



Kerkko Nordqvist & Teemu Mökkönen

PÖLJÄ WARE: PROPERTIES, DATING AND REGIONAL VARIATION

Abstract

This paper presents and discusses the characteristics of Pöljä Ware (dated between 3300 and 2500 cal BC) from eight sites located mainly in the lake district of Finland. Despite general similarities, the assemblages show both stylistic (decoration) and technological (temper) trends that reflect the different cultural and natural conditions in the northern and southern parts of Lake Saimaa. Pöljä Ware has closely resembling material in the asbestos- and organic-tempered ceramics of the Karelian Republic (particularly late Orovnavolok Ware) and belongs to the same techno-stylistic and chronological horizon as the Volosovo-related cultural units of northern European Russia. The use of asbestos parallels the accelerated use of organic tempers, both associated with possible new uses of pottery vessels and the requirements placed on them.

Keywords: Stone Age, asbestos- and organic-tempered pottery, ceramic technology, Pöljä Ware, Finland

Kerkko Nordqvist, Department of Cultures, P.O. Box 59, 00014 University of Helsinki, Finland: kerkko.nordqvist@helsinki.fi

Teemu Mökkönen, Finnish Heritage Agency, P.O. Box 913, 00101 Helsinki, Finland: teemu.mokkonen@museovirasto.fi

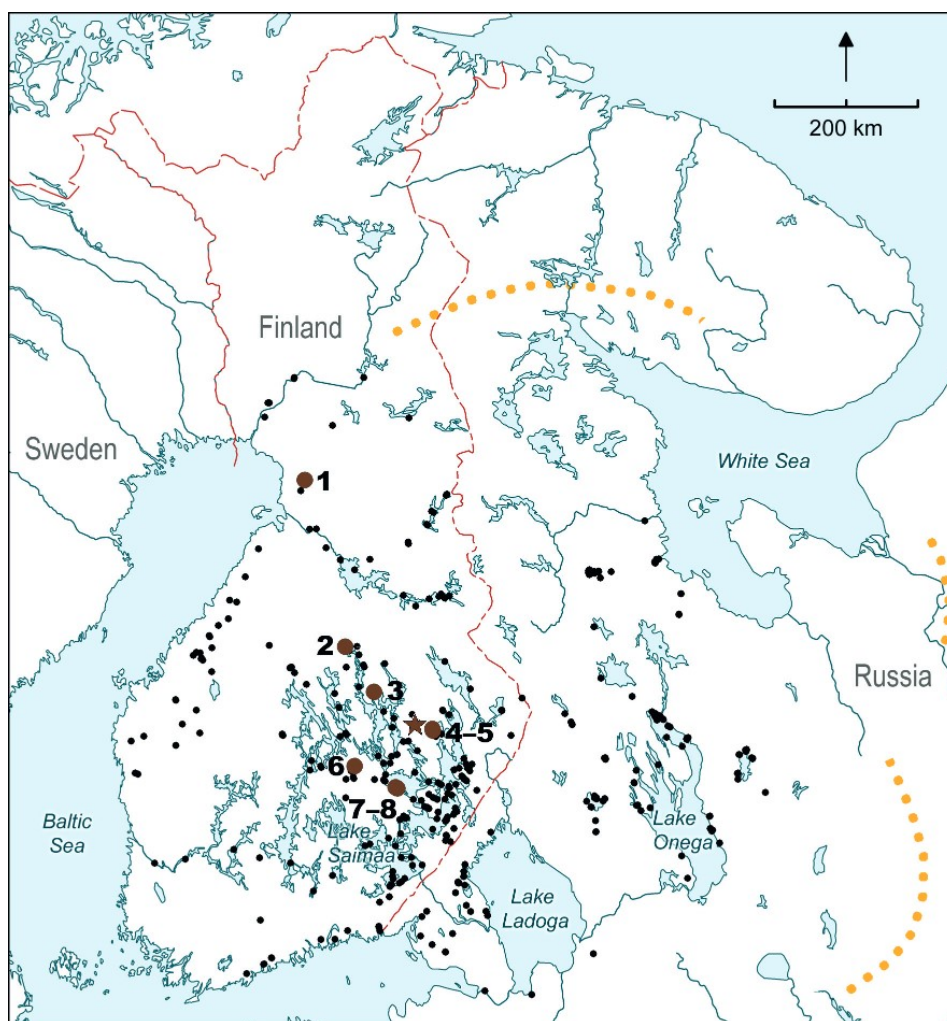
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INTRODUCTION

The introduction of ‘Asbestkeramik vom Pöljä-Typ’ by C. F. Meinander in 1954(a) was an important addition to knowledge about the Stone Age of the Finnish inland, which at that time was tenuously studied. The national narrative of pre-history had been constructed from a coastal perspective, and the eastern and northern parts of Finland remained in many respects uncovered. Based on current knowledge, Pöljä Ware and other asbestos- and organic-tempered potteries characterise the archaeological image of large territories in north-east Europe, starting from ca. 3600 cal BC (see Tarasov et al. 2017; Mökkönen & Nordqvist 2018).

‘Pöljä-Typ’ came to stay, but the tentative nature of Meinander’s brief description, together with the subsequent emphasis on an inward-bent rim list (Edgren 1964: 25) as the central defining attribute, led to a typological inconsistency between Pöljä and Kierikki Ware, the second asbestos pottery type associated with this period (Siiriäinen 1967). This issue of vague and asymmetric definitions is mentioned repeatedly in Finnish research literature (Carpelan 1979: 14; Siiriäinen 1984: 32; Lavento 1992: 29–30; Ikäheimo 1998: 47–8; Pesonen 2004: 92; Mökkönen & Nordqvist 2018: 93), but what ‘Pöljä Ware’ or ‘the Pöljä group’ really means or what context it belongs to is rarely explicitly discussed. The few papers on the topic

Figure 1. The analysed sites: 1 – Korvala, 2 – Jysmä, 3 – Pöljä, 4 – Laavussuo, 5 – Sätös, 6 – Tahinniemi, 7 – Pirskanlahti b, 8 – Ritokangas. The Paakkila Tuusniemi asbestos source in Outokumpu is marked with a star. Sites with Pöljä and Orovnavolok Wares in Finland and the Karelian Republic and on the Karelian Isthmus (Russia) are marked with dots, the dotted line being the approximate limit of occasional occurrences of the corresponding asbestos pottery further north and east (amended after Zhul'nikov 1999; 2005; 2006; Gerasimov et al. 2019; Pesonen et al. 2020). (Illustration: Kerkko Nordqvist.)



focus rather on small assemblages and individual sites (Edgren 1964; Purhonen 1973; Rähälä 1996; Miettinen 2007; see also Joensuu 2000; O’Ceallacháin 2014).

This paper presents Pöljä pottery assemblages from eight sites in Finland (Fig. 1, Table 1, Appendix 1). It introduces their characteristics and evaluates how the material corresponds to the previous understanding of Pöljä Ware, although due to its starting point and the methods used, the article cannot present solutions based on numerical taxonomy. The chronological framework is briefly discussed with the addition of 18 new dates (Appendix 2) (see Mökkönen & Nordqvist 2018: Table I; Nordqvist 2018: Table 2). Thereafter, Pöljä Ware is placed within the broader framework of asbestos- and organic-tempered pottery traditions in the forest zone. This paper forms a sequel and can also be read in tandem with our earlier work (Mökkönen & Nordqvist 2018) focusing on Kierikki Ware

in the milieu of 4th and 3rd millennium cal BC north-east Europe.

RESEARCH HISTORY

Asbestos-tempered pottery with properties corresponding to Pöljä Ware was first described in the early 20th century in eastern and northern Finland and on the Karelian Isthmus (Ailio 1909: 83; Tallgren 1914; Pälsi 1918: 32; 1920: 159–60). In 1928, Sakari Pälsi excavated at the eponymous Pöljä site in Siilinjärvi, in the northern part of the Finnish lake district (Fig. 1: 3), but he never published his results. ‘Asbestkeramik’ (Europaeus-Äyräpää 1930: 208) received only brief mentions until the 1950s, when C. F. Meinander (1954a: 162–5; also 1952: 34) used the Pöljä assemblage, at that time the only known material not mixed with other pottery types, and introduced the ‘Pöljä-Typ’ (Table 2).

Table 1. Sites, excavated areas and materials included in this study (research reports are archived by the Finnish Heritage Agency, Helsinki). KM – collections of the National Museum of Finland. Numbering refers to Fig. 1.

No	Site	Excavations (included areas)	KM	Area (m ²)	Pöljä Ware (pcs / g)	pcs /m ²	g/m ²	Site type: excavated context
1	Korvala	H.-P. Schulz 2000 (area 9)	32134: 1-2267	176	368 / 608.3	2.1	3.5	settlement site: pithouse (row house)
2	Jysmä	T. Edgren 1965 (areas 1-2, test pit 1)	13944: 1-73	166	326 / 1528.5	2.0	9.2	settlement site
3	Pöljä	S. Pälsi 1928 (areas I-II)	8981: 1-37	100	280 / 1180.2	2.8	11.8	settlement site
4	Laavusuo	T. Karjalainen 1996 (main area)	29556: 1-2334	111	11,189 / 9848.3	100.8	88.7	settlement site: pithouse
5	Sätös	T. Karjalainen 1998 (area 1)	30892: 1-2591	92	5908 / 12,729.0	64.2	138.4	settlement site: pithouse
6	Tahiniemi	T. Jussila 1985-6 (areas 1-5)	22955: 1-374, 23445: 1-499	211	1297 / 2233.2	6.1	10.6	settlement site: pithouse + settlement
7	Pirskanlahti b	T. Karjalainen 1998-9	31389: 1-626, 32004: 1-2283	157	3186 / 3899.4	20.3	24.8	settlement site: pithouse
8	Ritokangas	T. Karjalainen 1997 (area 1)	30771: 1-512	85.5	138 / 460.0	1.6	5.4	settlement site: pithouse

In Meinander's (1954a) monograph, Pöljä Ware is a superficially described inland offshoot in a study devoted to the coastal Stone Age. The adoption of the Γ-shaped rim as a key feature of Pöljä vessels (Edgren 1964: 25; Purhonen 1973: 25; Huurre 1986: 150), together with the equally problematic description of Kierikki Ware (Siiriäinen 1967), resulted in two seemingly contrasting but simultaneously loosely defined and even overlapping units. At this point, 'asbestos potteries' included also the so-called Jysmä Ware (Edgren 1964: 25; Carpelan 1979: 15), which, according to present opinions, is nonetheless pottery that belongs to Pöljä Ware (Nordqvist 2018: 107).¹ In addition, all these wares are preceded by earlier asbestos-tempered ceramics (i.e. asbestos-tempered Sperrings 2 Ware and Kaunissaari Ware; Pesonen 1995; 1996), which represent the earliest and currently the only systematically defined phase of Stone Age asbestos temper use in Finland.

In the 1980s, only about 30 sites with Pöljä Ware were known (Edgren 1992: 104). The situation changed in the 1990s due to increased

research activity in eastern and northern Finland, often financed by state employment programmes during the recession (see Pesonen 2002: 19; Mökkönen 2011: 12). Fieldworks resulted in the discovery of a new kind of inland Stone Age (see e.g. Ranta 2002) and also multiplied the number of known Pöljä sites. So far only a small part of the pottery material produced in these fieldworks is reviewed in detail (Räihälä 1996; Joensuu 2000; O'Ceallacháin 2014; this study), and, in general, the concepts and problems of asbestos- and organic-tempered potteries are relatively little scrutinised in Finland. This contrasts with north-west Russia, where asbestos- and organic-tempered pottery was also discovered and initially described during the 20th century (Gurina 1951: 134-6; 1961), and where this material has been largely systematised over the past decades (Zhul'nikov 1991; 1999; 2005; see also Gerasimov et al. 2019).

Table 2. Descriptions of Pöljä Ware by different archaeologists.

	Europaeus-Äyräpää (1930)	Meinander (1954a)	Edgren (1964)	Purhonen (1973)	Carpelan (1979; 1999*)
Name	Asbestos ceramics	Pöljä	Pöljä (and Jysmä)	Pöljä	Pöljä and Jysmä
Temper	Asbestos	Asbestos (generous, long fibre)	Asbestos (short and long fibre), also other (organic)	Asbestos (short and long fibre, generous), also organic (bone), talc, mica, sand	Asbestos, also organic (feather, hair; Jysmä)
Shape/size	Thin	Large, non-profiled, thin	Thin	Large, non-profiled	Simple, straight forms, also profiled with 'reduced' orifices, rim lists may have pointed upwards
Rims	Inward-bent	Often inward-bent list	Often inward-bent list, also straight (Jysmä: T-shaped rim); decorated or undecorated	Inward-bent list or inward curving	Inward-bent rim or rim list (Jysmä: T-shaped rim), also inward curving or thickened
Bottom	-	Round, occasionally flat	Flat	Round, occasionally flat	Round (Jysmä: flat)
Decoration	Wide comb or wound cord stamps; also undecorated	Wound cord, comb and other stamps in horizontal lines, careless appearance; also undecorated	Wound cord, comb stamp, drawn lines and stamps in horizontal rows, vertical zig-zags (rarely geometric); careless appearance; sometimes only upper part (rim) decorated (Jysmä), also undecorated	Wound cord, comb and other stamps, in horizontal rows, vertical zig-zags; careless appearance; covers whole surface; 1/3 decorated, 1/3 undecorated	Comb and wound cord stamps, in horizontal rows with altering directions or vertical zig-zags; loosely applied (Jysmä: sparse decoration, maybe only at the rim, also undecorated)
Surfaces	-	Undecorated hatched; also smoothed	May be striated or hatched	1/3 horizontal hatching (may be on both sides)	-
Other	-	Once a textile impression	Coiling (long u-joints)	Once a textile impression; coiling (long, forked u-joints)	(Jysmä: occasional textile impression)

* C. Carpelan, pers. comm. A lecture on Stone Age pottery given on the course 'Prehistoric artefacts', University of Helsinki, 12 February 1999.

DISTRIBUTION AND CHRONOLOGY

Distribution of Pöljä Ware is highlighted in the eastern and central Finnish lake district, but it occurs up to the Arctic Circle, and sites can also be found on the southern coast and in Ostrobothnia. Altogether, Pöljä Ware is currently known from approximately 250 locations in Finland (Fig. 1). Additional finds have been made at about 20 sites on the Karelian Isthmus and closely corresponding material – organised according

to a different typology (Zhul'nikov 1999) – is widely present elsewhere in north-west Russia. Few typologically ambiguous finds of asbestos- and organic-tempered pottery, possibly reflecting eastern influences during this time period, are recorded in coastal Norrland, Sweden (see Lindholm et al. 2007; Norberg 2008: 107; also Hallgren 2008: 265–6).

Based on shore displacement chronology and Finnish pottery typology, Meinander (1954a: 161; 1954b: 203) dated Pöljä Ware partly

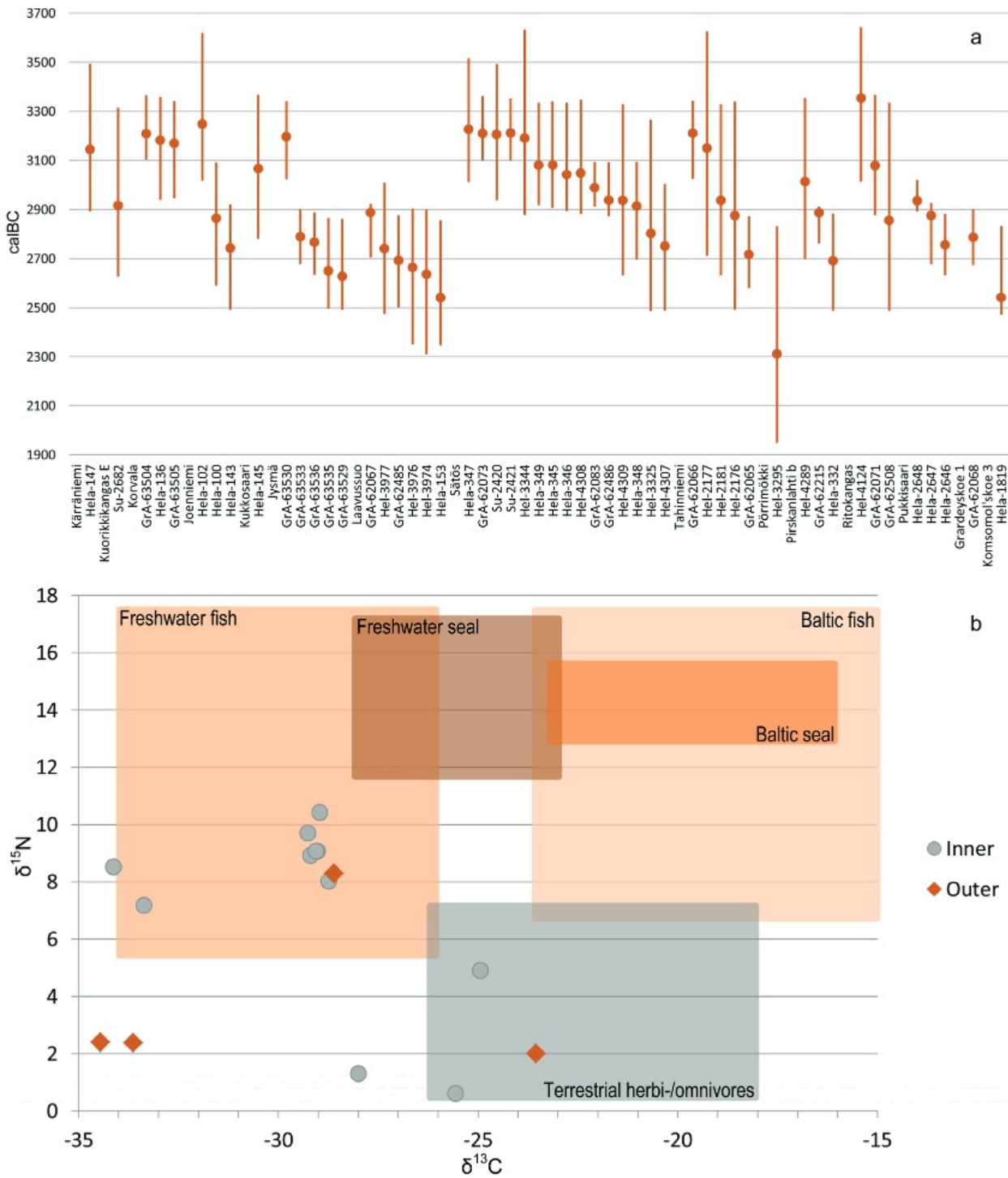


Figure 2. a) Radiocarbon datings of Pöljä Ware arranged geographically from north to south (left–right), the lines give the calibrated value with 95.4% probability (for data, see Appendix 2); and b) bulk stable isotope values ($\delta^{13}\text{C}$: $\delta^{15}\text{N}$) of surface deposits dated in this study and the approximate values of various prey animals (for data, see Etu-Sihvola et al. 2019; Mökkönen & Nordqvist 2019); different symbols mark samples taken from different surfaces of the vessel (birch bark tar excluded).

synchronous with Pyheensilta and Corded Wares (also Europaeus-Äyräpää 1930: 208), partly with Kiukainen and Textile Wares. Subsequent

studies adjusted its position in relation to other pottery types (Siiriäinen 1967: 32–4), but the broad typo-chronological position remained

the same and was summarised by Christian Carpelan (1999: 273; also 1979: 11), who dated Pöljä-Jysmä Ware ca. 3100–1900 BC.

Today more than 50 radiocarbon dates can be associated with Pöljä-related finds and structures (Fig. 2a, Appendix 2). Most of them are obtained from charred residues on pottery (29 pcs) or wood charcoal (including charred birch bark; 18 pcs). Modelling all of these dates as a single phase (OxCal 4.4.2) yields boundaries whose medians, ca. 3300–2500 cal BC, can be suggested as an approximate timeframe for Pöljä Ware.²

The development of a radiocarbon chronology of the Finnish Stone Age has repositioned Pöljä Ware in two ways. First, it is not directly contemporary with Corded Ware (ca. 2900 cal BC onwards), but predates it by several centuries. The second point is the early termination of Pöljä Ware compared to the traditional periodisation (also Pesonen 2004: 92). Some context dates of charcoal falling within the gap between 2500 and 1900 cal BC are presented in the literature (Leskinen 2002; Halinen et al. 2008; also Pesonen 2004), but none of these samples can be associated with undisputable Pöljä pottery. The corresponding ceramics in the Karelian Republic have a nearly analogous end date (see Tarasov et al. 2017: 108).

Could age differences be the result of reservoir effects in crust dates? Bulk stable isotopes ($\delta^{13}\text{C}$, $\delta^{15}\text{N}$) are measured (isotope-ratio mass spectrometry, IRMS) only for samples dated during the present work (Appendix 2). All but one of the studied sites (Korvala) are located in non-marine aquatic settings and also most of the crust samples correspond to the isotopic values for freshwater sources (see Etu-Sihvola et al. 2019 and Fig. 2b). Many of the samples indicating non-aquatic or low trophic level composition come from deposits sampled from the outer surface of sherds, supporting the view that these (*contra* foodcrusts on the inner surface) reflect not only the contents of the pots but also the fuel wood used (see Mökkönen & Nordqvist 2019: 822–4). Even if freshwater reservoir effect is assumed to be quite small in Finland (Pesonen et al. 2012: 665; but see Pesonen 2021: 51), local fluctuations cannot be excluded and the results need to be accepted with margins of uncertainty (Etu-Sihvola et al. 2019: 1008). However, since

foodcrusts are not systematically the oldest samples, and since site-level variation can also result from their recurrent use, the cause of the gap between the new radiocarbon dates and traditional periodisation may be an incomplete archaeological understanding of the period, not only freshwater reservoir effect.

MATERIAL

Qualifications

The analysed materials derive from seven settlement sites located in the lake district of Finland, and one site in Northern Ostrobothnia (Fig. 1, Appendix 1). Single component sites and unmixed contexts, investigated using adequately modern and accurate excavation methods, find recovery (sieves) and documentation, were selected to ensure maximum representativeness of the assemblages. All analysed materials were obtained during excavations of housepits, with the exception of the Pöljä³ and Jysmä sites, which despite differing methodological criteria, were included because of their research historical significance.

The sherds were inspected with the naked eye and certain technological and morphological variables were tabulated (see Appendix 1 and below). Altogether 22,690 pieces of Pöljä Ware weighing 32,490 g were inspected during the research (Table 1, Appendix 1). Pieces with at least one dimension greater than 3 cm were included in further analysis, totalling 1650 pcs (ca. 7% of all inspected) and 17,610 g (54%). These figures already show that Pöljä Ware frequently crumbles and flakes into small pieces, missing one or both surfaces.

Numerical classification methods are not applied in this study, since it was impossible to divide the fragmentary material into vessels within the time available for the analysis. Still, it can be estimated that the smallest assemblages consist of maybe two or three vessels, while the largest are likely to contain sherds of dozens of pots and cups. For analytical purposes, assemblages are arbitrarily divided into three classes – small (<500 g; Korvala, Ritokangas), medium (500–1500 g; Jysmä, Pöljä, Tahinniemi, Pirskanlahti b) and large (>1500 g; Laavussuo, Sätös) – of

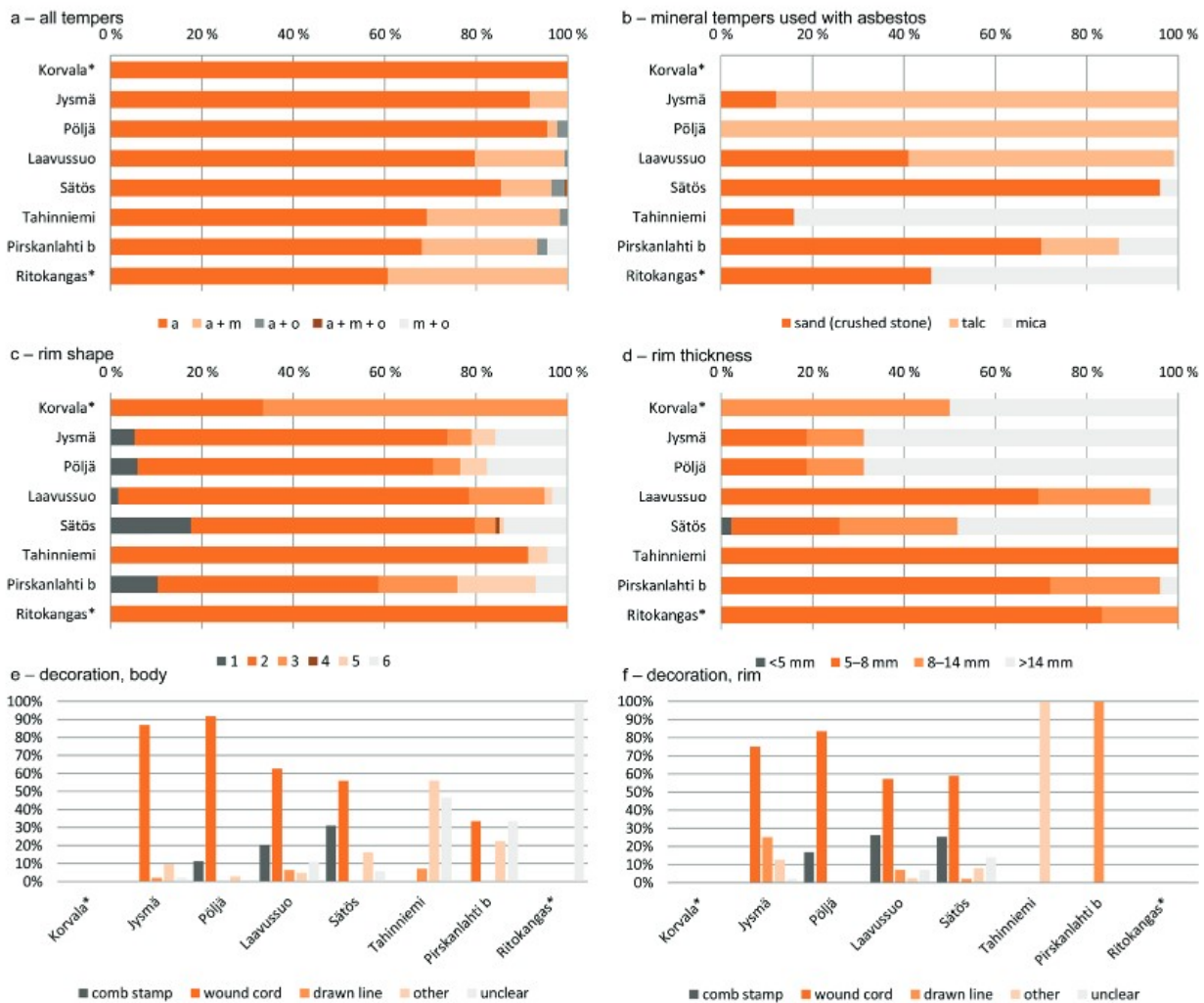


Figure 3. a) All tempers (a – asbestos, m – mineral (other), o – organic); b) percentages of the additional minerals in sherds combining asbestos and other mineral tempers (class a+m in graph 3a); c) rim shapes (1 – not thickened (straight or rounded), 2 – inward-bent (list), 3 – inward thickened, 4 – outward thickened, 5 – in- and outward thickened, 6 – unclear); d) thickness of the rim sherds; e) decoration elements on the body; f) decoration elements on the rim sherds. The sites are arranged geographically from north to south (left–right), small materials (total weight <500 g) are marked with an asterisk.

which medium and large are emphasised below in the discussion.

Qualities

Asbestos is the most common *temper*, and the only admixture in 60–100% of sherds (Fig. 3a). The use of long fibres (here >15 mm) is considered characteristic of Pöljä Ware (*contra* Kierikki; e.g. Meinander 1954a: 162; Edgren 1992: 107) and is present at all sites. At the same time, the mineral is also often cut into short fibres and crushed into coarse pieces, and the

amount of asbestos can occasionally be very meagre. Other mineral tempers used together with asbestos vary from place to place, and their proportion generally increases at the southern sites. These tempers include sand (with crushed stone), talc (especially at the northern sites) and mica (especially at the southern sites) (Fig. 3b).⁴ Organic temper is recorded at five sites. Its precise definition can rarely be made with the naked eye, but at least crushed bone (Laavussuo, Sätös, Pirskanlahti b) and hair (Sätös) are present.

The inward-bent *rim* or rim list (Figs. 3c; 4a–g, p), which many see as the most characteristic

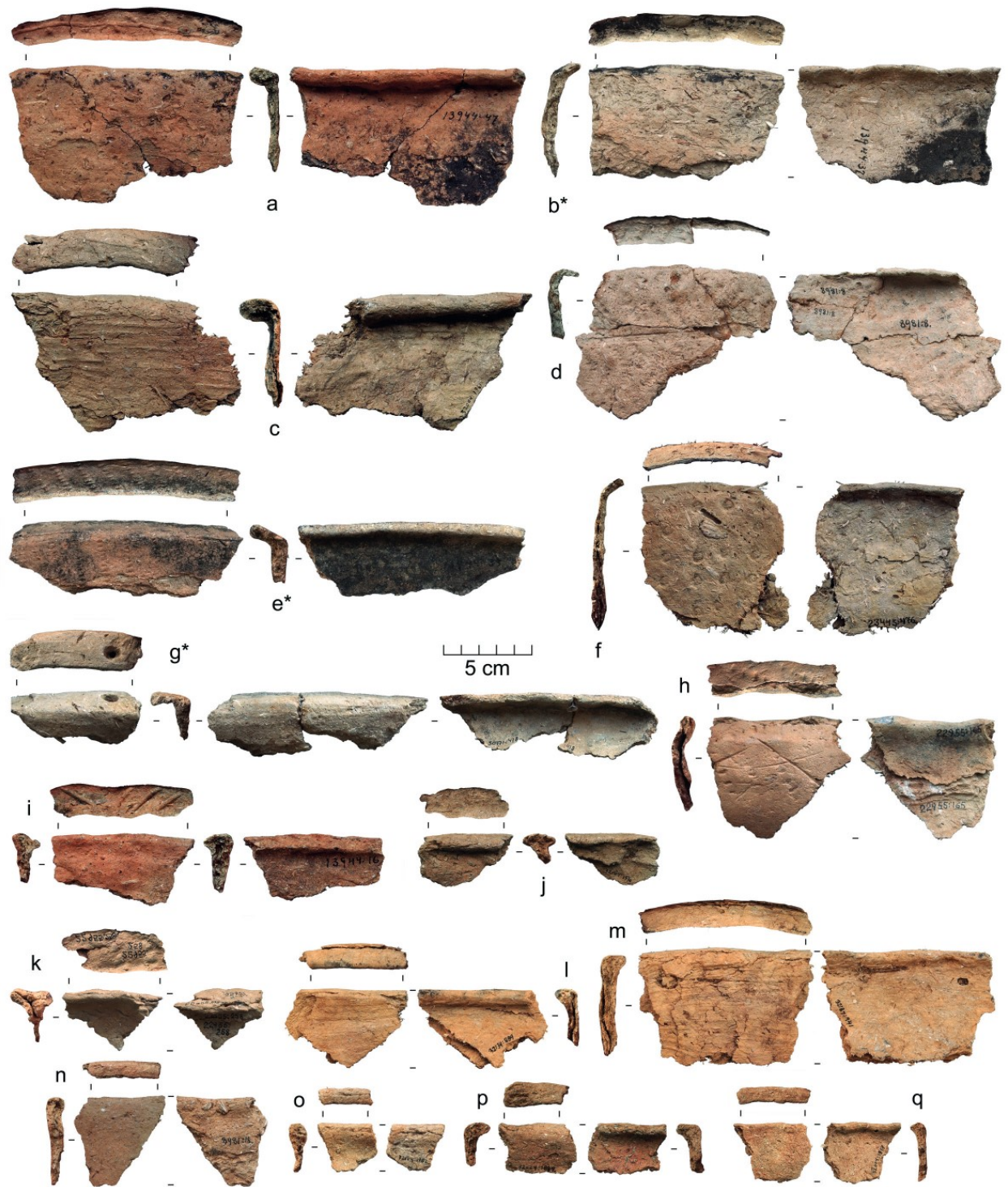


Figure 4. Rim sherds from analysed assemblages: a – KM 13944: 47; b – KM 13944: 37*; c – KM 32004: 1961; d – KM 8981: 8; e – KM 13944: 37*; f – KM 23445: 476; g – KM 30711: 415 + 418*; h – KM 22955: 165; i – KM 13944: 16; j – KM 32004: 1930; k – KM 22955: 258; l – KM 32134: 889; m – 32134: 941; n – KM 8981: 17; o – KM 32004: 1982; p – KM 32004: 1892; q – KM 32004: 1917. a, b, e, i – Jysmä; c, j, o, p, q – Pirskanlahti b; d, n – Pöljä; f, h, k – Tahinniemi; g – Ritokangas; l, m – Korvala. Dated sherds are marked with an asterisk. (Photos: Teemu Mökkönen, illustration: Kerkko Nordqvist.)

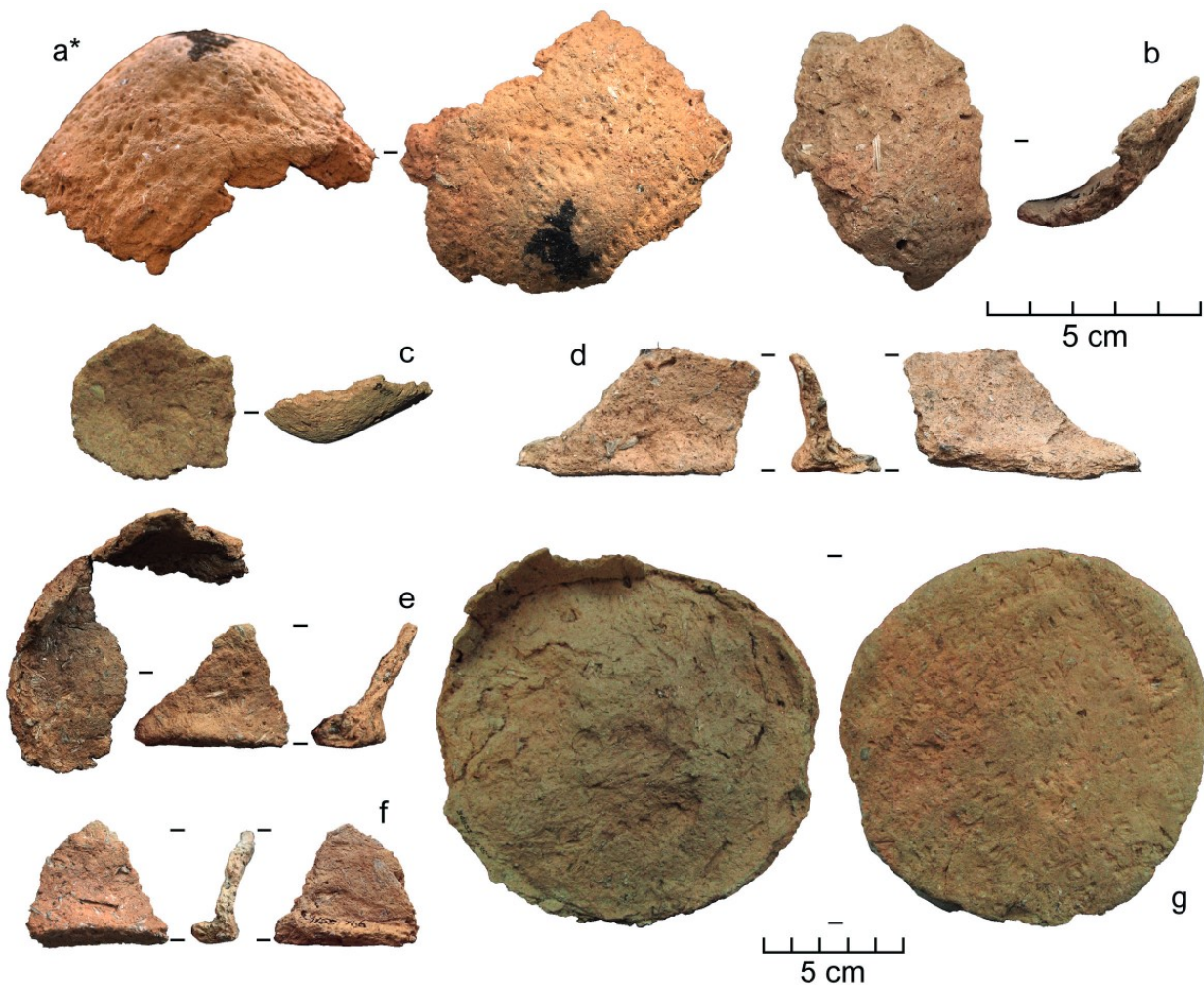


Figure 5. Bottom sherds from analysed assemblages: a – KM 29556: 481*; b – KM 8981: 32; c – KM 30892: 1128; d – KM 8981: 4; e – KM 29556: 961–82; f – KM 25556: 776; g – KM 30892: 1275. a, e, f – Laavussuo; b, d – Pöljä; c, g – Sätös. Dated sherds are marked with an asterisk. (Photos: Teemu Mökkönen, illustration: Kerkko Nordqvist.)

feature of Pöljä Ware, is the most common rim shape in all assemblages (ca. 60–90%). The rest of the rims are usually thickened inward (occasionally outward), and sometimes slanted, but also simple straight and rounded shapes are found (Fig. 4h, l, m–o, q). T-shaped rims are few and are rather thickenings than lists (Fig. 4i–k).⁵

The difference between a thickened rim and a rim list is not straightforward, especially when the list is moulded straight out of the wall by bending the topmost coil inward. The list is occasionally folded back again, making the inner edge straight or rounded and slightly plump. Another way to form the list is to add a separate coil to the rim; the material includes numerous such broken lists that can be mistaken for

simple straight rims or joint pieces. Most often the angle between the list and the wall is ca. 90°, followed by folds up to 130°, while curved lists are rare. Nevertheless, variations in shape and dimension can be large, even within individual sherds. In many cases, a shallow groove is visible under the rim and on the uppermost joint on the outer surface, which is probably connected to the moulding process (also Edgren 1964: 20; Purhonen 1973: 26).

Wall *thickness* is usually 5 to 8 mm (ca. 85–95%), with the exception of Sätös, where one third of the body sherds is <5 mm. Rim thickness at the southern sites is also usually 5–8 mm, whereas wide rim lists (over 14 mm and up to 24–6 mm) are more numerous at the northern



Figure 6. Various surface treatments for Pöljä pottery: a – KM 32004: 2116; b – KM 30771: 107; c – KM 29556: 1636; d – KM 30771: 22. a – Pirskanlahti b; b, d – Ritokangas; c – Laavussuo. (Photos: Teemu Mökkönen, illustration: Kerkko Nordqvist.)

sites (Fig. 3d). The bottom is usually the same thickness or slightly thicker than the walls.

Other *dimensions and shapes* are hard to determine. Not a single Pöljä vessel is reconstructed, but they are often called large. The present material includes vessels with an estimated mouth diameter from <5 to 60 cm. The body shape appears simple, but a small number of sherds indicates a weak profiling in the upper part of some vessels (Sätös, also Laavussuo, Pirskanlahti b, Tahinniemi). The *bottoms* are either round (rarely almost pointed) or flat (Fig. 5). The diameter of the latter is 8–16 cm, and some of them have a small foot (Fig. 5d–f). Correlation between the different rim and the bottom shapes and other dimensions cannot be shown based on the current material.

The percentage of *decorated sherds* varies greatly and indicates that some of the vessels were not ornamented. Rim top decoration correlates positively with the presence of wall decoration and both are usually done with the same tool (Fig. 3e–f); only the rounded rims are always undecorated. The bottoms of all shapes can be ornamented, although most of them are not (63%).

Decoration is located on the outer surface and the most common elements are wound cord and comb stamps. Rough surfaces and temper often make the decoration shallow and unclear, and ‘comb stamps’ also include imitations made with other tools. Wound cord dominates at the northern sites, whereas other elements – including ring, cord, stick, nail, and bone stamps and impressions – become more common towards the south and exhibit site-specific trends (also Edgren 1964: 27) (Fig. 3e–f). No pits are present.

The decoration on each sherd is typically done with a single instrument, possibly reflecting the ornamentation of the entire pot. The compositions are generally loose and commonly consist of vertical zig-zags of wound cord but also comb stamps. Horizontal motifs, rows of diagonal or vertical stamps or drawn lines, are also found, but other patterns such as crosses, lattices or horizontal zig-zags are rare. This lack of ‘geometric precision of Typical Comb Ware’ (Meinander 1954a: 165; also Edgren 1964: 23; Purhonen 1973: 30) led to the decoration being judged sloppy, although such a judgement purely reflects modern aesthetics.

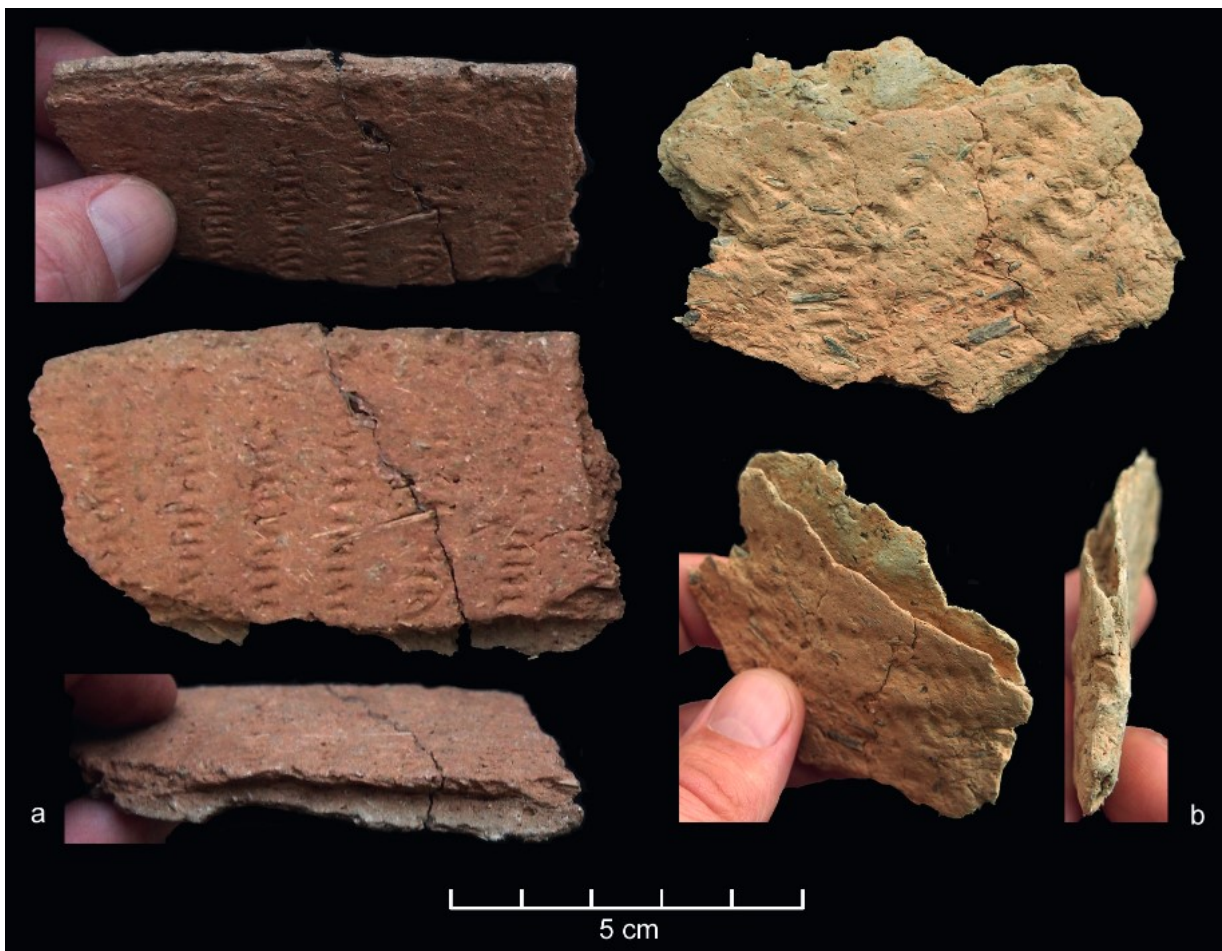


Figure 7. Coils and joints typical of Pöljä Ware: a – KM 13994: 28; b – KM 29556: 1240. a – Jysmä; b – Laavussuo. (Photos: Teemu Mökkönen, illustration: Kerkko Nordqvist.)

Variation from site to site is also visible in *surface treatment*, present in 10–35% of sherds (excluding small assemblages and the Pöljä site, where about 64% of sherds are treated). Slightly more common on the inner than the outer surface, they usually consist of light sweepings and smoothings, while heavier furrowed hatching is present on max. 16% of the sherds (but on approximately 92% in the small Ritokangas assemblage) (Fig. 6). Treated surfaces and decoration are not mutually exclusive, but the strongly striated (hatched) pieces are always undecorated (also Meinander 1954a: 165). Textile impression, occasionally associated with Pöljä Ware (Meinander 1954a: 162; Purhonen 1973: 28), is absent in the studied assemblages.

The vessels are built by *coiling* together 4–5 cm wide clay belts (Edgren 1964: 20; Purhonen 1973: 23) (Fig. 7). The tops of the coils are usually rounded (even pointed) and many vessels are characterised by deep joints (or forked joints;

Purhonen 1973: 23), when the upper coil noticeably overlaps with the lower one particularly on the inner surface (even 15 mm and more; especially Jysmä, Sätös, Laavussuo, Pirskanlahti b) (Figs. 6a, 7b). Such joints also form weak zones where pots often break. The firing is relatively good, although not always even, and the fabrics may not be very dense.

The occurrence of charred crusts on Pöljä vessels (up to 6% of sherds, but almost 60% in Pöljä) is interpreted as evidence of their use as cooking vessels (Edgren 1964: 20–1; Pesonen 1996: 29). The wear and tear is also implied by holes drilled in the walls, which are likely to represent reparation (Purhonen 1973: 27). However, the occasional perforations made through the rim lists (Laavussuo, Ritokangas, Sätös) must have had a different, yet unexplained function (Fig. 4g).

DISCUSSION

Pöljä Ware in the context of Finnish Stone Age ceramics

Meinander (1954b: 203; also Edgren 1964: 29; Huurre 1983: 153) originally derived Pöljä Ware from Typical Comb Ware, but after the recognition of other kinds of asbestos-tempered pottery, two main lines of succession emerged: development from Typical Comb Ware through Kierikki Ware (Siiriäinen 1967: 34–5; 1984: 32), or descent from the earlier asbestos-tempered potteries (with an emphasis on Kaunissaari Ware; Carpelan 1979: 14; also Pesonen 1996: 21). The present material supports the latter view more, but some features are similar to Typical Comb Ware. Since Typical Comb Ware of the northern Lake Saimaa area – the likely development area of Pöljä Ware – exhibits a certain mixing of local Kaunissaari Ware and incoming Typical Comb Ware traits (Mökkönen et al. 2017: 185), these influences need not be exclusive.

Kaunissaari and Pöljä Wares, whose distribution areas largely overlap in eastern and central Finland, are connected by the use of asbestos, even though the amount and treatment of temper may vary. Both types include exceptionally thin vessels and use a similar coiling technique of deep forked joints with often-wavy edges not known in any other Finnish pottery type (for Kaunissaari Ware, see Pesonen 1996: 29). Morphological similarities include inward thickened rims and rims that gradually widen to a Y-shape, although these are also met in Typical Comb Ware in the Lake Saimaa area. Instead, the Γ -shaped rim list finds isolated parallels only in early asbestos-tempered pottery (e.g. Pesonen 1996: Fig. 8).

The lack of pits and the use of wound cord stamps and vertical zig-zags, characteristic in the north, also link Pöljä Ware to earlier asbestos-tempered potteries (Rankama 1982; Pesonen 1996), while the ornamentation based on other small stamps and impressions, typical for the southern Lake Saimaa area, is closer to the so-called late Comb Ware tradition, both on the coast and in the inland. Instead, morphologically similar flat bottoms are known in Finland only in Corded Ware vessels, even if a few flat bottoms are reported in the preceding coastal

Jäkärälä Ware (Edgren 1982: 27–8). At the same time, Pöljä Ware shares features common to a number of other hunter-gatherer pottery types, such as regular U-joints, plain rims and simple vessel shapes.

The main impediment to assuming a direct development from Kaunissaari Ware to Pöljä Ware is the ca. 500-year gap between their present chronologies (Kaunissaari Ware ca. 4300–3800 cal BC; see Nordqvist & Mökkönen 2017: 81; Pesonen 2021: 65). Even if some linking traits (including the occasional use of asbestos) are present in the Typical Comb Ware of the northern Lake Saimaa area, a transitional agent is still absent. ‘Proto-Pöljä’ pottery (Räihälä 1996: 101–3), suggested to mark the transition from late Typical Comb Ware to Pöljä Ware, is yet rather hypothetical unit that cannot be safely placed in the puzzle. Neither Kierikki Ware, in itself ambiguous and small in numbers even compared to Pöljä Ware (Mökkönen & Nordqvist 2018: 98–9), can be reasonably attributed this role. Finally, even if this chapter discusses local (Finnish) parallels, it should be remembered that contacts elsewhere, especially to the east, influenced development in the Lake Saimaa area (see below).

The internal chronology of Pöljä Ware is another unresolved issue. The so-called Jysmä Ware was previously considered to follow Pöljä Ware or to constitute its final phase (Edgren 1964; Carpelan 1979: 15). This is not supported by the presently available datings of the assemblages with ‘Jysmä features’ (T-shaped rim, but also a flat bottom and organic admixture), which are also common in the parallel types of north-west Russia (see Zhul’nikov 1999: 45–55; Tarasov et al. 2017: 106–9). The observed differences may be site-specific and regional, not necessarily temporal. As seen in the present material, particular technological or stylistic variables can vary enormously from site to site, but in general, ‘classic Pöljä’ (*sensu* Meinander) is more common in the northern lake district and other features are emphasised in the south. Differences due to local cultural traditions and the direction of water routes are also evident, for example, in the case of Ostrobothnia (Miettinen 2007: 38) or Kainuu, north-east Finland (Huurre 1983: 153–4), of which the latter often shows similarities with the Russian material.

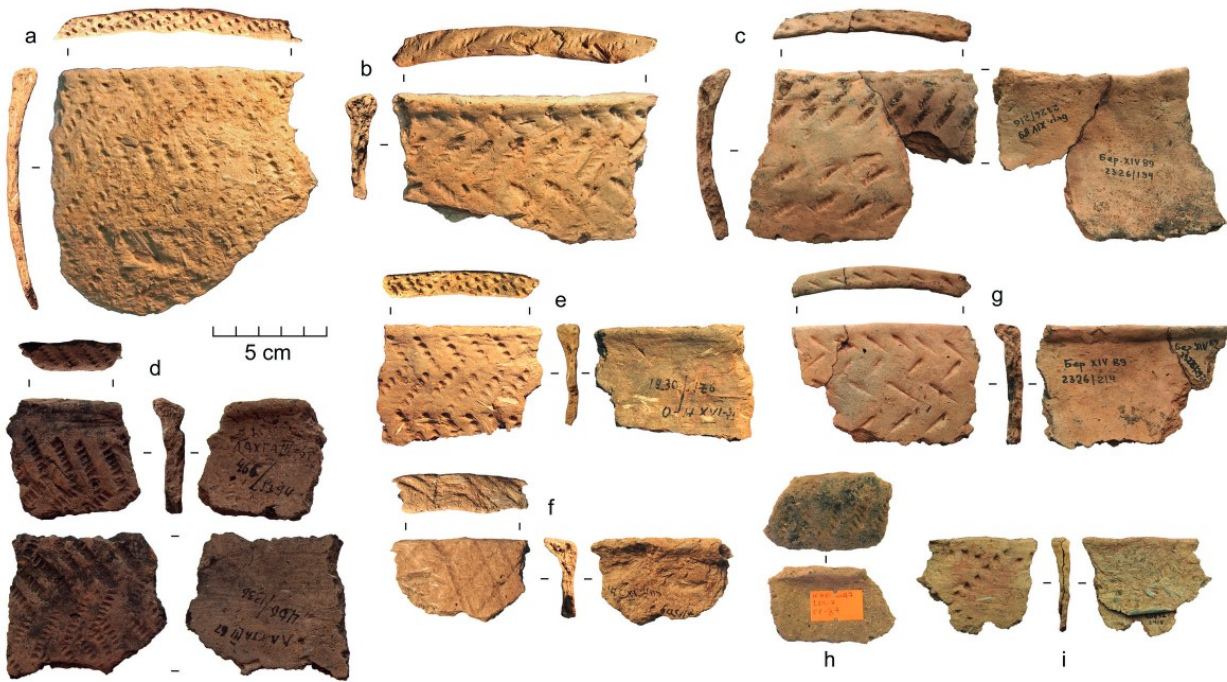


Figure 8. Orovnavolok Ware from north-west Russia (a–h), and a sherd (i) possibly imported from Karelia to the northern Lake Saimaa area: a – AM 1230/174; b – AM 1230/266; c – AM 2326/194 + 216; d – AM 446/1394 + 1336; e – AM 1230/176; f – AM 7/1509; g – AM 2326/214; h – MAE Г1-87; i – KM 30892: 2415. a, b, e – Orovnavolok XVI; c, g – Berezovo XIV; d – Lakhta III; f – Solomennoe VIII; h – Gvardeyskoe I; i – Sätös. AM – collections of the Archaeological Museum of the Institute of Language, Literature and History, Karelian Research Centre of the Russian Academy of Sciences; MAE – collections of the Peter the Great Museum of Anthropology and Ethnography, Kunstkamera. (Photos: Teemu Mökkönen & Kerkko Nordqvist, illustration: Kerkko Nordqvist.)

Asbestos, organic tempers and the production of ceramics

Pottery found in the Karelian Republic was paralleled to Pöljä Ware by Meinander (1952: 34; 1954a: 166). Following the classification of Aleksandr Zhul'nikov (1999), the closest match to Pöljä Ware, both typologically and chronologically, is the late Orovnavolok Ware. Even if the Finnish and Russian types are shaped by political and research history (Mökkönen & Nordqvist 2018: 98–9), the boundaries between them are not entirely artificial and do reflect geographically limited local units of a wider technostylistic horizon (Fig. 8).

Similarities between Pöljä Ware and late Orovnavolok Ware are present in the rim and bottom shapes, as well as in the decoration based on simple horizontal and vertical motifs with a lot of undecorated surfaces (see Zhul'nikov 1999: 50; Mökkönen & Nordqvist 2018: 97). Asbestos

and organic tempers are present in both, although the former is particularly emphasised in the Finnish research tradition (see Nordqvist 2018: 106). Even if absent from the present material, Pöljä Ware with organic temper only (hair, feather, bone, plant fibre) is occasionally described from different parts of Finland (Edgren 1964: 29; Mökkönen 2008: 129; Alenius et al. 2013: 4), and especially from Kainuu county (Huurre 1983: 153; 1986: 59; Lavento 1992: 36; 2001: 131).⁶

Since early asbestos-tempered pottery was not fully introduced into research until the mid-1990s (Pesonen 1995; 1996; but see also Pälsi 1920; Carpelan 1979), much of the previous discussion about asbestos innovation is linked to Kierikki and particularly Pöljä Ware. Asbestos use has been commonly explained by the discovery of the physical and technical properties of asbestos fibres, which made it possible to manufacture thin and light vessels with high

durability, impact resistance and heat-isolating properties (Meinander 1952: 34; 1959; Edgren 1964: 22; Carpelan 1979: 19; Huurre 1983: 149). Accordingly, the introduction of asbestos is described as ‘a great technical advance’ (Edgren 1964: 22), where ‘usability, however, supplanted aesthetics’ (Huurre 1998: 133) – indeed, Pöljä Ware was even compared with dried horse manure (Huurre 1998: 133), sodden cardboard or crispbread (O’Ceallacháin 2014: 31).

The parent rock of anthophyllite asbestos usually used in Finnish pots is customarily placed in the Paakkila Tuusniemi area near Outokumpu (Carlson & Meinander 1968; Carpelan 1979: 13; Lavento 2001: 131) (Fig. 1: star), even if asbestos can be found in other outcrops (Aurola & Vesasalo 1954; Hytönen 1999: 55). At the same time, asbestos analysed in the Karelian Republic often belongs to the local actinolite variety (Lavento & Hornytzkij 1996: 64), but in general, the provenience study still requires more effort. Pieces of asbestos are commonly found at settlement sites, and in areas without natural outcrops are already clear evidence of its transportation and exchange at this phase (see also Ikäheimo 1998: 50).

While the adoption of asbestos is emphasised as a local innovation of eastern Finland (Meinander 1959; Pesonen 1996), the use of organic temper in the research area during the 4th millennium cal BC is traced to eastern sources (Carpelan 1979: 14; Huurre 1983: 60; Chalikov 1986: 49; see also Zhul’nikov 1999; 2005). The use of crushed shell, as well as hair, feather, and plant fibre is a characteristic feature of many groups associated with the Volosovo and related cultural units (Oshibkina 1978: 118–9; Kozyreva 1983: 110; Kraynov 1987: 16), which influenced central and northern European Russia. Volosovo pottery was also recognised as a stylistic parallel for Pöljä Ware (Meinander 1954a: 167; 1984: 28; Carpelan 1999: 260), but a fairly young age previously given for it led to considering many of these features a late occurrence in Finland (and therefore associated with Jysmä Ware; Carpelan 1979: 14). Currently, the Volosovo culture is seen to exist since around 3600 cal BC (Piezonka et al. 2013: 68; Macāne et al. 2019: 9), which fully coincides with the emergence of asbestos- and organic-tempered pottery in

the research area – the ‘local’ asbestos use may therefore only present one side of the equation.

The common technological and stylistic traits between Volosovo and asbestos- and organic-tempered pottery are just one evidence of the cultural ties and networks that connected the eastern Baltic area, eastern Fennoscandia and central Russia in the 4th millennium cal BC. Asbestos is also occasionally reported east of Lake Onega (Zhul’nikov 2006), but it never spread widely in Volosovo contexts. Still, the intensified use of the previously locally known asbestos in Finland may have been triggered partly by the same factors that influenced development elsewhere.

Many organic tempers impart similar technological properties to pottery as asbestos minerals (partly also mica and talc) (Ikäheimo 1997: 45) and allow the production of lighter pots and improve their thermal insulation and shock resistance (West 1992: 140–2; Tite et al. 2001: 321–2). Thus, the widespread adoption of these tempers may indicate that the general requirements for pots, and indeed the way they are used, have changed. Organic tempers and asbestos could have been used interchangeably for the same aims (Ikäheimo 1997: 44–5; 1998: 55), which would also make the plain notion of ‘asbestos ceramics’ or ‘asbestos ware’ cherished in the Finnish tradition, but recently also taken up in Russia (Gerasimov et al. 2019), a simplified and one-sided concept. Variation in the use of tempers between different territories, within these areas, and even between different vessels at the same site may reflect different pot usage, the raw material availability or the season of manufacture (Ikäheimo & Panttila 2002: 9–10). This may also reflect socio-cultural choices connected to pottery production and, for example, the meanings associated with tempers. If this is the case, changes in cooking traditions or other vessel use could provide a new direction for future research as one of the potential drivers of cultural change taking place in north-east Europe and European Russia during the 4th millennium cal BC.

The production of asbestos- and organic-tempered potteries described here largely ceases by 2500 cal BC. The use of asbestos lives on in Palayguba Ware, described in Karelia but only rarely in Finland, perhaps for another half a millennium (Tarasov et al. 2017: 109), after which it is picked up in the Textile Ware tradition

(Lavento 2001). However, in many areas, the archaeological trace becomes thin, and cultural development can only be followed with difficulty. In the same way, the final Volosovo culture is inadequately explained, including its timing. The Corded Ware communities that emerge both in the Baltic Sea area and in central Russia in the early 3rd millennium cal BC alter the previous cultural settings and break old links. Various scenarios have been proposed for encounters between these populations (e.g. Carpelan 1999: 266–8; Zhul'nikov 1999: 90; Mökkönen 2011: 63–4), but in many areas, these last hunter-fisher-gatherers of the Stone Age just seem to slip out of our reach. In the current research situation, this is also the lot of the populations producing Pöljä Ware.

CONCLUDING REMARKS

The introduction of Pöljä pottery by C. F. Meinander (1954a) was a short description of limited ceramic material from one site only, just like the preliminary account of the Kierikkisaari assemblage by Ari Siiriäinen (1967). Nevertheless, in subsequent research, these labels, despite all their limitations, began to designate pottery types that characterise an entire phase of prehistory in large areas of north-east Europe. Carpelan's (1979: 9, 14) remark about the provisory groupings and superficiality of descriptions has remained largely valid.

A recent thesis dealing with the Pöljä assemblage from Laavussuo was aptly named *Pöljä, a pottery group or a rim shape?* (O'Ceallacháin 2014) and capsulises a key point concerning Pöljä Ware: the emphasis has often been on a single detail, whereas the larger context has remained obscure. The current paper has taken a closer look at the Pöljä pottery (dated here 3300–2500 cal BC) and its properties based on eight assemblages from Finland. The results reveal fairly clear trends, both stylistic (decoration) and technological (temper), which appear to scale on a north-south axis and reflect, above all, the different cultural environments and networks in the northern and southern Lake Saimaa area.

Based on the present material, Pöljä Ware, even with all its variation, is a more coherent group than the heterogeneous Kierikki Ware

(see Mökkönen & Nordqvist 2018). Still, these two artificial and often juxtaposed classification units need the third class, 'something else', beside them to further stimulate archaeological inquiry. The exploration of inter-regional links and trends of different scales opens up entirely different possibilities for interpretation than the mechanical application of a local template to all material.

On a broad scale, Pöljä Ware is part of a techno-stylistic and chronological horizon, where similar properties are manifested over a large territory in north-east Europe in akin, but still locally peculiar outcomes. Here it is suggested that the increased use of organic tempers in the east finds a technological counterpart in asbestos and organic tempers in the research area, reflecting the need for new kinds of vessels with certain new properties. Thereby, the expansion of asbestos use around the mid-4th millennium cal BC is not a local or isolated phenomenon, but is tightly associated with cultural developments taking place throughout north-east Europe.

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NOTES

¹ It should be emphasised that the majority of material from the Jysmä site was originally also considered to represent Pöljä Ware (Edgren 1964: 25).

² After the revision of the manuscript, a new radiocarbon date of charred crust of Pöljä Ware (KM 37962: 317) was published from the Seinäjoki Isosaari site: 4680±42 BP (Hela-2657;

$\delta^{13}\text{C}$ - 23.20) (Pesonen 2021: Appendix II). This date is not included in the present illustrations or tables, but it is one of the oldest dates obtained for Pöljä Ware so far (3622–3366 cal BC, 95.4% probability) and indicates that its start may be approximately a century earlier than suggested here.

³ The features at the Pöljä site, originally described by Pälsi (1929) as a smoking rack of fish or meat, are suggested to represent a pithouse as well (O’Ceallacháin 2014: 63), but based on the available documentation, neither interpretation can be confirmed.

⁴ Talc and some mica minerals also occur together with asbestos in natural deposits (Aurola & Vesasalo 1954: 30–3), and their visual separation is not always problem-free.

⁵ T-shaped rim, the main characteristic of the so-called Jysmä Ware, is present in Jysmä (1 pc.), Pöljä (1 pc.), Laavussuo (1 pc.), Sätös (1 pc.), Tahinniemi (1 pc.), and Pirskanlahti b (5 pcs); two of the three rims from the Jysmä site published by Edgren (1964: 19 Fig. 5b and 5c) are museum exhibits and are not included in our statistics.

⁶ The Kainuu material is also connected with Pyheensilta Ware (Chalikov 1986: 40; Vikkula 1987: 159; but see Edgren 1964: 26; Huurre 1986: 154; Lavento 2001: 23), a contemporaneous pottery type from south-western Finland. This discrepancy arises from the Finnish pottery research tradition, in which temper (or other technological choices) is seen as subsidiary to style (decoration); ‘Asbestos pottery’ is an exception to this practice, with a pronounced emphasis on (asbestos) temper.

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APPENDICES

Appendix 1. Pöljä Ware properties in analysed assemblages. The sites are arranged geographically from north to south (left-right).

		Korvala	Jysmä	Pöljä	Laavussuo	Sätös	Tahinniemi	Pirskanlahti b	Ritokangas
Sherds									
/ analysed	pcs	10.9% (40)	29.4% (96)	31.8% (89)	4.0% (450)	11.5% (677)	13.5% (175)	2.9% (91)	23.9% (33)
	weight (g)	63.3% (385.3)	79.7% (1218.7)	81.2% (957.8)	44.2% (4357.1)	63.9% (8140.6)	57.2% (1277.9)	24.5% (954.9)	68.7% (316.0)
/ not analysed (morsels)	pcs	89.1% (328)	70.6% (230)	68.2% (191)	96.0% (10,739)	88.5% (5231)	86.5% (1122)	97.1% (3095)	76.1% (105)
	weight (g)	36.7% (223.0)	20.3% (309.8)	18.8% (222.4)	55.8% (5491.2)	36.1% (4588.4)	42.8% (955.3)	75.5% (2944.5)	31.3% (144.0)
Of the analysed									
Size class (cm)	< 3	2.5%	1.0%	0.0%	0.4%	0.1%	2.3%	4.4%	6.1%
	4-6	80.0%	78.1%	69.7%	66.0%	68.5%	84.0%	89.0%	69.7%
	7-9	12.5%	11.5%	23.6%	27.6%	23.9%	13.1%	4.4%	21.2%
	>10	5.0%	9.4%	6.7%	6.0%	7.5%	0.6%	2.2%	3.0%
Temper	asbestos	100.0%	91.7%	95.6%	79.8%	85.4%	69.1%	68.1%	60.6%
	asbestos + mineral	0.0%	8.3%	2.2%	19.5%	11.1%	29.1%	25.3%	39.4%
	asbestos + organic	0.0%	0.0%	2.2%	0.7%	3.0%	1.8%	2.2%	0.0%
	asbestos + mineral + organic	0.0%	0.0%	0.0%	0.0%	0.4%	0.0%	0.0%	0.0%
	mineral + organic	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	4.4%	0.0%
	mineral	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%

	Korvala	Jysmä	Pöjä	Laavussuo	Sätös	Tahinniemi	Pirkanlahti b	Ritokangas
Surfaces present								
	both	58.3%	50.5%	49.8%	68.5%	54.4%	70.3%	81.9%
	outer	8.3%	13.5%	24.0%	8.7%	13.1%	3.3%	3.0%
	inner	24.0%	32.6%	23.3%	19.4%	13.7%	18.7%	3.0%
	one	4.2%	3.4%	1.6%	3.0%	15.4%	3.3%	12.1%
	none	5.2%	0.0%	1.3%	0.4%	3.4%	4.4%	0.0%
Surface treatment	no information (no surfaces)	43.8%	50.6%	50.8%	30.8%	46.3%	31.9%	18.2%
(% of sherds with adequate surfaces)	no treatment	87.0%	36.4%	69.3%	65.0%	69.1%	82.2%	55.6%
	outer surface treated	5.6%	6.8%	9.0%	1.3%	13.8%	6.5%	7.4%
	inner surface treated	3.7%	50.0%	6.8%	25.6%	16.0%	6.5%	18.5%
	both surfaces treated	3.7%	6.8%	14.9%	8.1%	1.1%	4.8%	18.5%
Decorated sherds / body	no information (no surfaces)	33.3%	36.0%	26.2%	22.7%	32.6%	26.4%	15.2%
(% of sherds with adequate surfaces)	no	17.2%	36.8%	28.3%	30.0%	63.6%	86.6%	96.4%
	yes	82.8%	63.2%	71.7%	70.0%	36.4%	13.4%	3.6%
Decorated sherds / rim top	no (or no information)	57.9%	29.4%	30.0%	52.8%	78.3%	96.6%	100.0%
	yes	42.1%	70.6%	70.0%	47.2%	21.7%	3.4%	0.0%

	Korvala	Jysmä	Pöijä	Laavussuo	Sätös	Tahinniemi	Pirskanlahti b	Ritokangas
Location of decoration / body	0.0%	100.0%	97.2%	100.0%	99.7%	100.0%	100.0%	100.0%
(% of decorated sherds)								
outer	0.0%	0.0%	2.8%	0.0%	0.0%	0.0%	0.0%	0.0%
inner	0.0%	0.0%	0.0%	0.0%	0.3%	0.0%	0.0%	0.0%
both	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
one	0.0%	0.0%	0.0%	0.0%	30.9%	0.0%	0.0%	0.0%
comb stamp	0.0%	0.0%	11.1%	20.2%	0.0%	0.0%	0.0%	0.0%
Elements of decoration / body								
(% of decorated sherds)								
wound cord	0.0%	86.8%	91.7%	62.6%	55.7%	0.0%	33.3%	0.0%
drawn line	0.0%	1.9%	0.0%	6.3%	0.3%	7.0%	0.0%	0.0%
stick impression	0.0%	9.4%	0.0%	0.0%	5.2%	0.0%	0.0%	0.0%
nail impression	0.0%	0.0%	0.0%	0.4%	0.0%	0.0%	0.0%	0.0%
bone stamp	0.0%	0.0%	0.0%	4.2%	3.3%	0.0%	0.0%	0.0%
ring stamp	0.0%	0.0%	0.0%	0.0%	0.0%	41.9%	0.0%	0.0%
cord impression	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	22.2%	0.0%
other impression / stamp	0.0%	0.0%	2.8%	0.0%	7.6%	14.0%	0.0%	0.0%
unclear	0.0%	1.9%	0.0%	10.9%	5.5%	46.5%	33.3%	100.0%
comb stamp	0.0%	0.0%	16.7%	26.2%	25.5%	0.0%	0.0%	0.0%
Elements of decoration / rim								
(% of decorated sherds)								
wound cord	0.0%	75.0%	83.3%	57.1%	58.8%	0.0%	0.0%	0.0%
drawn line	0.0%	25.0%	0.0%	7.1%	2.0%	0.0%	100.0%	0.0%

	Korvala	Jysmä	Pöljä	Laavussuo	Sätös	Tahinniemi	Pitskanlahti b	Ritokangas
stick impres- sion	0.0%	12.5%	0.0%	0.0%	2.0%	0.0%	0.0%	0.0%
bone stamp	0.0%	0.0%	0.0%	2.4%	2.0%	0.0%	0.0%	0.0%
ring stamp	0.0%	0.0%	0.0%	0.0%	0.0%	40.0%	0.0%	0.0%
other impres- sion / stamp	0.0%	0.0%	0.0%	0.0%	2.0%	0.0%	0.0%	0.0%
shallow pit	0.0%	0.0%	0.0%	0.0%	2.0%	60.0%	0.0%	0.0%
unclear	0.0%	0.0%	0.0%	7.1%	13.7%	0.0%	0.0%	0.0%
Rim shape								
not thickened (straight or rounded)	0.0%	5.3%	5.9%	1.6%	17.6%	0.0%	10.3%	0.0%
inward-bent (list)	33.3%	68.4%	64.7%	76.7%	62.0%	91.4%	48.4%	100.0%
inward thick- ened	66.7%	5.3%	5.9%	16.7%	4.7%	0.0%	17.2%	0.0%
outward thickened	0.0%	0.0%	0.0%	0.0%	0.9%	0.0%	0.0%	0.0%
in- and outward thickened	0.0%	5.3%	5.9%	1.7%	0.9%	4.3%	17.2%	0.0%
unclear	0.0%	15.7%	17.6%	3.3%	13.9%	4.3%	6.9%	0.0%
Bottom shape								
round	0.0%	100.0%	50.0%	47.1%	20.0%	100.0%	0.0%	0.0%
pointed	0.0%	0.0%	0.0%	29.4%	10.0%	0.0%	0.0%	0.0%
flat	0.0%	0.0%	50.0%	23.5%	70.0%	0.0%	0.0%	0.0%
Thickness (mm) / body								
unknown	57.5%	42.7%	55.1%	54.4%	35.7%	49.7%	25.3%	24.2%

	Korvala	Jysmä	Pöljä	Laavussuo	Sätös	Tahinniemi	Pirskanlahti b	Ritokangas
(% of sherds with adequate surfaces)								
<5	0.0%	5.5%	2.5%	3.4%	31.2%	6.8%	7.4%	0.0%
5-8	88.2%	94.5%	92.5%	94.6%	67.9%	90.9%	85.2%	100.0%
8-14	11.8%	0.0%	5.0%	2.0%	0.2%	2.3%	7.4%	0.0%
>14	0.0%	0.0%	0.0%	0.0%	0.7%	0.0%	0.0%	0.0%
Thickness (mm) / rim								
unknown	33.0%	15.6%	58.9%	18.3%	13.9%	21.7%	13.8%	0.0%
(% of sherds with adequate surfaces)								
<5	0.0%	0.0%	0.0%	0.0%	2.2%	0.0%	0.0%	0.0%
5-8	0.0%	18.8%	18.8%	69.4%	23.7%	100.0%	72.0%	83.3%
8-14	50.0%	12.4%	12.4%	24.5%	25.8%	0.0%	24.0%	16.7%
>14	50.0%	68.8%	68.8%	6.1%	48.3%	0.0%	4.0%	0.0%
Thickness (mm) / bottom								
unknown	0.0%	0.0%	0.0%	5.9%	50.0%	0.0%	0.0%	0.0%
(% of sherds with adequate surfaces)								
<5	0.0%	0.0%	0.0%	0.0%	20.0%	0.0%	0.0%	0.0%
5-8	0.0%	100.0%	100.0%	68.7%	60.0%	100.0%	0.0%	0.0%
8-14	0.0%	0.0%	0.0%	31.3%	0.0%	0.0%	0.0%	0.0%
>14	0.0%	0.0%	0.0%	0.0%	20.0%	0.0%	0.0%	0.0%

Appendix 2. Radiocarbon datings that can be associated clearly with Pöljä Ware from Finland and the Karelian Isthmus (for the corresponding data for the Karelian Republic, see Tarasov et al. 2017). All dates are calibrated with OxCal 4.4.2 (Bronk Ramsey 2009) using IntCal20 (Reimer et al. 2020) and given with a 95.4% probability.

Site	Lab ID	BP	±	cal BC	$\delta^{13}C$	$\delta^{15}N$	Material	Context	Sample	Reference
Gvardeyskoe 1	GrA-62068	4205	35	2901	-23.55	2.0	crust	settlement	MAE, Γ 1-1415; outer s.	Nordqvist 2016
Joenniemi	Hela-102	4555	80	3521	-	-	crust	settlement	KM 23701: 488; inner s.	Pesonen 2004
Joenniemi	Hela-100	4258	80	3092	-	-	crust	settlement	KM 24506: 159; inner s.	Pesonen 2004
Joenniemi	Hela-143	4170	85	2918	-	-	crust	settlement	KM 24506: 102, 140; inner s.	Pesonen 2004
Jysmä	GrA-63530	4465	35	3341	-29.01	9.05	crust	settlement	KM 13944: 73; inner s.	Nordqvist 2018
Jysmä	GrA-63533	4210	35	2902	-29.19	8.9	crust	settlement	KM 13944: 73; inner s.	Nordqvist 2018
Jysmä	GrA-63536	4175	35	2886	-29.05	9.04	crust	settlement	KM 13944: 37; inner s.	Nordqvist 2018
Jysmä	GrA-63535	4090	35	2865	-33.35	7.17	crust	settlement	KM 13944: 37; inner s.	Nordqvist 2018
Jysmä	GrA-63529	4080	35	2861	-33.64	2.39	crust	settlement	KM 13944: 24; outer s.	Nordqvist 2018
Komso- molskoe 3 / Kunnian- niemi	Hela-1819	4030	35	2831	-24.9	-	crust	pithouse	MAE, K3-31; inner s.	Seitsonen et al. 2012
Kukkosaaari	Hela-145	4390	100	3366	-	-	crust (‘Jysmä type’)	settlement	KM 25423: 1; inner s.	Pesonen 2004

Site	Lab ID	BP	±	cal BC	$\delta^{13}\text{C}$	$\delta^{15}\text{N}$	Material	Context	Sample	Reference
Kuorikkikangas E	Su-2682	4290	80	3316	-	-	crust	settlement	KM 28917: 1006; inner s. (not AMS)	Pesonen 2004
Kärräniemi	Hela-147	4450	105	3491	-	-	crust	settlement	KM 15222: 543	Pesonen 2004
Laavussuo	GrA-62067	4255	35	2923	-28.61	8.3	crust	pithouse	KM 29556: 481; outer s.	Nordqvist 2018
Laavussuo	Hel-3977	4170	100	3010	-27.0	-	charcoal	pithouse / house structure	-	Karjalainen 1999
Laavussuo	GrA-62485	4110	50	2875	-28.73	8.0	crust	pithouse	KM 29556: 1245; inner s.	Nordqvist 2018
Laavussuo	Hel-3976	4090	100	2902	-25.5	-	charcoal	pithouse / house structure	-	Karjalainen 1999
Laavussuo	Hel-3974	4070	110	2897	-26.3	-	birch bark	pithouse / house structure	-	Karjalainen 1999
Laavussuo	Hela-153	4010	60	2852	-27.2	-	birch bark tar / mastics	pithouse	-	Karjalainen 1999
Pirskanlahti b	Hel-4289	4350	100	3357	-	-	charcoal	pithouse / house structure	-	Karjalainen 1999
Pirskanlahti b	GrA-62215	4245	25	2911	-34.45	2.4	crust	pithouse	KM 32004: 2058; outer s.	Nordqvist 2018
Pirskanlahti b	Hela-332	4110	80	2883	-	-	birch bark tar / mastics	pithouse	-	Karjalainen 1999

Site	Lab ID	BP	±	cal BC	$\delta^{13}C$	$\delta^{15}N$	Material	Context	Sample	Reference
Pukkisaari	Hela-2648	4324	33	3022	-26.10	-	crust	pithouse	KM 29098: 203	Alenius et al. 2013
Pukkisaari	Hela-2647	4247	43	3003	-26.90	-	burnt bone (Mamma-lia)	pithouse	KM 29098: 252	Alenius et al. 2013
Pukkisaari	Hela-2646	4162	34	2881	-26.70	-	burnt bone (Mamma-lia)	pithouse	KM 29098: 239	Alenius et al. 2013
Purkajasuo Korvala	GrA-63504	4535	35	3366	-27.08	0.66	birch bark	pithouse / house structure	KM 32134: 214	Mökkönen & Nordqvist 2018
Purkajasuo Korvala	Hela-136	4475	60	3360	-28.8	-	crust	pithouse / stone embankment	KM 29764: 48; inner s.	Pesonen 2004
Purkajasuo Korvala	GrA-63505	4455	35	3340	-27.71	0.45	birch bark	pithouse / house structure	KM 32134: 199	Mökkönen & Nordqvist 2018
Pörrin-mökki	Hel-3295	3850	120	2662	-25.20	-	charcoal	pithouse? / pit feature	-	Pesonen 1996
Ritokangas	Hel-4124	4610	120	3639	-26.6	-	charcoal	pithouse / house structure	-	Karjalainen 1999
Ritokangas	GrA-62071	4400	100	3367	-27.50	2.8	birch bark tar	pithouse	KM 30771: 418; outer s.	Nordqvist 2018
Ritokangas	GrA-62508	4250	140	3335	-27.99	1.3	crust	pithouse	KM 30771: 418; inner s.	Nordqvist 2018
Sätös	Hela-347	4540	75	3514	-28.5	-	crust	pithouse	KM 30892: 1318	Pesonen 2004

Site	Lab ID	BP	±	cal BC	$\delta^{13}\text{C}$	$\delta^{15}\text{N}$	Material	Context	Sample	Reference
Sätös	GrA-62073	4525	35	3364	-29.25	9.7	crust	pithouse	KM 28153: 4798; in-ner s.	Nordqvist 2018
Sätös	Su-2420	4510	70	3488	-25.1	-	charcoal	pithouse / house structure	-	Karjalainen 1999
Sätös	Su-2421	4510	30	3355	-25.5	-	birch bark	pithouse / house structure	-	Karjalainen 1999
Sätös	Hel-3344	4490	150	3631	-25.9	-	charcoal	fireplace	-	Karjalainen 1993
Sätös	Hela-349	4425	55	3335	-30.0	-	crust	pithouse	KM 30892: 240	Pesonen 2004
Sätös	Hela-345	4415	75	3339	-30.10	-	crust	pithouse	KM 30892: 1754	Pesonen 2004
Sätös	Hela-346	4390	70	3335	-29.5	-	crust	pithouse	KM 30892: 1553	Pesonen 2004
Sätös	Hel-4308	4380	90	3351	-26.8	-	birch bark	pithouse / house structure	-	Karjalainen 2002
Sätös	GrA-62083	4380	35	3098	-28.96	10.4	crust	pithouse	KM 30892: 2492; in-ner s.	Nordqvist 2018
Sätös	GrA-62486	4310	50	3093	-24.94	4.9	crust	pithouse	KM 30892: 1835; in-ner s.	Nordqvist 2018
Sätös	Hel-4309	4300	90	3328	-26.7	-	birch bark	pithouse / house structure	-	Karjalainen 2002
Sätös	Hela-348	4290	60	3095	-28.4	-	crust	pithouse	KM 30892: 1150	Pesonen 2004

Site	Lab ID	BP	±	cal BC		$\delta^{13}\text{C}$	$\delta^{15}\text{N}$	Material	Context	Sample	Reference
Sätös	Hel-3325	4230	110	3307	2475	-25.5	-	charcoal	pit feature	-	Karjalainen 1993
Sätös	Hel-4307	4180	90	3005	2476	-26.7	-	birch bark	pithouse / house structure	-	Karjalainen 2002
Tahinniemi	GrA-62066	4470	35	3341	3024	-25.55	0.6	crust	pithouse?	KM 23445; 453; inner s.	Nordqvist 2018
Tahinniemi	Hel-2177	4450	140	3528	2703	-	-	charcoal	pithouse?	-	Jussila 1986
Tahinniemi	Hel-2181	4300	90	3328	2629	-	-	charcoal	pithouse?	-	Jussila 1986
Tahinniemi	Hel-2176	4260	140	3340	2492	-	-	charcoal	pithouse?	-	Jussila 1986
Tahinniemi	GrA-62065	4125	35	2871	2578	-34.12	8.5	crust	pithouse?	KM 22955; 167; inner s.	Nordqvist 2018