



Riina Rammo, Krista Wright, Ina Vanden Berghe, Alexia Coudray
and Riikka Räisänen

A blue pile textile dating to the Viking Age from Saaremaa, Estonia

Abstract

A wool textile with a pile surface on one side was found in a bog in Pöide, Saaremaa Island (Estonia), in the 1870s. It was brought to Finland in 1878 and donated to the National Museum collections of Finland soon after. Radiocarbon 14 dates the find to the Viking Age. This fragmentary textile is the oldest significant piece of textile available for study from Estonia and is a remarkable find for the north-eastern Baltic region. The first detailed analysis of the Pöide textile shows that the warp, weft, pile and braid bordering the textile all contain indigoids, suggesting an originally blue *vararfeldur* textile.

Keywords: pile weave, Viking Age, *vararfeldur*, Baltic Sea, dye analysis

Introduction

Archaeologists do not always have to participate in fieldwork to collect new finds. It is sometimes meaningful to carry out “excavations” in institutions dealing with heritage objects, such as museum collections, laboratories, and conservation facilities. Scientific methods and the current base of knowledge give further opportunities for new interpretations and discoveries based on forgotten finds.

The present paper introduces the discovery of an extraordinary textile fragment (KM1931:2) (fig. 1) in the National Museum of Finland storage facilities, based in Helsinki, that, according to the archival records, reached the museum collections almost 150 years ago from neighbouring Estonia. Once radiocarbon 14 dating (14C dating) had confirmed that the fragment was dated to the Viking Age (800–1050 CE in Estonian chronology), it became clear that this is one of the oldest textiles ever unearthed in Estonia. Fewer than ten tiny thread and fabric fragments are known from earlier periods (Peets 1992, appendix 4, table 28). The following paper describes the Pöide textile, gives an

overview of the results of detective work carried out in the archives and through analysis, and places this single piece in a broader north European context.

The discovery of the Pöide textile

The Pöide textile was discovered more than once. First, a Finnish student, Oskar Anders Ferdinand Lönnbohm (1856–1927), made a one-year trip to the area of present-day Estonia, which, like Finland in 1877, was part of the Russian Empire. The contact between the two countries has always been close; Finnish and Estonian people are closely related, and both languages belong to the Baltic Finnic languages (Uralic language family). Lönnbohm, genuinely interested in the Estonian language, visited several places in northern and western Estonia and compiled the first Estonian Finnish dictionary (Mustonen 1882). In addition to studying the language, he collected objects to which he attributed heritage value. Among other things, he acquired an archaeological textile while he was on Saaremaa Island. In 1879, he donated this piece, along with a few other Estonian objects, to



the Finnish Antiquity Society. The collections of this society were later merged with the National Museum of Finland, where the textile is currently preserved, labelled as “a shawl or a dress fragment” and provided with some incorrect contextual information. After this first discovery, the item was forgotten.

The second documented discovery of the textile find occurred nearly 50 years later. It was mentioned by another Finnish scholar, the archaeologist Aarne Michaël Tallgren (1885–1945), who was the first Professor of Archaeology at the University of Tartu (1920–1923). He highlighted the textile as an extraordinary find in an article introducing Estonian archaeological artefacts in the National Museum of Finland (Tallgren 1925). He also corrected the mistakes in the find context in the museum documentation and collected new folkloric information on the initial discovery on the island of Saaremaa. After this brief attention, the Pöide textile was again left in storage for decades. The artefact was rediscovered at the beginning of the 21st century when study of the textile began and various specialists continued discussing its “life trajectory”.

Archaeological context and find location

The earliest preserved notes on the find circumstances are in the National Museum of Finland’s documentation, which state that the find location was a bog near an ancient hillfort 1.5 versts north-east of Pöide church on Hiiumaa Island (KM catalogue, no. 1931). The verst is a historical Russian unit of length equal to 1.0668 km. Thus, the distance referred to is approximately 1.6 km. However, the records are wrong in two aspects: first, the direction and second, placing the find on another Estonian island, Hiiumaa. As Tallgren (1925, 38) already proved, the other landmarks (hillfort, bog, Pöide church) in the description leave no doubt that the textile was unearthed on Saaremaa, where the only bog, called Kareda, is located westwards from Pöide church (fig. 2). Like many other well-preserved northern European textiles made of wool, the Pöide item was discovered in the 1870s while cutting peat to a depth of 1.5–2 ells (approximately one metre). Regrettably, the workers’ peat shovels tore the original item of clothing apart, and only this fragment is preserved. The estimated find location is relatively easy to locate according to the corrected description, which points to the edge of the Kareda bog. A LiDAR map even shows outlines of some trenches from the time when peat was still cut by hand at the edge of the bog near the hillfort (fig. 3). The putative area of the find location is approximately 2.4 km northwest of Pöide church.



Fig. 1: The Pöide textile, pile side (Image: Krista Wright)

Considering the broader context of the find location, the nearby Pöide Stronghold is worth highlighting. The hillfort is located approximately 0.5–1 km from the assumed find location, near the Kareda bog. The first traces of a settlement on the hillfort are dated to the period around the beginning of the Common Era (Lõugas and Mägi 1994, 29). The first fortification here was built in the seventh to eighth century CE, and the site was also in use during the Viking Age (Mägi et al. 2023, 74; Lõugas and Lõugas-Mägi 1994, 32). Moreover, one of Saaremaa’s largest seventh to tenth-century harbour sites, at Tornimäe, is located 6.3 km eastward from Pöide Stronghold. Based on similar find material it has been suggested that the sites were closely related (Mägi 2005, 66). However, the heyday of Pöide Stronghold came later – most of the finds at Pöide belong to the 11th to 13th centuries (Mägi et al. 2023, 87–88). The central location of the Pöide area is stressed by the fact that the church, a



Fig. 2: Location of Saaremaa Island (Estonia) and sites mentioned in the text. The hatched area indicates Kareda bog (Image: Riina Rammo)

parish centre, was built in the 13th century after the Crusades and the Christianisation of Estonia at the beginning of the same century.

Methodology

The structure of the Põide textile was first examined with a low magnification stereo microscope (Leica S6D with EC6 camera and Las EZ 3.4.0 software). The technical details of the textile were documented, and the following characteristics observed: fibre material,

weave, thread count, spin direction of yarns and twist angles, yarn diameter, colour, traces of the finishing process, and notes on other specific characteristics.

Three samples from the warp, weft and braid were taken to examine the wool using optical and scanning electron microscopy (Jeol 7500 FA) coupled with an energy-dispersive spectrometer (SEM-EDS). One hundred fibres from two samples (warp and weft) were placed on the microscopy slide, mounted with Entellan New, and measured according to the procedures of archaeological textile research (Leica 2500 TLM, Leica MC190HD camera, and LAS V4.13.0 software) (for example, Nahlik 1963, 229–242; Ryder 1969; 1974; 2000; Kirjavainen 2005; Rast-Eicher 2008; Gleba 2012; Skals et al. 2024). Fibre diameters, pigmentation, and the presence of medullated hairs were systematically documented. Key statistical parameters, including average diameter, mode, standard deviation, and coefficient of variation, were calculated. The proportion of wool fibres across different diameter ranges, along with their relative distribution within the sample, characterises the specific wool selected for this textile. The natural colour of fibres and the diameter distribution was analysed in more depth to make assumptions on the sheep breed and fibre processing.

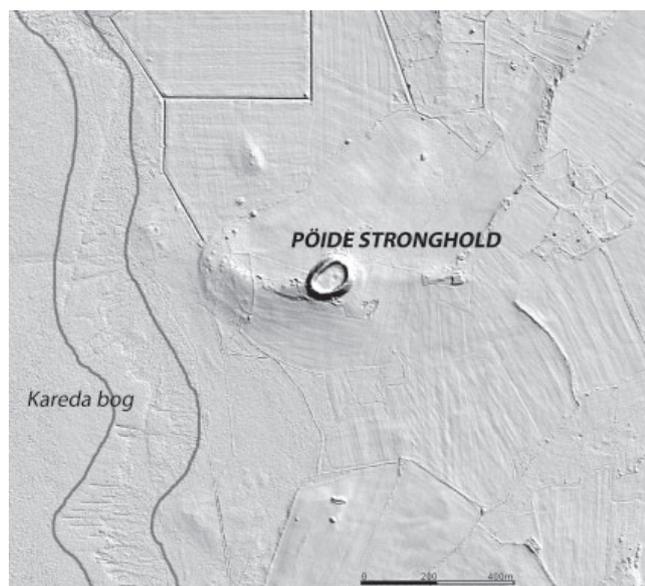


Fig. 3: Relief map of the putative find location. The edge zone of the Kareda bog is marked with grey lines (Image: Estonian basic map 2025, Republic of Estonia Land and Spatial Development Board)

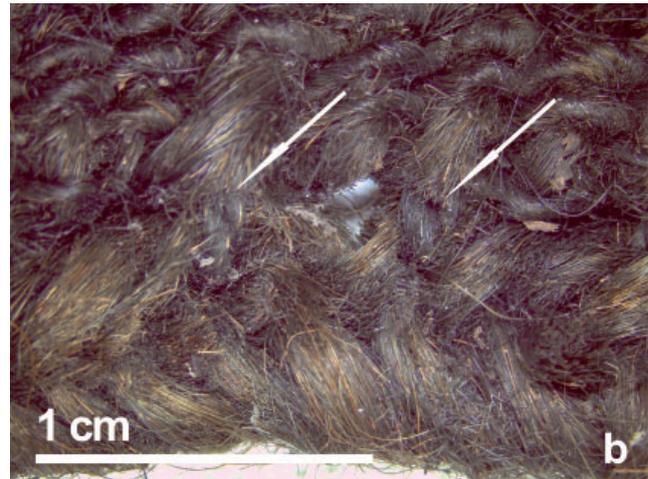


Fig. 4: a) tubular selvage with the braid; b) microphoto of dark plied sewing thread (see arrows) used to attach the braid (Images: Krista Wright)

To ensure comparability with previous studies, we classified the fibre distribution of the Pöide samples using established systems developed by Michael L. Ryder (1969; 2000) and Antoinette Rast-Eicher (2008; Rast-Eicher and Bender Jørgensen 2013). Ryder's classification is based on the evolutionary development of six fleece types and corresponding sheep breeds, while Rast-Eicher's system distinguishes 11 wool types, taking into account fibre processing techniques (Gleba 2012, 3656). The most recent and comprehensive overview of these classification methods, including a critical evaluation, has been published by Irene Skals, Ulla Mannering, and Eva Andersson Strand (2024, 30–34).

A sample of the weft yarn was radiocarbon-dated in the Tandem Laboratory at Uppsala University (Sweden) (Ua-74375) and calibrated with IOSACal v0.4.1 (Mucke 2022). Further, four samples (warp, weft, pile, braid) were analysed for dyestuffs in the Royal Institute for Cultural Heritage laboratory (KIK-IRPA) in Brussels (Vanden Berghe and Coudray 2024). The analyses were conducted using high-performance liquid chromatography and a photodiode array detection system (HPLC-DAD) with Acquity Arc HPLC equipment (Waters, US). The analyses were interpreted using the Empower software system from Waters. Separation was achieved using a LiChrosorb RP-18 end-capped column. The dyes were extracted in 250 μ L water/methanol/37% HCl (1/1/2, v/v/v) for ten minutes at 105°C, followed by a second extraction with 500 μ L of ethyl acetate. After vacuum evaporation of the upper phase, the residue was dissolved in 30/30 μ L methanol/water, from which 20 μ L was injected into the chromatographic system. A detailed description of the analytical protocol was published by Vanden Berghe et al. (2009).

Findings

The textile is approximately 15 × 27 cm in size (fig. 1), woven in 2/2 twill using z-spun yarns. The fabric is relatively coarse with a density of seven threads in the warp and six in the weft per cm. The warp yarns are notably thinner (1–2 mm in diameter) and more distinct than the thicker and fluffier weft (2–4 mm in diameter), and both thread systems have a twist angle of 45°. The warp and weft threads are clearly distinguishable because of the preserved tubular selvage approximately one cm wide and woven in tabby (fig. 4). To create a hollow tubular-like selvage, the weft is woven in tabby fashion as it approaches the edge, but on returning it misses the outer few warp threads (Walton Rogers 2007, 88). An approximately one cm wide simple braid, made presumably of six loosely spun threads (z, twist angle 20°) and looking like a simple but thick plait, is sown onto the selvage with a dark blue S2z plied thread (2–3 mm in diameter) (fig. 4).

One side of the textile is further covered with a dark pile of wool tufts with a blueish tint that creates a furry surface (fig. 5). The preserved pile is 3–6 cm long but heavily worn and was initially longer. Pile tufts seem to lie in the direction that is roughly parallel to the selvage. The wool locks, perhaps lightly twisted, were inserted into the shed while weaving and looped around the warp yarns. It is impossible to see a fixed structure and rhythm of inserted wool locks, but it seems that every wool tuft turns over one warp and then runs over four warps in every shed row. Tufting ascends from the left to the right. The system is similar to 11th-century Icelandic and Greenlandic finds (Guðjónsson 1962, fig. 5; Østergård 2004, fig. 50; Hopkin 2021, fig. 4). The pile has been inserted in the

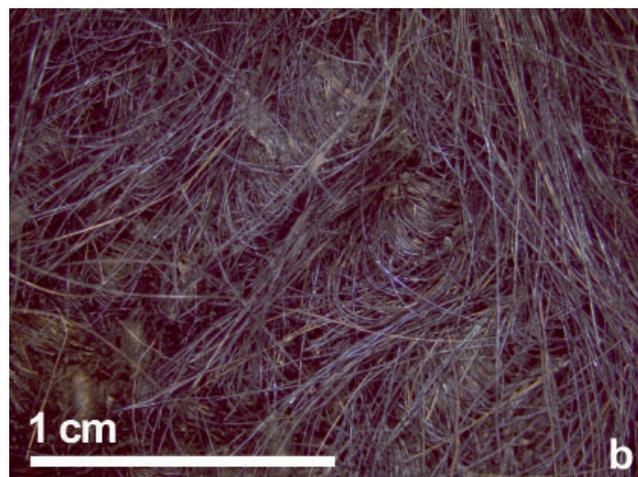


Fig. 5: a) close-up of the pile with some places where wool tufts have been wrapped around the warp yarns, as visible on the left; b) microphoto of a wool tuft wrapping (Images: Krista Wright)

shed so carefully that it is hardly visible on the other side of the textile, which looks like a plain 2/2 twill (fig. 6).

The wool used in the warp, weft, and braid consists of a mixture of fibres in various natural shades, all dyed blue (fig. 7). Visually, the wool in the warp appears slightly lighter than that in the weft, while the pile is more uniformly coloured but darker than the weft. However, fibre analysis does not indicate a sharp distinction between the warp and weft, as the blend of natural fibre colours is relatively similar (fig. 8, table 1). The majority of fibres are white (82% in the warp and 70% in the weft) and brownish (16% and 28%, respectively) in both samples; blackish fibres were rare. Notably, the proportion of medullated fibres is



Fig. 6: Pöide textile, non-pile side (Image: Krista Wright)

relatively high – approximately 40% in both yarns –, and medullation was also observed in finer fibres.

We attempted to classify the wool samples using the most commonly applied systems based on fibre diameter distribution to make the results comparable with the earlier studies. The warp yarn aligns well with Ryder's Hairy Medium fleece type: fibre diameters range from 9–64 μm , with a mean of 30 μm and a mode of 22 μm , and the distribution is positively skewed (table 1, fig. 7; Ryder 2000, 4). According to Rast-Eicher's classification, the warp wool corresponds most closely to the CD type: 78% of fibres are < 40 μm , 19% > 40.1 μm , and 3% > 60 μm (Rast-Eicher 2008). In contrast, the weft wool does not fit neatly into either Ryder's or Rast-Eicher's categories. It falls between the Hairy and Hairy Medium fleece types, with a relatively high mean diameter (36 μm), a diameter range of 14–64 μm , and a slightly positively skewed distribution. Within Rast-Eicher's framework, the weft wool most closely resembles types D or E: 61% of fibres are < 40 μm , 31% > 40.1 μm , and 3% > 60 μm (Rast-Eicher 2008). The conclusion of both classifications is the same: the wool of the Pöide textile is uneven and lacks uniform distribution around a single modal peak.

Given the heterogeneity and the variety of natural colours, the wool used in the Pöide textile probably originates from the double-coated fleece of native northern short-tailed sheep (e.g., Rammo 2015, 134; for sheep: Tapio 2006, 17–19; Walton Rogers 2004, 86). These sheep are characterised by short tails, horns, and a wide range of fleece colours, and were widespread across northern Europe during



Fig. 7: Microphotos of wool fibres: a) warp; b) braid; c) weft (Images: Krista Wright)

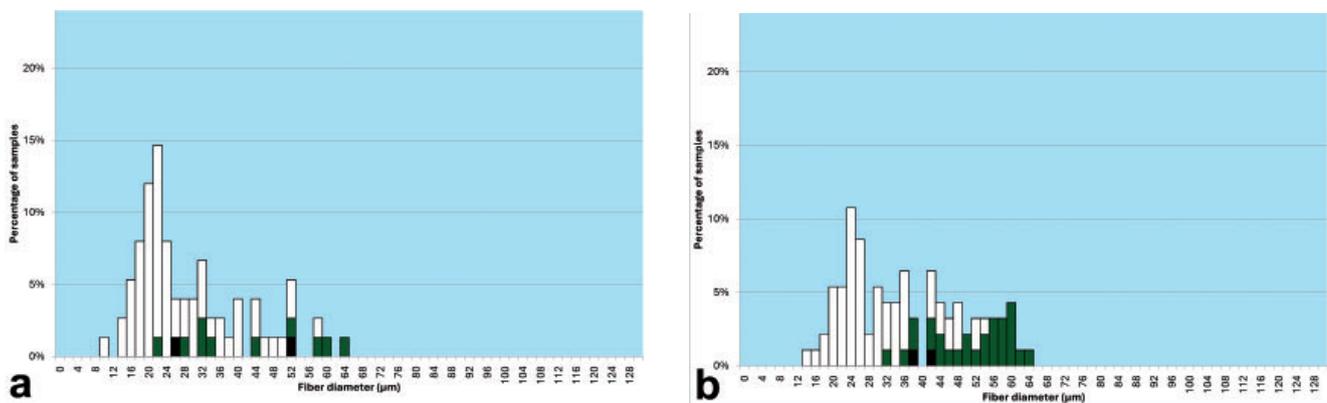


Fig. 8: Results of wool fibre measurements: a) warp; b) weft (Images: Krista Wright)

the Viking Age. Obviously, the wool was sorted and processed prior to spinning, as the proportion of finer fibres is relatively high and fibres thicker than 60 μm are rare (3%). The coarsest fibres were probably removed through combing, a common method in the Nordic region during that period. Slightly different wool types were selected for the warp and weft: the warp contains more fine fibres, while the weft includes a greater proportion of medium and coarse fibres (fig. 8).

Carbon 14 dating shows that the textile was made in the ninth to tenth century. The calibrated age of the fragment falls in the range of 775–977 CE (with 95.4% probability) (fig. 9). This means the Viking Age in the Baltic Sea region.

The HPLC-DAD analysis of warp and weft, and the pile and braid samples revealed the presence of dye molecules of indigotin, indirubin and isatin in all four samples, meaning blue dyeing with an indigoid-containing dye plant such as woad (*Isatis tinctoria*) or tropical indigo (*Indigofera* spp.) (Vanden Berghe and Coudray 2024). Based on the chemical composition detected in the extracts, it is not possible to distinguish between these two plant sources. Considering the historical context of the textile and presuming that the

textile was not of Oriental origin, it is probable that woad was the dye source. Trading in tropical indigo pigment only started in this region in the 16th century (Peets 1998, 307; Vajanto 2015, 56–28; Rammo et al. 2022).

	WARP	WEFT
Range	9, 14-55, 58-61, 64 μm	14, 17-38, 41-64 μm
Mean	30 μm	36 μm
Mode	22 μm	24 μm
Median	24 μm	34 μm
SD	12,87	12,98
Coefficient of variation	43%	46%
Medullated	38%	43%
White wool	82%	70%
Brownish wool	16%	28%
Blackish wool	2%	2%

Table 1: Results of wool fibre analysis, counted in a sample 100 fibres (Image: Krista Wright)

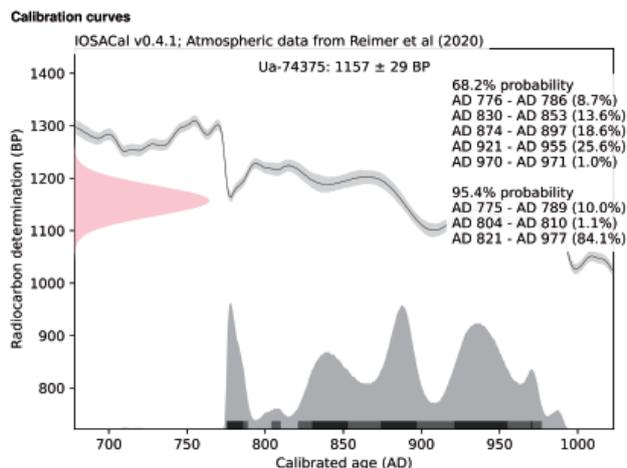


Fig. 9: Calibration curve of the 14C-dating (Image: after Mucke 2022)

Indigotin was found in every sample, although there is a slight difference in the hues in warp, weft, braid and pile, indicating that the wool of the yarns and pile were dyed separately before weaving. The available documentation produced over the years following excavation contains no information regarding the original colours of the textile. Although to date dye analysis has identified only a blue dye derived from woad (or possibly indigo), the absence of other colours does not necessarily indicate their original nonexistence. It remains possible that more delicate organic dyes have degraded or disappeared in the approximately 150 years since the excavation.

Discussion

Pile weaves in Viking Age Europe

The Pöide textile represents a cloth type called shaggy-pile weave. The defining characteristic of pile weave is the additional fibre tufts or threads worked into the fabric when weaving (Guðjónsson 1962, 65; Walton Rogers 2007, 85). There are various ways to achieve the shaggy effect: laying the wool locks in the shed (knotless pile) and winding or tying them around the warp threads (knotted pile) (Guðjónsson 1962, 65). Sometimes the pile is made of spun threads (Hägg 1991, 97; Hayeur Smith 2024, 54). Another possibility is to add the pile by darning in lengths of wool after weaving. Since the exact technique used to create the pile can be difficult to determine when it comes to archaeological textiles (Walton 1989, 335–336) and few technical details are published, this overview does not distinguish between different methods.

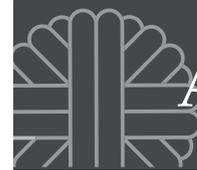
In general, piled textiles are widely spread in terms of time and geography (for example, Guðjónsson 1962,

70–71). The most up-to-date overview in a European context is given by Michèle Hayeur Smith (2024, 68–72); what follows mainly focuses on Viking-Age northern Europe. Piled textiles are relatively rare among archaeological finds, forming a heterogeneous group in terms of quality and technical detail. For instance, sixth to seventh century English dyed pile weaves are considered to be luxury textiles, often recorded in high-status male graves. One of the most famous examples comes from the Sutton Hoo ship burials (Walton Rogers 2007, 85). Pile weaves also occur in the eighth-century textiles from the Valsgårde boat graves in Sweden (Arwidsson 1942, fig. 68, 92–93).

Finds of archaeological piled textiles from the Viking Age are even more numerous. At least three bluish-reddish piled fragments have been found in ninth to tenth century Birka graves, also in Sweden (Geijer 1938, 131–132). However, compared to the previous examples, coarser piled fabrics dominate in the 9th to 11th centuries. The geographically closest parallel to the Pöide fragment could be several small coarse reddish pieces with sections of interwoven wool strands, found in a ninth-century deposit at Tira peatbog, Latvia (Žeiere 2008, 136). Other textile finds are known in Scotland (the Isle of Eigg) and the Isle of Man, England (York), Ireland (Dublin), Germany (Haithabu), Poland (Wolin), Sweden (Lund), Norway (Borgund and Trondheim), Iceland and Greenland (Guðjónsson 1962, 66–68; Lindström 1982, 182; Maik 1988, 176–178; Walton 1989, 336; Hägg 1991, 97–99; Bender Jørgensen 1992, 39; Pritchard 1992, 2017, 120; Østergård 2004, 74; Hayeur Smith 2024). The most extensive collection of 37 piled textile pieces has been documented at Borgund in Norway, dating to the Viking Age and Medieval period (Hayeur Smith 2024, 63).

The most common weave used for piled textiles is plain 2/2 twill woven using yarns with opposite spin-direction (z/s), although other combinations also occur: for example, tabbies and 2/1 twills, or the same spin direction in warp and weft. The pile mainly comprises weakly or unspun wool locks inserted in the fabric during the weaving (Guðjónsson 1962, 66–68; Lindström 1982, 182; Maik 1988, 176; Bender Jørgensen 1992, 39; Pritchard 1992, 2017, 120; Østergård 2004, 73); more rarely, spun threads were inserted into the weave (Maik 1988, 176–178; Hägg 1991, 97–99; Hayeur Smith 2024, 63). In general, the Pöide textile matches well with the abovementioned piled textiles where the typical traits are relatively coarse 2/2 twill weaves and a pile consisting of unspun wool tufts looped around the warp yarns. However, no such fabric combining z-yarns in warp and weft systems has been found.

Regrettably, dye and wool fibre analysis of piled



textiles has been conducted rarely. One Greenlandic piece contained a lichen dye and another was dyed with tannin-rich dyestuff (Walton Rogers 2004, 89; Østergård 2004, 74), while in one Dublin fragment an unknown local orange-reddish dyestuff was detected (Pritchard 2017, 120). The Tira bog tabby fabric was visually reddish (Žeiere 2008, 136). No indigoid dyes have been reported in these coarse twills so far.

All three Greenlandic pile weaves were made of Ryder's Hairy Medium fleece type in both warp and weft (Walton Rogers 2004, 84). This aligns relatively well with the Pöide analysis results. Unfortunately, it remains unclear whether and to what extent the wool fibre composition of the warp and weft yarns differed. Penelope Walton Rogers notes only that, since the fibre distribution results of piled fragments differ markedly from local Greenlandic textiles, the items must have originated elsewhere (Walton Rogers 2004, 84). Specifically, local twill weaves tended to show a coarser fibre blend (Hairy in Ryder's classification) for warp as this thread system needs more strength when weaving. Similar results have been obtained in a study of Viking Age textiles from Denmark (Skals et al. 2024, 42–44). The described fibre distribution pattern also differs from that of the Pöide textile, which features a coarser blend in the weft thread.

Estonian and broader north-eastern Baltic context

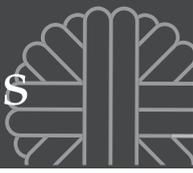
Due to the prevalence of cremation burials, textiles are rare in Estonian archaeology before the 11th century, and comparisons for the Pöide textile are thus missing. However, in the 11th to 13th centuries, a relatively well-defined local weaving tradition can be observed based on the preserved textile finds. The Estonian mainland and islands share specific textile technology with south-western Finland in this case, which it can be traced back to at least the beginning of the Viking Age (Bender Jørgensen 1992, 96). This Finnish-Estonian weaving tradition shares several generic features that characterise textile cultures from various periods across Europe, including the Viking Age Nordic region. For example, the Hairy Medium or Hairy Medium/Generalised Medium wool types interpreted as coming from local double-coated fleeces (Peets 1992, 11–34; Vajanto 2013; Rammo 2015, 133–135), the preference for twill weave for wool cloth, and usage of indigoid blue dyestuff, most likely originating from woad (Lehtosalo-Hilander et al. 1982; Riikonen 2003; Vajanto 2015; Rammo et al. 2022), can be cited. Tubular selvages typical of weaving on the warp-weighted loom are also preserved in Estonian and Finnish textiles (Lehtosalo-Hilander et al. 1982; Riikonen 2003; Rammo and Tamla 2022, 25–26). The

structure of some finds is identical to the Pöide textile's tubular selvage.

A distinct feature of the Finnish-Estonian weaving tradition is the combination of plied warp yarns (S2z) and single weft yarns (z) in 2/2 wool twills (see for example, Bender Jørgensen 1992, 140; Riikonen 2022, 67; Wright and Sahramaa 2023; Wright and Suomela 2025). The Pappilanmäki type (S2z/z, 2/2 twill) named by Lise Bender Jørgensen, is in fact rare in all other Viking Age textile collections in northern Europe (Bender Jørgensen 1992, 96, 100, 140). In neighbouring areas, for example, Scandinavia, Latvia, north-western Russia, and eastern Finland, it is more common to use single yarns in warp and weft. Further, warp yarns are usually z-spun, while the spin direction of the weft varies according to cloth type, specific region and period. In tenth to eleventh-century Scandinavia, z-spun yarn in warp and s-spun in weft in plain 2/2 twills was the most common combination (Bender Jørgensen 2003, 136; Hayeur Smith 2015, 31), which also holds for the 11th-century pile weaves found in Iceland and Greenland. However, the z/z twisted plain 2/2 twills were more popular, for example, in Gotland, Iceland, and Norway (Bender Jørgensen 1992, 138; Hayeur Smith 2015, 27). Regrettably, the spin direction of the Norway shaggy pile weaves is not known; a comparison of this data with that of the Pöide textile would have been of particular interest. Z/z twisted 2/2 wool twills were also produced in Latvia, eastern Finland and occasionally in north-western Russia during the Viking period (for example, Zariņa 1970; 1988; Orfinskaya and Mikhaylov 2020, 44; Vajanto 2021, 60–63), although pile weave does not seem to be a typical textile feature in these regions. Apart from one exceptional find from the Tira peat bog, no Viking Age shaggy pile weaves have been reported in eastern and east northern Baltic countries (for example, Nahlik 1963; Zariņa 1970; 1988; Lehtosalo-Hilander 1984; Riikonen 2004; Hvoštšinskaya 2004, 110–126; Žeiere 2005; 2017; Orfinskaya and Kotškurkina 2014; Orfinskaya and Mikhaylov 2020).

The provenance of the Pöide textile

Given this Finnish-Estonian weaving tradition with use of a plied warp in wool fabrics, the Pöide textile does not fit into this production scheme, indicating that it could be a non-local textile item that reached Saaremaa Island from abroad. The question about the Pöide textile's provenance is not easy to answer. Coarse pile fabrics in Ireland and Scotland share the same uncertainty about provenance (Bender Jørgensen 1992, 39; Walton Rogers 2007, 85–86; Pritchard 2017, 121). According to archaeologist Irita Žeiere (2008,



136, pers. com. Žeiere 2025), the Tira bog tabby piled fabric with z-spun yarn in warp and s-spun in weft is atypical for the local weaving tradition and must have been brought from elsewhere.

Although several authors have stressed that piled textiles, for example in the form of cloaks, were produced widely in Iceland from the tenth century and traded along with *wadmal* to Scandinavia, this assumption is primarily based on written sources (Guðjónsson 1962, 68–69; Hayeur Smith 2024, 53–54; Hopkin 2021, 31–32). A recent study on Icelandic and Norwegian archaeological textiles using strontium isotope analysis to determine wool provenance contradicts this popular theory of pile weaves being an Islandic commodity in Viking Age long-distance trade (Hayeur Smith 2024, 73). Hayeur Smith argues that piled textiles were spread throughout north Europe and made locally in various places (Hayeur Smith 2024, 54). It remains unclear at this stage how this outcome corresponds with the observation that the fibre distribution in the piled textiles from Pöide and Greenland deviates from the established Greenlandic and Danish Viking Age pattern (Walton Rogers 2004, 84; Skals et al. 2024, 46–47) as there is not enough comparison material available. Might this result indirectly support the idea that pile weave technique was employed across various locations?

However, the Pöide textile is unique in the eastern Baltic region and does not fit into the local weaving tradition. In addition, the location of Saaremaa on the *Austrvegr*, which means the Viking route from the Varangians to the Greeks, the Pöide Stronghold's relationship with the Viking Age harbour in Tornimäe, and the arrival of this item from Scandinavia, or via Viking mediation, is at present the most likely option. It is, of course, impossible to say whether the Pöide textile was a traded commodity or reached Saaremaa with travellers as a personal item. Future isotope analyses would hopefully clarify the provenance of the Pöide fragment.

The function of the textile item

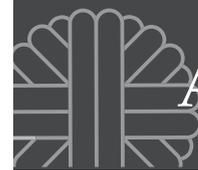
The archival records documenting the find circumstances indicate that the Pöide textile fragment was part of a larger piece of clothing discovered in the 1870s (KM catalogue, no. 1931). Regrettably, the description is extremely vague: “a shawl or a dress fragment” (ibid.), “a shirt or body covering” and “sleeveless” (Tallgren 1925, 38). The most common opinion is that this cloth type was used mainly for (hooded) cloaks (Østergård 2004, 74; Walton 1989, 336; Walton Rogers 2007, 207; Pritchard 2017, 120; Hopkin 2021, 32–33; Falk 1919, 52; Guðjónsson 1962, 69). The

Icelandic sagas, based on the tenth to eleventh century tradition and written down in the 13th century, and other types of written source mention clothing items called *vararfeldur*, *feldir*, and *röggvarfeldir*, which have been interpreted as woven mantles or cloaks with a pile surface, and either circular or rectangular and in various lengths (Falk 1919, 177; Guðjónsson 1962, 68; Hayeur Smith 2024, 53–54). Coloured versions of these garments have been mentioned; among others, blue ones are also known to have existed. Although no other entirely blue examples are currently known among published archaeological finds other than the Pöide textile, this colour is also mentioned in these sources.

The textile from Pöide might originally have functioned as an upper body garment. Due to the absence of buttonholes, fastening bands, or fibulae, it is not possible to determine with certainty how it was worn. The braid sewn along the selvedge might have served either a decorative or reinforcing purpose, or potentially both. Previous research has emphasised the capacity of *vararfeldur* to provide protection in cold and wet conditions (Wincott Heket 1992, 163–164). If worn with the pile facing inward, the garment would probably have enhanced thermal insulation by creating a warm air layer around the wearer's body. Conversely, if *vararfeldur* were worn with the pile facing outward, they may have functioned as rudimentary rain garments. Archaeological pile weaves have been associated with several medieval European depictions, typically showing men wearing shaggy cloaks, identifiable by their outward-facing pile. In Christian iconography, for instance, the shaggy mantle is a distinctive attribute of John the Baptist (Guðjónsson 1962, 71). Experimental studies have demonstrated that this textile type performs well in wet conditions, offering insulation even when damp and drying relatively quickly (Hopkin 2021, 42). A later analogue to the Viking Age *vararfeldur* can be found in Scandinavian boat rugs, which were used by fishermen to retain warmth in harsh, damp environments. A key feature of these rugs was the presence of lanolin-rich wool staples in the pile (Toikka-Karvonen 1971, 41–41; Kjellmo 1996; Plath 1966, 9). It is unknown though, if the *vararfeldur* contained any lanolin, which would have increased weather performance.

Conclusion

The Pöide textile, which is 14C-dated to the Viking Age, opens an entirely new chapter in Estonian textile history as the oldest textile fragment, bigger than a fingertip, found in Estonia. The textile is a plain 2/2 twill woven of z-spun wool yarns dyed with woad. It



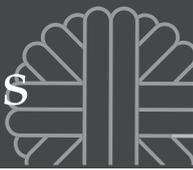
belongs to a specific group of piled weaves, where in this case wool tufts were inserted into the shed when weaving, resulting in a shaggy pile on one side of the cloth surface. Based on the technical traits mentioned above, the Pöide textile is a good fit for Nordic Viking Age cloth culture. Because piled weaves are relatively rare among archaeological textile finds, provenance and use are difficult to determine. However, the Pöide textile appears foreign to textile production in Estonia and possibly the entire eastern and north-eastern Baltic region. The closest parallels in terms of technical traits are known from Norway, Greenland and Iceland with pile weaves mentioned in the sagas pointing to a specific Islandic commodity. However, recent isotope analysis and the fibre distribution patterns indicate the possibility that piled fabrics could have been produced in several places, meaning that the question of the Pöide textile's provenance remain unsolved. The find location near the Viking Age Pöide hillfort and its relation to the harbour site supports the interpretation that this textile reached Saaremaa via Scandinavian contacts. Regrettably, the Pöide clothing item was destroyed during its discovery approximately 150 years ago, but it could have been a cloak or other type of loose overgarment.

Acknowledgements

This research was funded by the European Union's Research and Innovation Action Horizon-CL2-2022 Heritage-01-04 program for the Colour4CRAFTS project, no. 101094809, and the Maalöydöstä koruksi project (2020–2022), hosted by the Kalevala Women's Association with funding from the Finnish Cultural Foundation. Our special thanks to conservator Mira Karttilla (Zenzie Tinker Conservation, Brighton, UK) who introduced us to the Pöide fragment.

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Corresponding author:
riina.rammo@ut.ee