinud Kesk-Vidzemes ja Põhja-/Kesk-Latgales, teise grupi ketassõled Kagu-Eesti põhjaosas ning esimese grupi ketassõled Kagu-Eesti lõunaosas, Kesk-Vidzemes ja Põhja-/Kesk-Latgales. Kohti, millel olid kõrgeimad tsentraliseerituse väärtused, võib interpreteerida teljena, mille kaudu toimus kommunikatsioon, mis hoidis ülal nende alade samalaadsust ja ühtekuuluvust. See telg ulatus uurimisala põhjaosast Kesk-Vidzemesse ja Kesk-Latgalesse. Kalmed, mis ei jäänud sellele teljele, ei pruukinud olla väga olulised suhtluses, mis hõlmas kohalike sõlgi. Hilised profileeritud sõled ja kohalikud ripatsid on teiste kohalike ehetega stiililiselt ühtsed. Nende kandmine koos teiste kohalike ehetega näitab ühtset stiili, mille poolest erineti nendest, kes elasid teistel aladel. Seetõttu on võimalik, et kohalikud ehted olid piirkonna ühtsuse ja sarnasuse markeriteks.

Kalmed, millest leitud ehteid uuriti, paiknevad üldjuhul jõgede läheduses, mille tõttu võib oletada, et suhtluseks ja transpordiks kasutati peamiselt veeteid, mis ühendasid geograafiliselt kaugeid alasid, ning pidev suhtlus hoidis ülal alade ühtsust ja samalaadset materiaalselt kultuuri. Lähemate aladega suhtlemiseks võidi kasutada ka maateid. Kõrgema tsentraliseerituse väärtusega aladel oli ligipääs mitmele veetele ja seetõttu asetsesid need logistiliselt soodsates kohtades, kuhu oli inimestel erinevatelt aladelt lihtne liigelda.