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EARLY COPPER USE IN NEOLITHIC NORTH-EASTERN EUROPE: AN OVERVIEW

Copper finds from Neolithic contexts in eastern Fennoscandia represent the earliest phase of metal use in northern Europe. Currently some 30 sites, which have produced approximately 180 copper finds, are known. The finds consist mainly of nuggets and indeterminate lumps of copper, but a number of personal adornments and small tools are also present. The centre of copper use is located on the northern and western coasts of Lake Onega, where native copper deposits are available.

The objective of this paper is to provide an overview of the early copper finds and metal use in north-eastern Europe between 4000 and 2000 BC. It is argued that Neolithic metal use in the research area can be divided in two phases. The adoption of metal during the first phase, associated with Rhomb-Pit and Typical Comb Ware pottery, was most likely a local innovation. The second phase, attributed to the Asbestos- and Organic-tempered Wares, saw the introduction of more advanced metallurgy that emerged as a result of external influences. We further propose that the reasons for adopting copper are not reducible to purely practical considerations, but had to do with symbolic or metaphysical concepts associated with the metal: the early adoption of copper was related to the wider Neolithisation process of the area, during which the relationships between people and the surrounding world faced profound changes.

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Introduction

Copper was known and used in different parts of Eurasia several millennia before the beginning of the Bronze Age. The earliest evidence derives from the Near East and Anatolia, where copper was first used between the 11th and 7th

millennia BC, whereas copper use in Europe, specifically in the Balkans and the South-East, began by the mid-6th millennium BC (Roberts et al. 2009, 1013). Copper use spread from south-eastern Europe to the steppes of southern Russia (Chernykh 1992, 41 f.) and was introduced farther to the forested regions of East European (or Russian) Plain along the rivers Volga and Kama in the 4th millennium BC (Krajnov 1987, 14 f.; Nagovitsyn 1987, 32). The use of copper was introduced in central, western and northern Europe through different processes at different times (Roberts et al. 2009, 1015 f.); copper smelting was known in the eastern Alps in the 5th millennium BC (Höppner et al. 2005), at a time when large-scale metal production in the Balkans had begun (Bailey 2000, 209), whereas signs of metal use are few in north-western Europe before 2500 BC (Roberts 2009, 467).

In north-eastern Europe the use of native copper began soon after 4000 BC in what is today the Republic of Karelia (Russian Federation), when copper artefacts appear in find assemblages. While a number of early copper finds are also known from central and northern parts of Finland, they are very rare on the Scandinavian Peninsula and in the Baltic countries. The early appearance of copper in eastern Fennoscandia is common knowledge among Russian and Finnish archaeologists, but the general picture of this early copper use is patchy and its wider context elusive, which has to do with the limited research material, different academic traditions as well as linguistic and national boundaries. As the relevant publications are mainly in Russian and Finnish, the early copper finds from north-eastern Europe have often been omitted from the surveys and studies on the beginning of metal use in Europe. Even the early metal finds have been subject to some research and scientific analyses in Russia and Finland, very little has been said about why copper was adopted and how early copper use relates to broader cultural developments.

This paper provides an overview and discussion of the early copper finds and metal use in north-eastern Europe. More specifically, the geographical research area stretches from the shores of Lake Onega in the east to the Baltic Sea in the west and from the Baltic countries in the south to the Arctic Ocean in the north (Fig. 1). Early metal use in this region is put in a broader context, with a special reference to the northern European Russia. The period of interest here is 4000–2000 BC (all dates are given in calibrated radiocarbon years, i.e. calBC). A large part of this time frame is commonly referred to as the Eneolithic in Russia but is called the (Sub-)Neolithic in Finland (Fig. 2). In this paper the term Neolithic is preferred, although we acknowledge that it contradicts especially the Russian periodisation. Without going deeper into the reasoning behind the definitions it suffices to say that recent research (e.g. Vaneeckhout 2009; Mökkönen 2011; Herva et al. n.d.) has increasingly indicated that the cultures in the research area between 4000–2000 BC can be described as Neolithic in a more real sense that has been traditionally thought. It is against this 'Neolithic proper' background the early copper use in the north must be considered.

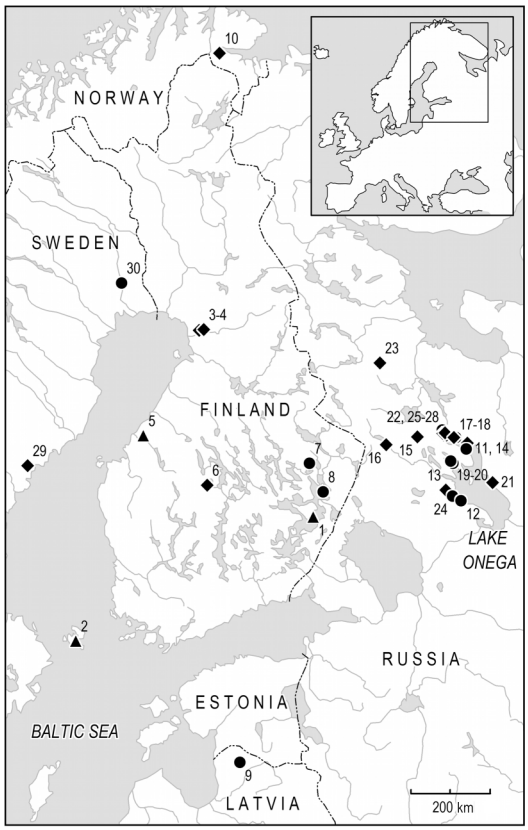

Fig. 1. Neolithic sites with copper finds in the research area. The numbering refers to Table 1. Dots indicate sites with Typical Comb Ware and/or Rhomb-Pit Ware, diamonds sites with Asbestos- and Organic-tempered Wares and triangles sites with undetermined or other Middle–Late Neolithic context.

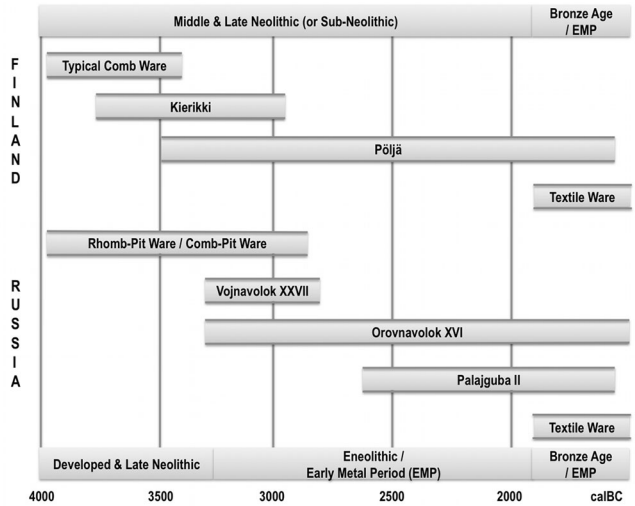

Fig. 2. Simplified chronology and corresponding pottery types in the research area between 4000–2000 BC (Finnish chronology after Pesonen 2004; Pesonen & Leskinen 2009, Karelian dates after Zhul´nikov 1999; 2005).

Cultural context and dating of early copper use in Karelia and Finland

Before turning to a closer examination of the copper finds, it is necessary to provide a general outline of the cultural phases and development in the research area in 4000–2000 BC. Ceramic chronology is of special interest here, although the absolute dating of pottery types is far from complete. Nevertheless, the relative chronology based on pottery provides the only available framework for dating copper finds from particular sites – a detailed discussion on this topic will be provided in another article (Nordqvist et al. in prep.). Pottery was introduced in the research area from the south-east during the later half of the 6th millennium BC (German 2009, 270 ff.; Pesonen & Leskinen 2009, 300 ff.). Initially the groups that adopted pottery seem to have retained their Mesolithic character, but gradually more and more changes emerge. By the 4th millennium BC various new developments are already well in evidence, and also copper appears in the archaeological record.

The appearance of copper is preceded by the emergence of variants of Comb Ware in the research area. The origins of this tradition are generally traced back to the Volga–Oka region or to the area south-east of Lake Onega, where Pit-Comb Ware is thought to develop on the local late Mesolithic/early Neolithic basis in the 5th millennium BC, and from where it then spread in all directions (Gurina & Krajnov 1996, 173 ff.; Lobanova 1996, 101 f.; Carpelan 1999, 256 f.). The interaction of Pit-Comb Ware groups with local populations resulted in new variants of pottery, including a type called Comb-Pit Ware in Karelia and Typical Comb Ware (TCW) in Finland (Oshibkina 1996, 220 f.; Vitenkova 1996a, 118 f.; Carpelan 1999, 257 f.) (Fig. 3). Around the same time another pottery type with Pit-Comb Ware roots, Rhomb-Pit Ware (RPW), appeared around Lake Onega, similarly as a result of southern influences (Oshibkina 1996, 220 f.; Vitenkova 1996b, 151 f., 160). It is with these pottery types the earliest copper finds in the research area are associated.[1]

The introduction of TCW is currently dated to around 3900 BC, with RPW viewed as roughly contemporary (Zhul´nikov 1999, 76 f.; 2005, 25; Pesonen 2004, 90) (Fig. 2). The production of TCW was discontinued after 3400 BC, but in

[1] Typical Comb Ware and Comb-Pit Ware are names given by different research traditions to essentially one and the same pottery type – in this paper name TCW is generally used. In Karelia TCW and RPW are often found at the same sites, but due to the predominance of context dates it has not been possible to establish their inner chronology; these dates include less than 20, more or less reliable, conventional radiocarbon dates (Zhul´nikov 1999; 2005). No AMS-dates of carbonized crust on Middle or Late Neolithic pottery have been published from Karelia, and many published conventional dates are accompanied with insufficient data about the dated contexts or are otherwise unreliable. The dating of Typical and Late Comb Ware in Finland is based on ca 60 AMS-dates of crust and birch bark pitch on pottery shards, in addition to an undefined amount of context dates and other information (Pesonen 2004; Pesonen & Leskinen 2009).

Fig. 3. The extent of Typical Comb Ware (TCW), Asbestos- and Organic-tempered Wares (AOW) and Volosovo and Garino-Bor cultures; areas with deposits of native copper in Karelia and copper-bearing sandstone in Volga–Kama-area are marked dark gray (after Zhuravlev 1977; Krajnov 1987; Nagovitsyn 1987; Chernykh 1992; Carpelan 1999; Zhul´nikov 1999).

some places Late Comb Ware persists in the archaeological record until 2800 BC (Carpelan 1999, 259; Pesonen 2004, 90). In Karelia, RPW and the derivatives of TCW likewise seem to continue at least up to this time (Zhul´nikov 1999, 76 f.). Only a few radiometric dates can be directly connected to contexts including copper finds, but they, alongside with other evidence like shore displacement dating, seem to show that copper is present in the find material from 3800–3700 BC on. Almost half of all the copper finds are associated with RPW, some 2% with RPW/TCW and 7% with TCW contexts.

The Comb Ware phase has traditionally been viewed as a relatively uniform culture that covered a vast area ranging from the Urals to the Baltic Sea and from Northern Ukraine to the Arctic Ocean. This ‘Comb Ware culture’, however, was not a unified entity, but rather a network of different groups connected to each other to a varying degree through kinship, trade and other links. The economy of these communities was predominantly based on hunting, fishing and gathering, but more or less clear Neolithic traits begin to appear simultaneously with the emergence of TCW and RPW. Cultivation was introduced to eastern Fennoscandia around the beginning of the 4th millennium BC, and possibly even earlier (Kriiska 2007; 2009; Mökkönen 2010), rather than in the later 3rd millennium BC as the conventional view holds (see Mökkönen 2010, 6 ff. for an overview). This phase also saw the birth of village-like concentrations of (timber-built) pithouses (e.g. Zhul´nikov 2003; Mökkönen 2011), several major changes in the material culture, including the adoption of new raw materials and artefact forms, and an influx of symbolic expression.

The apparent uniformity of Comb Ware phase began to disintegrate after some centuries, and was well under way by 3500 BC. In the research area the combination of local traditions, the legacy of Comb Ware and new influences from the Volga–Kama region resulted in the birth of several variants of Asbestos- and Organic-tempered Wares (AOW) (Carpelan 1999, 259 f.; Zhul´nikov 1999, 40 ff.). There was no observable break in cultural development, however, and many of the cultural phenomena that emerged during the first half of the 4th millennium BC continued into and became more distinctive during the AOW phase. Copper is also found in the archaeological assemblages associated with the AOW groups.

The AOW types associated with copper finds include Kierikki and Pöljä Wares in Finland and Vojnavolok XXVII, Orovnavolok XVI and Palajguba II Wares in Russia (Fig. 2).[2] The maximum duration proposed for the Kierikki phase is dated to 3800–2900 BC and for the Pöljä phase to 3500–1500 BC (Pesonen 2004, 90 ff.; Pesonen & Leskinen 2009, 300, 304). The available radiocarbon dates and other evidence suggest that Vojnavolok XXVII Ware dates from the second half of the 4th to the early 3rd millennium BC, Orovnavolok XVI Ware from the late 4th to late 3rd or even 2nd millennium BC, and Palajguba II Ware from the mid-3rd to mid-2nd millennium BC (Zhul´nikov 1999, 76 f.; 2005, 23 f.). Most copper finds of the AOW phase derive from Vojnavolok XXVII (25%) and Orovnavolok XVI (13%) contexts, whereas copper finds from contexts associated with Kierikki, Pöljä and Palajguba II Wares are rare (ca 1% each). Also the majority of the radiocarbon-dated AOW contexts with copper finds pertain to the last centuries of the 4th and the first centuries of the 3rd millennium BC, but some dates indicate the use of copper both before and after that period as well.

Like their predecessors, AOW groups seem to have maintained vast and varying intra- and inter-regional contact networks through which materials like Baltic amber and so-called Onega green slate (i.e. particular metatuff) were distributed far beyond their original source areas. AOW groups also came into contact with Corded Ware groups after 3000 BC, which inflicted changes in the material culture, economy and society (e.g. Zhul´nikov 1999, 53 f., 89 f.; Mökkönen 2008, 142 ff.; 2011, 62 f.) – however, unlike in many other regions in Europe, no copper finds have been associated with Corded Ware in eastern Fennoscandia. AOW

[2] The AOW types defined in Finland and Russia are partly overlapping not only geographically and chronologically, but also as typological entities. As detailed studies remain to be done, and as the types have been defined according to different criteria, straightforward equations should be avoided. Establishing a timeframe for these pottery types is also made difficult by the small amount of dates and discrepancies in them, which results in margins and uncertainties of several centuries in their initial and terminal dates. The age determination of Finnish material is based on AMS-dates of carbonized crust on 20 Kierikki and Pöljä shards, in addition to context dates and other information (Pesonen 2004; Pesonen & Leskinen 2009). The radiocarbon dates used to date the Russian types include three conventional charcoal dates from Vojnavolok XXVII, ca 10 dates from Orovnavolok XVI and ca 15 dates from Palajguba II contexts (Zhul´nikov 1999; 2005).

continued to be made at least until the end of the Stone Age and the emergence of new pottery type, Textile Ware, in around 1900 BC, which represented yet another influx of influences from the Volga–Oka region (Carpelan 1999, 268 ff.; Lavento 2001).

In sum, 11 sites with copper finds can be connected to RPW and/or TCW and 15 to AOW, whereas two sites can only be dated to the Middle and Late Neolithic (Table 1).[3] There are also some other sites in the northern parts of eastern Fennoscandia, which show signs of fairly early metal use (see Zhuravlev et al. 1981; Huurre 1982; 1986; Huggert 1996). While copper may have been known or metalworking practiced at these sites in the Late Neolithic, this cannot be confirmed due to the mixed contexts including also Early Metal Period finds and even later material.[4]

Copper finds and their archaeological contexts

The first copper finds from Stone Age contexts were documented in Karelia during the excavation of the Orovnavolok II and Vojnavolok IX sites in 1938–1940 (Gurina 1951, 101–128). In Finland, the first find was made at the Polvijärvi Suovaara site in 1960 (Björkman 1961). In Russia these copper finds were at first connected with the bronze and iron metallurgy of the Early Metal Period (Gurina 1951), but after supplementary studies, and especially following the large-scale excavations at Pegrema in the 1970s (Zhuravlev 1974; 1975; 1977; 1979; 1987; 1991), the finds were reattributed to the Stone Age, or the Eneolithic to be more precise (see Vitenkova 1996b, 152; Zhul´nikov 1997, 150; 1999, 5 ff.). Copper finds from Finnish sites, by contrast, remained limited in number and were usually regarded as mere curiosities or later intrusions (Salo 1981, 33; Edgren 1992, 70; but see Sarvas 1969, 33). A handful of sites have nonetheless yielded copper finds since the 1980s, indicating that the occurrence of copper in Neolithic contexts in Finland, while uncommon, is not exactly exceptional (Taavitsainen 1982, 46; Pesonen 1998, 26 f.). The few copper finds made in northern Sweden and Norway since the 1980s have ever since their initial discovery been interpreted as indicating contacts with the TCW and AOW groups (Schanche 1989, 66 f.; Halén 1994, 159 f.; George 2007, 239).

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[3] In addition, two copper rings from the Zvejnieki burial ground in Latvia have been connected to the TCW influence in the area of the Baltic states (Zagorska 2006, 100 f.). However, a recent ^{14}C-dating, assuming it is flawless, suggests that the burial and the rings are several centuries older than even the initial date of TCW in the north. A perforated piece of copper sheet from the Jomala Jettböle site on Åland Islands (Finland) is also worth mentioning, but the find seems to be associated with the western influence of Swedish Pitted Ware or Corded Ware culture (Edgren 1992, 70; Carpelan 1999, 259 f.).

[4] Early Metal Period is a term created to describe the metal-poor periods prior to the 'proper' Iron Age (see Gurina 1951; 1961). However, in Russia this term covers the Eneolithic and the Bronze Age (i.e. roughly 3500–1000 BC), but in Finland the Bronze Age and the Early Iron Age (ca 1900 BC–AD 300) (see Fig. 2).

Table 1. Sites with copper finds and the find assemblages. The classification of specimens according to the references, numbering refers to Fig. 1. References: 1) Costopoulos 2002; 2) Edgren 1992; 3) George 2007; 4) Gurina 1951; 5) Gurina 1961; 6) Halén 1994; 7) Hood & Helama 2010; 8) Ikäheimo & Pääkkönen 2009; 9) Jussila et al. 1992; 10) Kosmenko 1992; 11) Leskinen 2002; 12) Pankrushev & Zhuravlev 1966; 13) Pesonen 1998; 14) Pesonen 1999; 15) Schanche 1989; 16) Schulz 2000; 17) Seger 1987; 18) Skantsi 2005; 19) Taavitsainen 1982; 20) Tarasov 2010; 21) Zagorska 2006; 22) Zhul´nikov 1993; 23) Zhul´nikov 1995; 24) Zhul´nikov 1999; 25) Zhul´nikov 2005; 26) Zhuravlev 1987; 27) Zhuravlev 1991. * = The given amount is minimum.

No	Site		Dating (ceramic affiliation)	Nuggets	Sheets	Awls	Knives	Hooks	Hammered pieces	Rings	Beads	Unclear/ fragment	Total	References
1	Finland	Ankonpykälänkangas	Typical Comb Ware or Pöljä		1								1	9
2	Finland	Jettböle	Swedish Pitted Ware or Corded Ware		1								1	2
3	Finland	Korvala	Pöljä									1	1	16
4	Finland	Kuuselankangas	Kierikki				1						1	1, 8
5	Finland	Köyrisåsen 3	Late Neolithic		1								1	17, 18
6	Finland	Rusavierto	Pöljä		1								1	11
7	Finland	Suovaara	Typical Comb Ware + Rhomb-Pit Ware							1			1	19
8	Finland	Vihi 1	Typical Comb Ware		1						1(?)	7	9	13, 14
9	Latvia	Zvejnieki	Typical Comb Ware (?)							2			2	21
10	Norway	Karlebotnbakken	Kierikki				1						1	7, 15
11	Russia	Chelmuzhskaya Kosa XXI	Orovnavolok XVI	2		1						1	3	24
12	Russia	Derevyannoe I	Rhomb-Pit Ware	2	1		1						4	4, 24
13	Russia	Fofanovo XIII	Orovnavolok XVI										14*	20
14	Russia	Klim I	Rhomb-Pit Ware	3									3	24
15	Russia	Kochnavolok II	Palajguba II	1									1	24
16	Russia	Kudomguba VII	Palajguba II		1								1	10, 24
17	Russia	Orovnavolok (II)	Rhomb-Pit Ware	3			1	2					6*	4, 5, 24
18	Russia	Orovnavolok XVI	Orovnavolok XVI	1	1								2	24, 25
19	Russia	Pegrema I	Rhomb-Pit Ware	25	20	2			1	1		12	61*	24, 26, 27
20	Russia	Pegrema VII	Rhomb-Pit Ware	3	5		1						9	24, 27
21	Russia	Pervomajskaya I	Vojnavolok XXVII + Organic-tempered Ware	1									1	23, 24
22	Russia	Sandermokha I	Rhomb-Pit Ware	3									3	24
23	Russia	Tunguda XIV	Orovnavolok XVI										2	10, 24, 25
24	Russia	Vigajnavolok I	Rhomb-Pit Ware + Comb-Pit Ware	2						1			3	12, 24
25	Russia	Vojnavolok IX	Rhomb-Pit Ware + Comb-Pit Ware										?	4, 24
26	Russia	Vojnavolok XXIV	Orovnavolok XVI		1								1	24
27	Russia	Vojnavolok XXV	Orovnavolok XVI		2								2	24
28	Russia	Vojnavolok XXVII	Vojnavolok XXVII	6	5				33				44	22, 24
29	Sweden	Bjästamon	Organic-tempered Ware		1								1	3
30	Sweden	Lillberget	Typical Comb Ware		1						1		2	6

By the end of the year 2010, some 30 sites in the research area had yielded over 180 copper finds dating to the period between 4000 and 2000 BC.[5] Roughly half of the finds derive from two unusually copper-rich sites in Karelia, Pegrema I and Vojnavolok XXVII, whereas investigations at most sites have yielded between one and five copper objects (Table 1). The majority of the finds consists of seemingly indeterminate bits and pieces of metal, while the identifiable artefacts are more or less unique specimens. Thus the material allows only a rough classification, not necessarily reflecting the original functions of the finds, and provides no basis for typological dating.

Nuggets of native copper, small hammered pieces, and poorly preserved fragments of metal comprise the largest find category. These finds are usually only a few centimetres in size and a few grams in weight, although nuggets weighing as much as 200 g are known (Zhuravlev 1987, 146). Nuggets are usually dendritic in form, which is typical to native copper, whereas worked pieces show signs of cold hammering (RPW/TCW, AOW) or cold and hot working (AOW) (Chistyakova 1991, 194, 198). Finds of this group are restricted to the Lake Onega region where they are present in both RPW/TCW and AOW contexts.

Nuggets can reasonably be considered as raw material – analyses have shown that several artefacts have been hammered out of nuggets (Chistyakova 1991) – but they might also have been meaningful as such (see below). The function or nature of the small worked pieces and fragments of sheet metal is not entirely clear either. Copper sheets, small and irregular or elongated pieces of metal, are known throughout the research area, from both RPW/TCW and AOW assemblages. Sheets have been made out of nuggets by cold hammering, although a few heat-treated examples are known from later contexts (Chistyakova 1991; Zhuravlev 1991, 101). These pieces have usually been explained as debris and destroyed or unfinished artefacts, but this may be a too simplistic view. It is true that copper sheets have served as the basis of artefact production also elsewhere where the raw material has consisted of small copper nuggets (Franklin et al. 1981), but it is likely that the pieces of (sheet) metal had other meanings as well.[6] Some sheets can also be classified as ornaments of the body or clothing, including the pendants with punctured holes for hanging from Derevyannoe I, Köyrisåsen 3 and Rusavierto

[5] The number of finds, as well as of sites, must be viewed only as suggestive and presenting minimum values, as the information is collected from various sources with partly incongruent data. For example, since the last reported excavations at Pegrema I, a large amount of new material has allegedly been found there but not properly published (see Zhuravlev 2006, 18, figures). Finally, after the completion of this manuscript additional copper finds have been made at least at one site in the research area.

[6] The usual size of copper sheets is 1–6 cm in length and 1–2 mm in thickness. While it would have been possible to produce an artefact by folding together several copper sheets, in most cases the size of a copper nugget determined the size of an object that could have been produced from it (Franklin et al. 1981, 34 f.). For this reason a large part of Neolithic copper finds both in eastern Fennoscandia and e.g. in Alaska (Cooper 2011, 261) are small sheets, as more complex forms were difficult to produce from average sized copper nuggets.

(Seger 1987; Chistyakova 1991, 192 ff.; Leskinen 2002, 158) – the perforated sheet from Jettböle (see note 3) could also be added to these.

Ornaments include also two possible tubular beads, both of them found in TCW contexts. The bead from Lillberget is a small verdigris-covered piece (2 × 0.4 × 0.4 mm), apparently made of hammered and rolled copper sheet (Halén 1994, 157 ff.), and the curvy pieces of sheet metal from the Vihi 1 site may derive from a similar artefact (Pesonen 1998, 26). Other ornaments include rings, which are known from three TCW sites (Pankrushev & Zhuravlev 1966; Taavitsainen 1982; Zhuravlev 1991). The ring from Pegrema I is made of narrow copper band while the two other rings are thin and flat strips of metal hammered into a roundish or oval shape (2.5–6.5 cm in diameter) with open ends – the aforementioned Zvejnieki rings (see note 3) also fit this description. Two small horseshoe-shaped artefacts (2–3 cm long and 1–2 mm thick) found at the Tunguda XIV site (Orovnavolok XVI) and made by cold and hot hammering (Chistyakova 1991, 194 f.; Zhul´nikov 2005, 71) can also be interpreted as possible ornaments. In addition a small bundle of narrow copper band has been found at the Pöljä Ware site of Korvala (Schulz 2000). It is not clear if the strip was originally straight or coiled, in which case it could have been used e.g. as a bead or pendant.

In addition to ornaments, copper finds include artefacts classified as tools. The finds from the Lake Onega region include three awls or punchers, i.e. narrow and thin pieces of sheet copper a few centimetres long. The two specimens found in RPW contexts are cold hammered, but the one from AOW context bears possible signs of hot working (Zhuravlev 1987, 146; Chistyakova 1991, 186, 196 ff.). Moreover, three knives made of copper sheet with blades formed by intense cold hammering have been found in RPW contexts in the Lake Onega region (Gurina 1951, 119; 1961, 290; Chistyakova 1991, 190 f.). Two knife- or dagger-like artefacts, completely different from those found at Lake Onega, are known from Kierikki Ware contexts in Northern Scandinavia (Schanche 1989; Costopoulos 2002; Ikäheimo 2009; Ikäheimo & Pääkkönen 2009; Hood & Helama 2010). These are rather large (15 × 2 × 0,3–1,5 cm) tanged pieces made by hammering, the one from Karlebotnbakken showing traces of grinding (Schanche 1989, 62 f.) and the other from Kuuselankangas with weak signs of low-temperature annealing (Ikäheimo & Pääkkönen 2009, 171). Furthermore, two small fragments identified as fishhooks have been found at the RPW site of Orovnavolok II (Gurina 1951, 119).

Finally, three copper adzes from the northern part of the research area must be mentioned, as they are often featured among the early copper finds in literature. These artefacts vary in size, shape and have been made using different techniques (Zhuravlev et al. 1981; Huurre 1982, 16 ff.; Chistyakova 1991, 198 ff.; Huggert 1996, 72 ff.). Although found in the vicinity of prehistoric dwelling sites, they all are strictly speaking stray finds, and, with the possible exception of the Kukkosaari adze from north-eastern Finland (Huurre 1982), are most probably younger than the Late Neolithic. Also the above-mentioned poorly contextualized metal finds from the northern part of the research area partially differ from the Neolithic copper finds presented here, thus suggesting a later dating – this group

includes projectile points or tools, pieces of sheet metal, rods and drops of metal, as well as pieces of crucibles (Huurre 1982, 21 ff.; Huggert 1996, 72 f.; Lavento 2001, 124 ff.).

At sites where copper is present, the number of metal finds usually comprises less than 3% of the total find material, even when bulk finds such as pottery, lithic debitage, whetstones and burnt bone are excluded from the count. It was thus much rarer than most other materials and in all likelihood not used on an everyday basis. Given its rarity and unusual properties, copper was probably a rather special material in the Neolithic eastern Fennoscandia (Herva et al. in press; n.d.), although this is not reflected in broad depositional patterns in any clear manner. Copper finds derive from dwelling sites and mainly from the cultural layer inside or just outside the housepits. The specific find locations of copper or the distribution of copper finds within the excavated sites do not seem to stand out as special in any obvious way.[7] However, such contextual associations are self-explanatory and of limited value for assessing the meaning of copper in the Neolithic of the research area, because excavations have almost exclusively been targeted on dwelling remains and their immediate vicinity, whereas burials attributable to the RPW and AOW groups are not known, to name just one obvious deficiency. Therefore, little can presently be said about the meaning of copper from a contextual point of view.

Evidence of metalworking and its development

Apart from the metal finds themselves, archaeological evidence of procurement of raw material and copper working is limited. Both copper ores and native copper occur in the Lake Onega region (Kuleshevich & Lavrov 2010), but Neolithic mines or other evidence of metal extraction have not been preserved or found. It would seem reasonable to assume that early copper use was opportunistic – nuggets of copper were picked up when found – and that any mining or digging for the metal, if it took place at all, was of small scale.[8] Also the import of raw material cannot be ruled out (see below). The working of copper by hammering does not leave much archaeological evidence either, although some finds have been interpreted as hammer and anvil stones used

[7] Based on a superficial examination of find contexts the copper finds seem to concentrate along the walls of the houses as well as around the fireplaces. This is congruent with the observations made on the depositional patterns of bulk finds like lithic debitage and burnt bone at housepit sites in north-east Europe. In a few cases it has been proposed that copper items would originally have been placed inside ceramic vessels (Zhuravlev 1987, 143), but apart from the Zvejnieki finds (associated with burial) it is not possible to establish a clear connection between copper finds and ritual or 'non-domestic' contexts, as this would require more advanced analyses on the artefact and raw material combinations and distributions at the sites.

[8] It is possibly of interest here that in northern North America many prehistoric people primarily obtained the raw material not through mining, but by collecting pieces of native copper detached from the deposits by natural processes (Wayman 1985, 68).

in metalworking (Gurina 1951, 125; Zhuravlev 1991, 101; Halén 1994, 158). The evidence of Neolithic smelting in the research area is limited to some copper artefacts (Chistyakova 1991), one possible furnace (Zhuravlev 1987; 1991, 16 ff.) and the alleged fragments of crucibles reported from a few sites (Zhuravlev 1991, 21–23, 44 ff.; Halén 1994, 143 f.; Zhul´nikov 1999, 66; cf. Nordqvist et al. 2011). No casting moulds can be unquestionably associated with Neolithic metalworking.

The most abundant evidence of local metalworking has been reported from the RPW site of Pegrema I at Zaonezh'ya peninsula (Lake Onega). A quadrangular building, interpreted as a workshop, and three housepits with a rich assemblage of copper finds have been excavated at the site. The workshop was found to contain hammer and anvil stones, pieces of crucibles and numerous nuggets and hammered pieces of copper, in addition to a structure made of quartzite slabs and further interpreted as a furnace (Zhuravlev 1987; 1991, 16 ff.). However, the alleged evidence of advanced metallurgical techniques is not particularly convincing, given that not a single copper artefact from Pegrema I or any other RPW/TCW site bears evidence of such techniques. The interpretation of the stone structure as a furnace has also been questioned (Zhul´nikov 1997, 152; 1999, 66), and it is equally doubtful if the reported pieces of 'crucibles' were in fact associated with Neolithic metalworking in any way.

Thus, while Pegrema I is certainly an interesting site in terms of early metal use in north-eastern Europe, the evidence for advanced metalworking techniques found there is unconvincing. This is also the case with the TCW site of Lillberget in northern Sweden. Evidence of smelting and other hot working techniques dated as early as 3900 BC have been reported from the site (Halén 1994), but the data appears to have been somewhat misinterpreted and do not really allow the conclusions drawn from them (Nordqvist et al. 2011). Other studies of copper finds from eastern Fennoscandia have indicated that during the RPW/TCW phase the predominant technique of metalworking was cold hammering. Hot working and smelting seem to have been introduced only during the late 4th millennium BC and are associated with the AOW contexts (Chistyakova 1991, 194, 198; Zhuravlev et al. 1991, 167, 170; Zhul´nikov 1997, 152; 1999, 66).

Origins of copper and metalworking: local or imported?

The origins of the copper used in Neolithic north-east Europe and the origins of the knowledge of metalworking have been subject to some debate, and based on various analyses two main arguments have been put forward. First, it has been argued that the metal derives from the Lake Onega region (Zhuravlev 1991, 142; Zhul´nikov 1999, 65 f.), where copper objects and raw material – ores as well as metallic native copper in the form of nuggets – are mainly distributed north-west of Lake Onega and in Zaonezh´ya peninsula (Kuleshevich & Lavrov 2010) (Figs 1, 3). Second, it has been proposed that the copper originates in the

Urals (Taavitsainen 1982, 45, 48; Halén 1994, 159) where copper-bearing sandstone formations are found (Kuz´minykh 1977, 33; Chernykh 1992, 6 f.). While native copper is 'ready to be used', extracting copper from ores requires knowledge and advanced metallurgical skills.

Scientific analyses have shown that the Neolithic metal objects in the research area are made of pure, unalloyed (native) copper (e.g. Chistyakova 1991, 183; Zhuravlev et al. 1991, 169), but they have ultimately failed to resolve the question of provenance for various reasons, ranging from insufficient resolution of the employed methods to deficiencies in the reference material (Huggert 1996, 78 f.; Ikäheimo & Pääkkönen 2009, 264 f.). It is, however, possible and worthwhile to consider the origins of metal and knowledge of metalworking from an archaeological point of view. The fact that native copper was locally available in Karelia is certainly an important point, but it does not automatically mean that the earliest metalworkers there exploited local resources. The use of native copper was discovered independently several times in different parts of the world, but for example in central and western Europe the earliest metalworking seems to have been generally founded on externally introduced knowledge on actual metallurgy and smelted copper even in regions where native copper was locally available (Roberts 2009, 468; Roberts et al. 2009, 1015, 1019).

As far as we know, there is no published evidence on the use of metal among the hunter-fisher-gatherers of northern European Russia contemporaneous to the early metal use among the RPW/TCW groups. Rather, it appears that the use of metals begins in the northern part of the Russian Plain only in the second half of the 4th millennium BC within Volosovo and Garino-Bor cultures. These two cultures, or spheres of influence, can help to understand some aspects of the early copper use in Eastern Fennoscandia and must therefore be briefly discussed here.

Volosovo and Garino-Bor have their roots in the local Neolithic (Comb Ware) groups of the Volga–Kama region (Krajnov 1987, 25 ff.; Nagovitsyn 1987, 30 ff.) (Fig. 3). What is today described as Volosovo culture seems to have emerged during the 4th millennium BC, although its initial, or 'proto', stage is identified already somewhat earlier, and continued until the late 3rd millennium BC (Krajnov 1987, 13 f., 28; Korolev & Shalapinin 2010). The chronological position of Garino-Bor culture is less well defined than of Volosovo, but is thought to be roughly contemporaneous with it (Nagovitsyn 1987, 28 f., 34). The influence of Volosovo and Garino-Bor cultures radiated far beyond their core areas reaching what are today the Baltic states, Finland, Karelia and north-eastern European Russia, as evidenced by certain traits of material culture, such as the use organic tempers in pottery and specific types of arrowheads and figurines made of flint (e.g. Chalikov 1986, 44 ff.; Stokloss 1997; Carpelan 1999, 260; Zhul´nikov 1999, 89).

The birth of Volosovo and Garino-Bor metallurgy has been attributed to external influences from the steppes, especially from Yamnaya culture, and in the later stages also from Fatyanovo and Balanovo cultures (Chernykh & Kuz´minykh

1977, 95; Kuz´minykh 1977, 31; Krajnov 1987, 20; Chernykh 1992, 186).[9] Metal finds and signs of metalworking appear at Volosovo and Garino-Bor sites gradually towards the late 4th millennium BC and with notable regional differences: sites near copper sources show evidence of advanced metallurgical knowledge whereas finds are fewer or absent elsewhere (Kuz´minykh 1977, 31 f.; Krajnov 1987, 14 f., 20; Nagovitsyn 1987, 32). Virtually all Volosovo and Garino-Bor metal artefacts have been made of copper smelted from local copper-bearing sandstones, and the artefact repertoire consists of simple tools and ornaments, bits and pieces of metal, as well as clay crucibles (Chernykh & Kuz´minykh 1977, 93 ff.; Kuz´minykh 1977, 32 ff.; Krajnov 1987, 20; Nagovitsyn 1987, 34; Chernykh 1992, 187).

Two things can be suggested on the basis of the preceding discussion in regard with the Neolithic metal use and its origins in Karelia. Firstly the adoption and use of copper in the early 4th millennium BC in eastern Fennoscandia must have been a local development based on the exploitation of local native copper – there simply is no known region from where the knowledge of copper or metal itself could plausibly have been imported at this fairly early date. The supposed Uralic origin of raw material and technology is difficult to accept, as metalworking was apparently unknown there at the time. Metallurgy in the Volga–Kama area is, as already noted, of later date, and the occasional indications of metal use and processing in the central and northern Urals and the semi-arctic regions of north-eastern European Russia are all contemporaneous to, or slightly later than the early metal use within Volosovo and Garino-Bor (Chalikov 1986, 44; Stokloss 1997, 237; Chairkina 2005, 209 ff.). The finds from Zvejnieki burial ground in Latvia could be taken to hint at southern influences, but the Zvejnieki rings aside, there is no evidence of metal use in the Baltic countries before the late 3rd and early 2nd millennium BC (Lang 2007, 22 f.). Finally, also a western origin seems unconvincing, as Stone Age metal use in Sweden is of a southern origin and represented in the central parts of the country only by a few isolated finds from later contexts belonging to Funnelbeaker, Swedish Pitted Ware and Corded Ware cultures (Malmer 2002, 35, 66, 158; George 2007, 239).

Secondly Volosovo and Garino-Bor cultures probably did influence metal-working in eastern Fennoscandia, however, not in the initial RPW/TCW but rather in the following AOW phase. The idea that smelting was independently invented in Karelia (Zhuravlev et al. 1991, 171; Chernykh 1992, 188 f.) seems unfounded without reliable dates or other concrete supporting evidence. Instead, the material culture provides a wealth of evidence indicating contacts with copper-smelting Volosovo and Garino-Bor. The idea of independent invention of actual

[9] Yamnaya (Pit-Grave) was a pastoral culture formed in the steppes during the first half of the 4th millennium BC and influenced a large area, reaching even the forest steppe areas of Volga–Urals where it came into contact with the local hunter-gatherers (Chernykh 1992, 83–91, 132 f.; Koryakova & Epimakhov 2007, 46 ff.). Fatyanovo and Balanovo were eastern variants of Corded Ware, which spread to the Upper- and Middle-Volga from the west during the first half of the 3rd millennium BC (Chernykh 1992, 133 ff.; Koryakova & Epimakhov 2007, 100 ff.).

metallurgy in the research area is also at odds with recent research (e.g. Roberts 2009, 472; Roberts et al. 2009, 1019), which indicates that actual metallurgy may only have been discovered once and then spread through Eurasia.

Even if the initial adoption of copper in Karelia was an indigenous development, it did not take place in a vacuum. It is likely that ideas indirectly associated with metal, or ideas resonating with particular properties of copper, had reached eastern Fennoscandia already before the actual adoption of metal in this region. Neolithic copper finds in north-eastern Europe in general manifest similarities as well as differences with the contemporary copper finds from the rest of Europe. Jewellery/ornaments and small tools, basic constituents of copper find assemblages elsewhere in Europe and Russia (see Chernykh 1992; Ottaway & Roberts 2008, 214), are to some degree present also in the research area. Still, while the finds belong to common functional categories, at least from the modern point of view, they rather show local character than simply imitate external models (Kuz´minykh 1977, 33; Zhul´nikov 1999, 66; Ottaway & Roberts 2008, 214 f.). Some artefacts found in northern Europe do have parallels in southern Europe or Russia, but their occasional and superficial character is not enough for answering questions on the origins of early metalworking or to clarify the reasons for the adoption of metal. These issues are briefly addressed in the final section of the paper.

Early copper use in the context of the Neolithic

While the reasons for early copper use or the meanings of the metal in the research area cannot be discussed in depth here, a number of points must be taken up in a more or less tentative manner. Little has been said about these issues in earlier research, which may relate to the largely nondescript character of the copper finds and the implicit techno-economically laden assumption that metal use was somehow obviously or inherently 'a good idea'. In general, Neolithic use of copper has been seen as something of a simple and unrelated prelude to the later age of metal (e.g. Huurre 1986, 53; Chistyakova 1991; Zhuravlev et al. 1991; Chernykh 1992, 214; Edgren 1992, 70). Yet, simple technocentric and rationalist explanations are clearly insufficient because early copper artefacts were not really superior, in practical terms, to similar artefacts made of other materials (see also Ottaway & Roberts 2008, 193; Roberts 2009, 472 f.).

Copper and other 'exotic' materials have, of course, been considered also in terms of symbolic and social value (e.g. Núñez & Okkonen 2005; Zvelebil 2006; Okkonen 2009). This line of thought suggests that the possession of rare materials originating in distant lands marked social status because such materials were presumably not available to everyone. The expression of identity and social status by means of material culture may well have been a significant factor in the Neolithic communities in north-eastern Europe and beyond, and it is surely relevant here that personal adornments often comprise an important category of

Neolithic copper finds around Europe. Even though copper was not an imported material in the Lake Onega region, its apparent rarity and material properties would presumably have qualified the metal as an 'exotic' or 'special' substance which perhaps had associations with 'otherness' in spite of its local origins (Herva et al. n.d.), and thus made it a suitable vehicle for expressing social status. Nonetheless the possible association between social status and 'exotic' or 'special' materials is rather a generic and in itself insufficient explanation to the adoption and use of metal, and other aspects of early copper use in the research area must also be considered.

As noted earlier, copper appears in the archaeological record of north-eastern Europe in the early 4th millennium BC. Since the deposits of native copper at Lake Onega are often found in connection with quartz and slate, it has been suggested that people discovered copper when quarrying stone (Zhuravlev 1991, 144 f.; Vitenkova 1996b, 159). This seems to be a reasonable suggestion, but also begs the question why it was only in the early 4th millennium BC that copper became an object of interest and utilization? Given that the settlement around Lake Onega dates to the 8th millennium BC (see Filatova 2004; Shakhnovich 2007) at the latest, it might be reasonably assumed that people would have been familiar with deposits of native copper much earlier, but for one reason or another did not use it. It is probably of significance, in other words, that copper appears in the archaeological record at the time when does, that is, when various other significant changes in (material) culture are also in evidence. The changes observed in the archaeological record since around 4000 BC can plausibly be considered in terms of Neolithisation of eastern Fennoscandia (see further Vaneeckhout 2009; Mökkönen 2010; 2011; Herva et al. n.d.), and it is against this background the early copper use must be examined. The adoption of metal was linked to more profound, albeit undoubtedly gradual, changes in the ways people related to and engaged with the world around them in both material and conceptual terms.

Recent research has proposed that colour, luminosity, texture and other sensorial properties may have been more central to the meaning of Neolithic materials and material culture than has previously been appreciated (e.g. Cummings 2002; Jones & MacGregor 2002; Bradley & Phillips 2008). Rather than pursuing possible meanings of particular properties of copper here (see Herva et al. in press; n.d. for further discussion on these issues), we merely wish to point out that in Neolithic north-eastern Europe copper may well have been meaningful as a substance *per se*. In other words, the possibility should be taken seriously that nuggets of native copper were considered important as such, and not only as raw material for making artefacts. Likewise, the seemingly useless bits and pieces, copper may well have been meaningful objects in themselves rather than simply refuse-related metalworking. It is not very far-fetched to suggest that in the early phase of its use in Neolithic Europe copper was of interest mainly due to its novel sensory properties and metaphysical associations rather than some practical usefulness of the metal (Herva et al. in press).

These are only speculative notions as they stand, of course, but the point we wish to make here is that it is not readily obvious what aspects of copper and copper objects were considered important in the Neolithic and why. Simplistic categorization of copper and metalworking – or any other things and practices – in terms of symbolic-practical, ritual-rational and other such binary categories are almost certainly of little value. That is, they only reflect modern preconceptions and rationality and may ultimately have little to say about how people perceived, understood and conceptually organized their world in the Neolithic (see further Brück 1999). Thus, even though Neolithic copper finds in the research area sometimes appear in the form of practical artefacts and derive from domestic contexts, this does not provide sufficient grounds for concluding that copper and metalworking had only some transparent practical function and meaning.

Even though a proper contextual analysis of Neolithic copper finds in the research area remains to be done, some broad patterns of geographical and chronological distribution are fairly clear. There can be little doubt that the areas north and west of Lake Onega were the centre of early metal extraction, production and use in north-eastern Europe during both the RPW/TCW and AOW phases. The copper found in other Neolithic sites in eastern Fennoscandia most probably derives from the Lake Onega region, although the influence and import from the Volga–Kama region is also possible during the AOW phase. The resolution of the available chronological data is unfortunately limited, but it seems that the number of metal finds increases in the second half of the 4th millennium BC, when hot working of copper was also introduced (cf. Zhul´nikov 1997, 145 ff.; 1999, 66). The amount of copper decreases sharply again in the course of the first half of the 3rd millennium BC and remains on a very modest level until the end of the Stone Age. The changes in the amount and frequency of copper items, as well as in the utilized technology and the properties of objects, obviously relate to changing meanings of and significance attributed to the metal, but such considerations are, unfortunately, beyond the scope of this paper.

Note: after finishing the article, elemental analyses (pXRF) conducted on some of the copper finds revealed that the metal sheet from Jettböle is, in fact, bronze and therefore cannot be connected with Stone Age habitation, but with later human activities at the site (the results of the analyses of copper samples will be discussed in detail in a separate article by the current authors).

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ÜLEVAADE NEOLIITILISEST VASEKASUTUSEST PÕHJA-EUROOPAS

Resümee

Fennoskandia idaosa erinevatest arheoloogilistest kontekstidest on kogutud 4. ja 3. aastatuhandest pärinevaid vaskesemeid, mille näol on tegemist varaseima metallikasutuse ilmingutega Põhja-Euroopas. Peamiselt nüüdse Karjala Vabariigi (Venemaa) ja Soome territooriumile jäävalt alalt on praeguseks teada ligikaudu 30 muistist, kokku on leitud üle 180 vaskeseme. Leidude hulgas domineerivad vasekamakad, lehtmetallitükid ja määramatud metallikänkrad, ent on teada ka väheseid ehteid ning pisikesi tööriistu. Varase vasekasutuse keskuseks oli Äänisjärve põhja- ja läänerannik Karjalas, kus looduslik vask oli hõlpsasti kättesaadav.

Neoliitilise metallikasutuse võib uurimispiirkonnas jagada kahte faasi. Neist esimene, 4. aastatuhandel eKr alguse saanud periood, on seostatav romblohk-keraamikat ja tüüpilist kammkeraamikat valmistavate rühmadega. Metallide kasutuselevõtt sel perioodil näib olevat kohalik innovatsioon, mille käigus asuti koguma ja enda tarbeks ära kasutama Äänisjärve ääres looduslikult pinnases leiduvaid vasekogumeid. Väljastpoolt lähtuv otsene mõju esialgsele metallide kasutuselevõtule on vähetõenäoline. Teine faas algas asbestkeraamikat ja suure orgaanikasisaldusega keraamikat kasutavate rühmadega 4. aastatuhande teisel poolel eKr

ning on seostatav väljakujunenud metallurgiatehnoloogia vastuvõtmisega, mis hõlmas vase sulatamist ja kuumtöötlust. Teise faasi arengud olid kahtlemata sõltuvad välistest mõjudest, mis lähtusid Volga-Kama piirkonda asustanud Volossovo ja Garino-Bori rühmade praktiseeritud metallurgiast. Viimane omakorda oli selgelt mõjutatud stepialade tehnoloogiast.

Vase kasutuselevõtu taga ei tohiks näha pelgalt praktilisi tehnoloogilis-majanduslikke põhjusi. Ilmselt olid olulised ka vase tunnetuslikud omadused ja metallidega üldiselt seostatavad sümboolsed ning metafüüsilised kontseptsioonid. Põhja-Euroopa neoliitikumis viitab arheoloogiline materjal sümboolsete väljendusviiside kasvule ja variatsioonirohkusele neoliitikumis. Selle taustana võib näha Äänisjärve piirkonna laiemat neolitiseerumise protsessi, mille käigus toimusid sügavad muutused inimeste ja ümbritseva maailma vahekorras. Teisisõnu, vase ja metallide varast kasutamist tuleks vaadelda olulisemate muutuste raames inimeste elu-ning mõtteviisides, aga mitte kui isoleeritud kurioosumit.