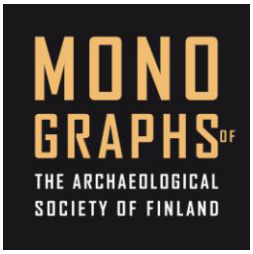

Nålbinding in Prehistoric Burials – Reinterpreting Finnish 11th–14th-century AD Textile Fragments

Author(s): Krista Vajanto

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Nålbinding in Prehistoric Burials – Reinterpreting Finnish 11th–14th-century AD Textile Fragments

Krista Vajanto

ABSTRACT **This article discusses Finnish prehistoric, woollen textiles made with the nålbinding technique. These textiles are from Late Iron Age inhumation burials and dated to the 11th to 14th centuries AD. A case study is made of the nålbound Eura Luistari fragments. These results are discussed in connection with the data related to other Finnish nålbinding fragments and material obtained from a survey done in 1957 concerning the nålbinding technique. The double spiral technique is suggested to explain the structure of the striped area in the Eura Luistari fragments. This explanation seems to exclude the presence of a thumb structure and casts doubts on the earlier mitten interpretation. It is suggested, in general, that due to the absence of a thumb, the prehistoric nålbound fragments might have been some kind of pouches.**

KEYWORDS

***nålbinding*, Late Iron Age, burial textiles, experimental archaeology, dyed wool, folklore**

Introduction

In Finland, the Iron Age ended mainly in the middle of the 12th century AD, in Eastern Finland ca. 1300 AD (Kivikoski 1973:10). There are inhumation graves dated to the Late Iron Age containing different types of grave goods, like bronze jewellery, ceramics, iron tools, and textiles, as well as fragments of *nålbinding* (**Table 1**). These *nålbound* fragments have been dated to the 11th–14th centuries AD and were found in the middle part of the grave where the deceased has been in a supine position. The fragments have often been located near the finger or hand bones, in connection to bronze rings and/or a bronze knife sheath or other bronze objects (Schwindt 1893:116–120, Plate 45; Lehtosalo-Hilander 1982:89–93; Riikonen 2003:233, 240, Plate 28). Only one nålbound fragment has been found near a foot bone (Luoto & Fischer 1989:49; Riikonen 2006:15).

The earlier research, which explains archaeological fragments of nålbinding as mittens or socks based on the ethnographic material (Kaukonen 1960; Vahter 1934), is reconsidered here. The data obtained from Finnish prehistoric nålbinding fragments, folklore, and ethnographic materials is compared. The question is raised of whether the ethnographic and prehistoric material groups can be compared. Are there hidden but important elemental differences that should be taken into consideration in comparing prehistoric textile materials with modern ones, despite the many obvious similarities?

Research history

Nålbinding in textile history

In research, the nålbinding technique has been given many names, like knotless netting and looping (Seiler-Baldinger 1994:17; Gleba & Mannering 2012:11–12), in Finnish *neulakinnastekniikka*. The nålbinding technique has had many variants (Collin 1917; Davidson 1935; Nordland 1961; Steffensen 1976; Brodén 1978; Westman 1983; Hansen 1990; Seiler-Baldinger 1994:17; Böttcher 2001; Claßen-Büttner 2012), but has often been mentioned only as an interesting curiosity within the art of handicrafts (Rutt 1987:8–9; Barber 1991:182–183; Turnau 1991:13–15).

The oldest textiles made with the nålbinding technique are a bast fibre net from the Late Mesolithic (4200 BC) Tybrind Vig, Denmark (Bender Jørgensen 1992:115, 159–160), and textiles of a plant material from Bolkilde (Denmark, 3400 BC) and Tulstrup Mose (early Neolithic, Denmark) (Mannering *et al*. 2012:94–95). In these finds the looping is quite simple. Relative stitches can be found in a woollen hat from the Tarim basin dated to 1000 BC (Barber 1999:32–33) and in sandal socks from Egypt dated to the 1st–5th centuries AD (Rutt 1987:28–31; De Moor *et al*. 2008:74, 130–131).

From the 10th to 16th centuries AD, there are woollen mittens from Middle and Northern Europe, a sock from England, a glove from Latvia, and fragments from Estonia (Arbman & Strömberg 1934; Nordland 1961:43; Zarina 1968; 1988; 1998; Caune & Zarina 1980; Peets 1987; Walton 1987; 1989; Østergård 1991; Nockert & Possnert 2002). There is also a golden nålbound lace fragment found in 10th-century-AD Mammen, Denmark (Hansen 1991). In these finds, the stitching resembles a more or less never-ending spiral, with differences in loop count and row fastening.

In Finland, the nålbinding technique was a part of living folk tradition until the middle of the 20th century, after which it was known only by textile enthusiasts. The technique was traditionally used for woollen mittens and socks, sometimes also for caps (Vahter 1934; Kaukonen 1960:46–49). Winter-fishing mittens, *jouhikkaat*, were made of pig or horse hair, and milk sieves were made of horse hair (Kaukonen 1960:46–49). There are possible woollen sock fragments from the 17th century from Oulu Cathedral, with straps to fasten them to knee pants (Kuokkanen & Lipkin 2011:153–158; Lipkin 2011:54). The Finnish prehistoric nålbound textile fragments are discussed in detail elsewhere in this paper (see below).

Finnish ethnographic material and nålbinding folklore

Folklore has had a strong role in Finnish nålbinding research when the nålbound textile material from Finnish Late Iron Age burials has been interpreted. The prehistoric fragments have been defined as mittens merely based on the technique. For example, a decorated fragment was defined as a mitten by comparing it with decorated ethnographic mittens and neglecting the observation of the missing thumb (Vahter 1934). In addition, archaeological nålbinding finds were readily associated as white funeral mittens mentioned in folklore (Kaukonen 1960:56). However, at that time, the Finnish research knew only of nålbinding finds with bright, colourful yarns (Kaukonen 1960:66–69).

The prehistoric Kaukola fragments were interpreted as sock remains on the basis of the stripes, because there were striped socks in 20th-century ethnographic material (Vahter 1934). It should be noted that neither fragment has any remains of heels and nothing in the excavation data refers to socks.

The survey material from 1957, described by Kaukonen 1960, contains oral folklore, mittens, half-finished exemplars, and needles. The mitten samples of this survey were re-researched by the author and nålbinder Sanna-Mari Pihlajapiha in 2010 at the Ethnographic Archive of the National Board of Antiquities of Finland. It was discovered that the folklore and the actual textile samples provided contradictory information. For example, the optimal yarn for nålbinding was said to be s-spun and plied (Kaukonen 1960:56). However, amongst the ethnographic mittens, Z2s-, S2z-, and even S4z-plied yarns existed, and in general there was a greater variety of stitch types (**Table 1**).

Notation systems

Nowadays, the most common way to describe the stitches in the nålbinding technique is Egon Hansen's notation (Hansen 1990). Hansen's notation consists

Table 1. Nålbinding mitten samples at the Ethnographic Archive of the National Board of Antiquities of Finland.

No.	Inventory number, site	The stitch family, notation	Twist of yarns
1.	KA 7758:4 Rautjärvi	The Finnish stitch, UUOOO/UUUOOO F2	Z2s
2.	KA 7758:5 Rautjärvi	The Russian stitch, UOOU/OUUOO F1 or F2	S2z
3.	KA 7758:7 Puumala	The Russian stitch, UOOU/OUUOO F1 or F2	Z2s
4.	KA 7653:37 Vuoksenranta	The Finnish stitch, UUOOO/UUUOOO F1	S2z
5.	KA 9170:5 Suojärvi	The Russian stitch, UUOOUUU/OOOUUOOO F2	S2z
6.	KA 9461:1 Rautjärvi	The Finnish stitch, UUOOO/UUUOOO F2	S2z
7.	KA 9461:2 Rautjärvi	The Russian stitch, UUOOU/OUUOOO F2	S2z
8.	KA 9461:3 Rautjärvi	The Russian stitch, UOU/OUOO F2	S2z
9.	KA 9461:4 Rautjärvi	The Finnish Turning stitch, UUOO(U /O)UUOO F2	S2z
10.	KA 9616:1 Rautjärvi	The Finnish stitch, UUOOO/UUUOOO F2	S2z
11.	KA 9616:2 Rautjärvi	The Russian stitch, UUOOUU/OOUUOOO F1 or F2	S2z
12.	KA 9616:3 Rautjärvi	The Finnish Turning stitch, UUOO(O/U)UOOO F1 or F2	S2z
13.	KA 9616:4 Heinjoki	The Finnish stitch, UUOO/UUOOO F1 or F2	Z2s
14.	KA 9616:5 Mikkelin mlk	The Russian stitch, F1	not determined
15.	KA 9616:6 Savitaipale	The Finnish stitch, UOO/UUOO F1 or F2	not determined
16.	KA 9616:7 Parikkala	The Russian stitch UUOOUU/OOUUOOO F2	Z2s
17.	KA 9616:8b Parikkala	The Finnish Turning stitch, "plaited edge" UUOO(O/U)UOOU FT	S2z
18.	KA 9616:9 Parikkala	The Russian stitch, UUOOUU/OOUUOOO FT	S2z
19	KA 9616:10 Parikkala	The Russian stitch, "plaited edge", UUOOUU/OOUUOOU FT	S2z
20.	KA 9616:11 Polvijärvi	The Russian stitch UOOUU/OOUUOOF2	S2z
21.	KA 9616:12 Nurmes	The Russian stitch UOOUU/OOUUOO? F2	S4z
22.	KA 9616:13 Korpiselkä	The Russian stitch UUOOUU/OOUUOOO F2	Z2s
23.	KA 9616:14 Ristijärvi	The Russian stitch UOOUU/OOUUOU, "plaited edge" F1 or F2	not determined
24.	KA 9616:15 Kiihtelysvaara	The Russian stitch, 2+2+2, UUOOUU/OOUUOOO F1 or F2	S2z
25.	KA 9616:16 Paltamo	The Russian stitch, 1+2+2, UOOUU/OOUUOO F1	Z2s
26.	KA 9616:17 Pyhäjoki	The Finnish stitch, UOOO/UUUOO F1	S4z
27.	KA 9616:18 Jaakkima	The Finnish stitch, UUOOO/UUUOOO F2	S2z

of the "U" and "O" letters and describes not only the course of the yarn in a single stitch, but also the joining direction and stitch count of the connection to the previous row (from front: F1, F2, from back: B1, B2, etc.). There is also an older notation system created by Odd Nordlund and a stitch typology classified by Margarethe Hald (Nordland 1960; Hald 1980:285–310).

Finnish folklore knows three stitch "families ", namely the Finnish stitch (UUOO/UUOOO F1 or 2), the Russian stitch (UUOOUU/OOUUOOO F1 or F2), and the Finnish Turning stitch (UUO Down U/O Up UOOO F1 or F2)(**Fig. 1**). There are also other, local names for these stitches (Soisalon-Soininen 1956; 1957; Kaukonen 1960:61–63). In addition, there are variations in the loop count among the stitch families (**Table 1**). The prehistoric Finnish fragments (see **Table 1**) have mostly been made with the Finnish stitch, UUOO/UUOOO F1 or 2, but two fragments use its variation, the Kaukola Kekomäki stitch, UUOO/UUOOO Mid 1+F1.

Figure 1. From top to bottom: The Finnish stitch, the Russian stitch, the Russian stitch with a plaited edge, the Finnish Turning stitch, and the Finnish Turning stitch with a plaited edge.

Hansen's notation has been improved by adding the parameters "top", "mid", and "bottom" (Schmitt 2000:21–22), small "u" and "o" letters to describe the split yarn in some stitch types (Pihlajapiha, 2013a), and the parameter "T" to describe a certain type of joining through the stitch rows (Vajanto 2003:13, 15). The "plaited edge" structure (Vajanto 2003:14, 37) can be added to any stitch type when more density is desired. The "T" (through) joining can be found in both plaited-edge and "normally" stitched variants (**Table 2**). The Finnish turning stitch also has two variants from Joutseno. In these variants, the twisting of the loop is made with the fingers or in the middle of the stitching process (Pihlajapiha 2013b).

The double or multiple spirals make significant changes in the structure at the starting point and on the texture by creating skewed stitch rows. The author's suggestion is that in the striped textiles, the number of independent stitch rows should be calculated and marked, for example, with the letter "X".

Finnish prehistoric nålbinding finds

The currently known fragments of nålbinding can be classified into three groups based on their visual parameters: monochromatic, embroidered, or striped (**Table 1**). The predominant twists of yarn are the z-spin or S2z-ply (about twists of yarn, see Gleba & Mannering 2012:11). This is typical of Finnish prehistoric textile material in general (Bender-Jørgensen 1992:93–100; Riikonen 2006:14).

The monochromatic fragments

This group consists of fragments that have only one solid colour. Because the archaeological fragments are usually small, the monochromatic appearance may be only an illusion, and there might have been other colours in areas of the object that have not been preserved. For example, in the white Swedish Åsle mitten, dated to 1510–1640 AD, the wrist part is decorated with red and green yarns (Arbman & Strömberg 1934; Nockert & Possnert 2002:65–67). In addition, the textiles that seem to be undyed might contain faded dyes that cannot be detected with visual analysis.

There are monochromatic and possibly undyed fragments from Masku Humikkala grave 30 (Tomanterä 1982:161), Perniö Yliskylä grave 6 (Appelgren-Kivalo 1907), and Köyliö Köyliönsaari C, grave 28 (Cleve 1978:41–42; Tomanterä 1987:119, 120; Vajanto 2003:23, 27). The fragment from Piikkiö Huttalanmäki has been published with no mention of colours (Luoto & Fischer 1989:49; Riikonen 2006:15). The fragment from Halikko Rikala grave 38 is made of white wool (Mäntylä 2011:225–226), but the probably felted fragment from same site is solid reddish brown (Tomanterä 1987:120; Mäntylä 2011:233).

The tiny fragment from Kaarina Kirkkomäki grave 1 is blue (Tomanterä 1987:118–119; Riikonen 1990:77; 2003:240), but the colour might be a result of contamination from other blue textiles in this grave (Riikonen 1990:77; 2003:242–246). In addition, there are nålbound fragments from Kaarina Kirkkomäki graves 21, 23, 24, 27, and 40 with no mention of possible colours (Asplund & Riikonen 2007:21; Kirjavainen & Riikonen 2005:33; 2007:135; Riikonen 2011:211).

Table 2. Nålbinding fragments from Iron Age burials.

No.	Inv. number, site	Date, burial	Context	Yarns	Hansen's notation	Size
1.	Eura Luistari, Grave 56 NM 18000:1696 NM 18000:1700 NM 18000:1702	11th century AD female	near hand bones, finger rings and a bronze knife sheath	yellowish: S2z red: S2z blue: 2z	the Finnish stitch UUOO/UUOOO F2 blue: split F2 or F1	3 x 2.5cm, 3.5 x 2cm, 9 x 5 cm
2.	Halikko Rikala NM 12690:475	11th century AD	stray find	felted?	not determined	6 x 4 cm
3.	Halikko Rikala Grave 38 NM 12841:29	11th century AD male	near a bronze finger ring	S2z	the Finnish stitch, F joining	2.5 x 2 cm
4.	Kaarina Kirkkomäki Grave 1 NM 12687	11th century AD female	near a bronze knife sheath	S2z	the Finnish stitch, F joining	1 x 1 cm
5.	Kaarina Kirkkomäki Grave 31 NM 27196:H 31:101	11th –12th c. AD female	near finger bones and a bronze knife sheath	dark: S2z white: 2z or loose S2z	the Finnish Turning stitch or the Finnish stitch, F1 joining	4.5 x 4 cm 2 x 1 cm
6.–10.	Kaarina Kirkkomäki Graves 21, 23, 24, 27, 40	11th century AD female (grave 24: male)	middle part of the grave, near bronze items	not determined	not determined	not determined
11.	Kaukola Kekomäki Grave 1 NM 2489:40	13–14th c. AD female	near a finger ring	all colours: 2z or loose Sz	the Kaukola Kekomäki stitch UOO/UUOO Mid 1+F1	6.7 x 5.8 cm
12.	Kaukola Kekomäki Grave 1 NM 2489:49	13–14th c. AD female	near an apron hem ornamented with bronze spirals	all colours: 2z or loose Sz	the Kaukola Kekomäki stitch UOO/UUOO Mid 1+F1	6.7 x 5.8 cm
13.	Köyliö Köyliönsaari Grave 28 NM 8723:308	11th century AD female	near a bronze bracelet	S2z	the Finnish stitch, F joining	2.5 x 1.5 cm
14.	Köyliö Köyliönsaari Grave 28 NM 8723:315	11th century AD female	near a bronze knife sheath	S2z	the Finnish stitch, F joining	2 x 3 cm
15.	Masku Humikkala Grave 30 NM 8656:H30	11th century AD female	middle part of grave, near hand bones	2z	The Finnish stitch UUOO/UUOOO F2	3.5 x 1.7 cm
16.	Mikkeli Tuukkala NM 9770:4 Grave 1/1933	13–14th century AD male	unknown	Z2s decoration: loose s or untwisted	The Finnish stitch UUOO/UUOOO F2	18 x 5.5 cm
17.	Mikkeli Tuukkala NM 99 69:14	13th century AD female	unknown	s or unplied, felted decoration: z	The Finnish stitch UUOO/UUOOO F2	10 x 10.5 cm
18.	Perniö Yliskylä Grave 6 NM 2919:95	12th century AD female	stuck to a bronze finger ring	2z	The Finnish stitch UUOO/UUOOO F2	2.5 x 1.5 cm
19.	Piikkiö Huttalanmäki Grave G2	11th century AD female	near a foot bone	not determined	not determined	not determined

The embroidered fragments

From Mikkeli Tuukkala, there are two embroidered fragments that have been excavated by non-archaeologists (Tomanterä 1987; Lehtosalo-Hilander 1988:206–207). The fragment from grave 1/1933 has been made of possibly undyed white wool. The textile has been decorated with blue or green yarns using chain stitch, herringbone styled stitch, and stem stitch (Vahter 1934:237; Kaukonen 1960:69). Some reddish embroidery is also present (Vajanto 2003:27–28, 32). The other embroidered fragment is a stray find and has been

Figure 2. Fragment Eura Luistari NM 18000:1702, the reverse side. The archaeological collections of the National Museum of Finland.

made of possibly undyed and probably slightly felted white sheep´s wool. The textile has herringbone and stem stitch decoration that has been made with blue and reddish yarns (Kaukonen 1960:66–67; Tomanterä 1987:117; Vajanto 2003:27, 32).

The striped fragments

There are three-coloured nålbinding fragments from Eura Luistari grave 56 (Lehtosalo-Hilander 1978:31–32; 1982:89–93, Plate 28; 2001:63; Lehtosalo-Hilander *et al.* 1982:20–21, 32, 41; Tomanterä 1978:54–57; 1987). Fragments with three repeating colourful stripes have been found in Kaukola Kekomäki grave 1 (Schwindt 1893:16–20, Plate 45). The stripes seem to be bluish, white/undyed, and reddish brown (Vajanto 2003:25, 27, 31), but because of fading and contamination from soil, it is impossible to determine the original shade of the colour.

From Kaarina Kirkkomäki grave 31, there are two-coloured fragments (Aaltio 2011:8) that have both dark and light coloured yarns. The replica mitten based on these fragments was made with the Finnish Turning stitch (Aaltio 2011), but the author's interpretation is that the fragments might have been made with the Finnish stitch with F joining and with high loop count.

Case study: Research and results of the nålbound Eura Luistari fragments

To increase our knowledge of prehistoric nålbound textiles, some samples from the Eura Luistari fragment were subjected to closer research.

Visual analysis of the Luistari fragments

The nålbound fragments from the inhumation cemetery at Eura Luistari were found in the female grave 56 (Lehtosalo-Hilander 1978:31–32; 1982:89–93, Plate 28; 2001:63; Tomanterä 1978:54–58; 1987:117–118; Lehtosalo-Hilander *et al.* 1982:21, 41). The fragment NM 18 000:1702 was stuck to a bronze knife sheath, which had preserved the yarns in excellent condition (**Fig. 2**). This better side was interpreted to be the reverse side of the textile. The front side was more degraded and covered with bark. In addition, there are some smaller fragments (Vajanto 2003).

Fragment NM 18 000:1702 has red, yellowish, and blue yarns, while the other, smaller fragments have only remains of red and yellowish yarns (**Table 3**). The red and yellowish yarns are S2z-plied, while the blue yarns are s-spun and used in pairs (Vajanto 2003:34). All the yarns have been spun with a moderate degree of twist.

The red and yellowish stitch rows have F2 joining and are skewed when compared to the blue stitch rows that are more horizontal (Vajanto 2003:41). These

Table 3. Visual analysis data of the Eura Luistari NM18000:1702 yarns.

Colour	Twist	Diameter	Spinning angle	Plying angle
Red	S2z	2 mm	30–40°	25–40°
Yellow	S2z	2 mm	45–55°	30–40°
Blue	2s	1 mm	30–50°	–

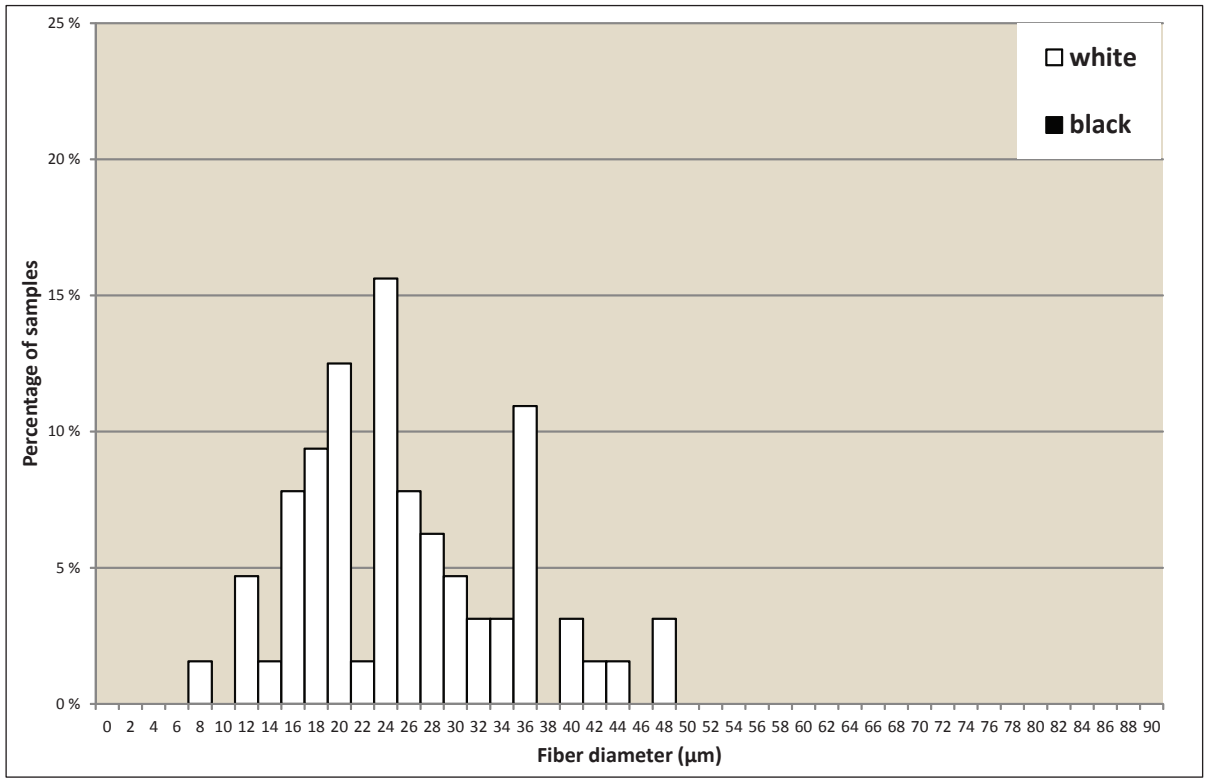

Figure 3. Fibre distribution of the fragment Eura Luistari NM 18000:1969, sample A.

blue rows probably have F1 joining or split F2 joining, that is, instead of stitching through the loop formed by the two parallel yarns, only one yarn was caught in the connection stitch.

Fibres of the Luistari fragments

Loose yarns from fragment NM 18000:1969 (sample A, yellowish yarn) and from fragment NM 18000:1702 (samples B and C, red yarn) were selected for a closer study to determine fibre materials, dyes, and wool types. One millimetre was cut from samples A, B, and C each and placed on a glass slide under a covering glass with distilled water as medium (Ryder 2000:2–8). Due to the poor condition of the fibres, the recommended 100 fibres could not be measured from sample A, but the results can be taken as a good approximation (Kirjavainen & Riikonen 2007:135). The diameters of the samples were measured with a Leica DMLS (DFC 420) transmitted light microscope without dyeing and by using the Leica LAS Core V 3.6 program. The fibre measurement data was loaded into the Excel program for empiric statistical fibre analysis.

Sample A was spun from white Hairy medium/Generalised medium, where the median was at 24.5 µm (n=65 fibres) (**Fig. 3**; **Table 4**). Sample B contained white and some black fibres. The wool type was Hairy with a median at 21.90 µm (n= 104 fibres) (**Fig. 4**; **Table 4**). Both samples contained mainly underwool that can be obtained by sorting the fleece or collecting the

Table 4. Fibre analysis data of Eura Luistari yellowish yarn (Sample A) and red yarn (Samples B and C).

	Sample A	Samples B & C
Number of samples (100%)	64	104
White fibres (%)	100	97
Pigmented fibres (%)	0	3
Medullated (%)	0	4
Median (µm)	24.5	21.90
Average	25.67	23.92
Standard deviation	9.12	11.27
Mode	24	22
Variance	83	127

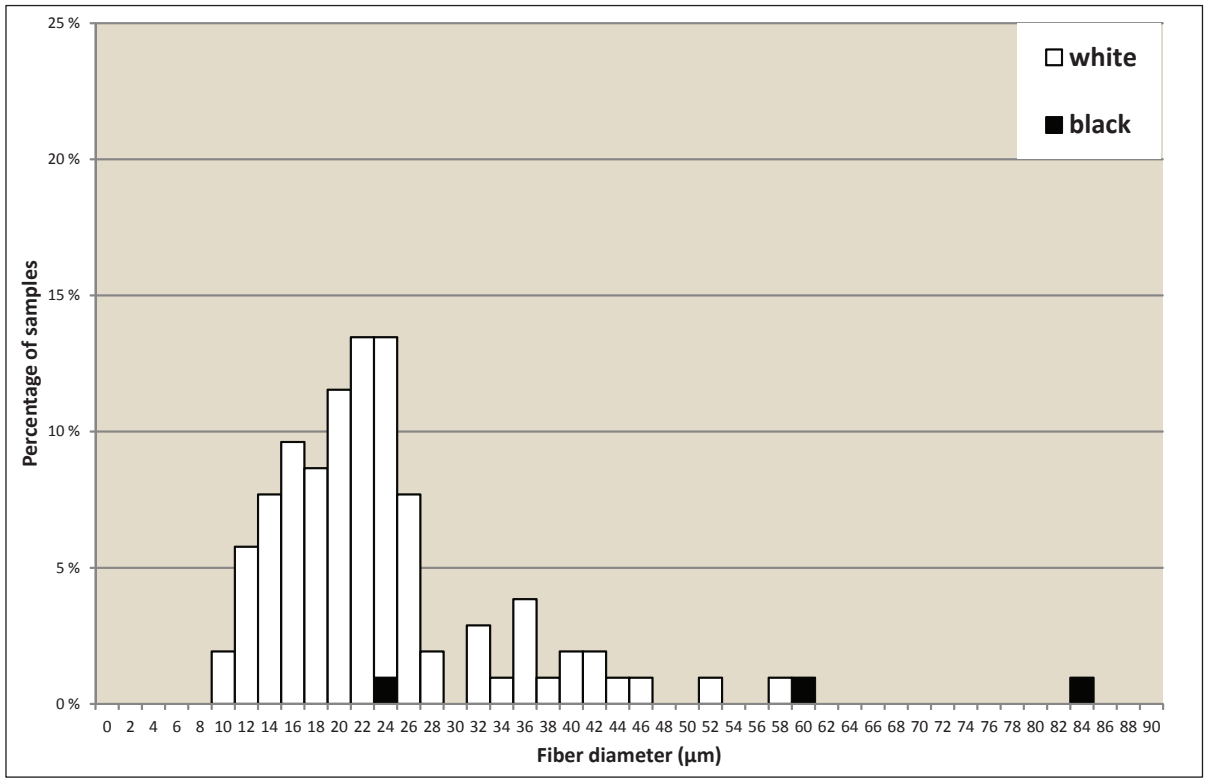

Figure 4. Fibre distribution of the fragment Eura Luistari NM 18000:1702, samples B and C.

underwool during the natural shedding time. The blue yarn in fragment NM 18000:1702 was analysed visually without sampling. In this yarn, the fibres seemed to be finer than in the other yarns. In addition, these fibres were very shiny.

Sample C contained not only sheep wool, but also undetermined fur hairs with a pearl-string-like medulla and minor particles of probable bast fibres (**Fig. 5**). These were oriented similarly to the wool fibres. The diameters of the fur hairs were ca. 10–20 µm and the fibres were orange in colour, probably because of the bedstraw dye found in the HPLC analysis (see below). The hairs might have been spun into the yarn with wool on purpose, or there might have been some contamination before, during, or after the spinning process. In the North, the Sami people spun hare yarns as late as the 17th century to make soft caps and mittens (Itkonen 1979:222). Hare yarn has also been found in a Greenlandic textile as a decorative stripe in sheep's wool twill (Walton Rogers 2004:83; Østergård 2004:71). Alternatively, these fibres could originate from fur lining, a piece of fur, or a fur garment.

Dyes of the Luistari fragments

The yellowish sample A was sent for HPLC-PDA analysis to the Cultural Heritage Agency of the Netherlands. The analysis found purpurin as main colourant, but also alizarin, indirubin, and indigotin were detected. No yellow dyestuffs were found (Van Bommel 2013). The yellow shade of colour in sample A was possibly a combination of blue and red dyestuffs. It is difficult to say whether this shade was dyed on purpose or whether it is the result of migrated dyestuffs. Even a very small amount of dye on a white wool yarn could cause a colourful effect.

The red samples B and C from the fragment were sent for HPLC-DAD dye analysis to IRPA/KIK, the Royal Institute for Cultural Heritage of Belgium. It was discovered that the samples contained mainly purpurin with only small amounts of alizarin and xanthopurpurin (Vanden Berghe 2012a:6, 11). The combination of the red compounds was typical of dyes derived from plants of the *Rubiaceae* family (Cardon 2007:122–127). Although alizarin was present in the samples, its ratio to purpurin was very low, which ex-

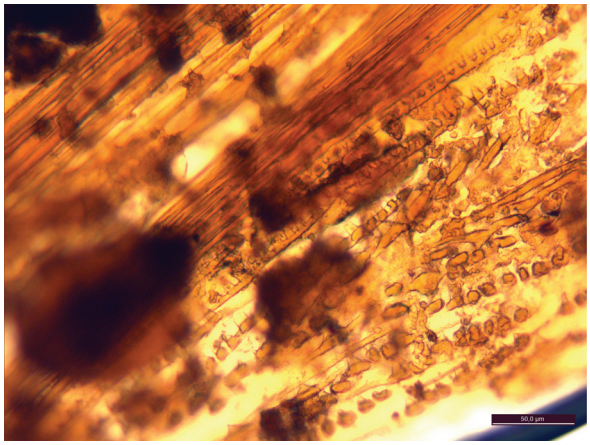

Figure 5. Animal hairs and probable bast fibres from the fragment Eura Luistari NM18000:1702, sample C. Scale bar 50 µm.

cluded the use of dyer's madder *(Rubia tinctorium)* (Vanden Berghe 2012a:11; Van Bommel 2013). Possible sources of red dye in samples A, B, and C are white bedstraw *(Galium mollugo* L.) and northern bedstraw (*Galium Boreale* L.) (Proaño Gaibor 2011:1–4, 80–82; Van Bommel 2013), as well as lady's bedstraw (*Galium verum* L.) and dyer's woodruff (*Asperula tinctoria* L.) (Vanden Berghe 2012b:13, 17–18).

No direct local parallel for the bedstraw dye has been found among Finnish prehistoric textiles. Traces of alizarin have previously been detected from only one Late Iron Age Finnish sample. This textile is the band of a leg binding from the Kaarina Kirkkomäki inhumation cemetery, and it is dated to the 11th century AD (Kirjavainen & Riikonen 2005:40; 2007:137). Elsewhere in contemporary Europe, textiles were dyed red with cultivated dyer's madder (Cardon 2007:120).

The blue yarn was left out of the dye analysis, because there were remains of it only in one fragment. The blue dye is probably from woad (*Isatis tinctoria*), which was cultivated on a large scale in contemporary Central Europe (Cardon 2007:374–376) and is found in small quantities in fragment A. The indigo pigment is identical in both woad and the tropical indigo shrub (*Indigofera tinctoria*), but there has been speculation on when the true indigo was traded to Europe for the first time (Cardon 2007:335, 362–364). In the North, the Vikings' marine route to the east and back followed the coast of Finland and resulted in a great amount of eastern silver coins on the coasts of the Baltic Sea (Lehtosalo-Hilander 1984:317–319). The true indigo dye could have been a trade article like the silver coins and other trade items.

Luistari fragments and experimental archaeology

The first replica based on these fragments was inspired by the wishes to complete the so-called Eura costume with a pair of mittens. It was made with one spiral row interlacing the red and yellow yarns (Vajanto 2003). There were transition places from yellow to red and back, similarly to some ethnographic textiles (Kaukonen 1960:64). This seemed to indicate that the red stitch row of the fragment, which lies between the yellowish and the blue ones, would have been the beginning of the thumb. The stripes in this replica textile were more or less horizontal (**Fig. 6**).

Another replica was made using the double spiral technique that has lately become popular among modern nålbinders. This technique in unknown or at least poorly recognised in the ethnographic material. In this method, there are independent and parallel stitch rows for each colour of the striped area. There are no transition places from one colour to another. The triple spiral technique might be present in the Kaukola Kekomäki fragments.

Figure 6. The replica presented in the author's Master's thesis (Vajanto 2003).

Figure 7. The new replica with the double spiral technique in the striped area.

The replica with double spiral technique in the striped area is highly comparable with the three-coloured fragment NM 18000:1702 from Eura Luistari. The yellow and red rows (2X UUOO/UUOOO F2) are similarly skewed and the blue rows (as 1X UUOO/UUOOO F1) are similarly horizontal (**Fig. 7**). Unfortunately the double spiral technique seems to exclude the presence of a thumb in the Eura Luistari NM 18000:1702 fragment. In the new replica, the red area that is between the yellow and blue rows is just the end of the red spiral row. Nothing in the fragment proves the existence of a thumb. It could, of course, have been situated somewhere in the unpreserved area.

Reconsidering the interpretations

The nålbinding technique itself should not be used as a parameter to define the shape and use of a prehistoric textile. For instance, we don't define all twill fragments as dress remains either. It is true that most of the prehistoric Finnish nålbinding finds are from the middle part of the grave, often near the hand bones (Vahter 1934:237; Riikonen 1990:77, 105). But this is also the location of bronze finger rings and knife sheaths that play a major role in the preservation of organic textile materials. Consequently, the find place of the nålbinding fragments indicates only the place of *optimal preservation* of organic material as a result of bronze oxides and bone calcium and provides little information about the function of the textiles.

The double spiral technique has been hitherto found only in the striped prehistoric fragments and is unknown in the younger material. This implies changes in the stitching tradition and might indicate that the purpose of the prehistoric nålbound textiles was different than those of the younger periods. Consequently, it can be questioned whether the Finnish ethnographic data is too recent to be used as an ethnographic parallel to the prehistoric textiles.

The folklore and survey material described by Vahter and Kaukonen provide with all likelihood some facts about nålbinding in the 19–20th centuries AD, but it is difficult to estimate the reliability of folklore and to know what facts are useful for textile-archaeological research. At least the twists of yarns that were announced to be optimal for nålbinding (Kaukonen 1960:56) differ from the yarns of ethnographic mitten material obtained in the very same survey (**Table 1**).

Due to the obvious colours, the Eura Luistari textiles and several other prehistoric nålbound textiles might have no connection with the white funeral mittens described in Finnish folklore (Kaukonen 1960:56). The white mittens might be a relatively new phenomenon or a cultural loan. At least in 19th– 20th-century Estonia, there is folklore data on white funeral mittens (Peets 1987:110). The fragments from Kaarina Kirkkomäki graves 1 and 23 suggest that the nålbound textiles were not simple winter mittens at all. On the basis of macrofossil finds, these burials were carried out in the summer (Riikonen 2003:234, 240–241; *pers. comm*. 2012). The rare bedstraw dye found in the Eura Luistari fragment might imply a textile with a very special meaning.

The Eura Luistari fragments, which are made with the double spiral technique, have no remains of a thumb. Remains of thumbs or heels are not found in other Finnish fragments either. This can be just a coincidence, but based on the material we have now, no prehistoric fragments can be clearly defined as mittens or socks. Perhaps these fragments are the remains of some kind of pouches with a still unknown function.

Conclusions

The nålbinding technique has been applied to several kinds of textiles. The Finnish folklore data related to nålbinding and the nålbound textiles in the Finnish ethnographic collections have influenced the interpretation of Finnish archaeological finds as mittens or socks. It can be questioned whether this data is too recent to use as an ethnographic parallel to the prehistoric 11th–14th-century-AD material. Half of the Finnish prehistoric nålbound textiles are colourful, not like the white funeral mittens that were described in the survey material obtained in the 20th century AD. The absence of the double spiral technique from the younger material might indicate deeper changes in the nålbinding tradition.

In the Finnish prehistoric finds, the placement near the hand bones does not confirm the nålbinding finds as remains of mittens. This area often has most of the bronze remains, which preserve the organic material and textiles. The placement indicates only the optimal place of preservation for organic material.

The double spiral technique produces a textile structure that is identical to the nålbound archaeological fragment of Eura Luistari NM 18000:1702, where the differently coloured stitch rows are skewed. This excludes the presence of a thumb from this Eura Luistari fragment. There is no evidence for thumbs or heels in other prehistoric fragments either. Consequently, the prehistoric Finnish nålbound finds could have been some kind of pouches with an unknown purpose.

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