

# Archaeological Textiles Review

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Dear Reader,

The year 2022 became the one in which the pandemic finally lost its tight grip on our academic world and the world in general. Conferences could take place in person again and the previous good experiences with online participation made it possible for those still unable to travel to link up with old and new scientific communities. In this issue, we have news from some of these conferences. There are still fewer than usual but the number is increasing. Please remember that you are all welcome to report on all events relevant to our *Archaeological Textiles Review* readers in the future. Despite the pandemic, ATR has received a constant flow of contributions this year and we already have many exciting articles and project reports in the pipeline for the next issue (ATR 65) – but we are always ready for more. We do our best to process material for the next issue as promptly as possible and continue to be a route to relatively quick publication. However, the editors and peer reviewers are all volunteers and we are grateful for your patience, if the process is delayed or postponed. We, just like everybody else at the moment, struggle with difficult work conditions for international collaborative work.

Our cover for this issue pays tribute to Ukrainian refugees who are volunteering with our colleagues in Estonia in an extensive textile project. Jaana Ratas, textile conservator at the University of Tartu and Anu Lensment, a fashion designer working for Estonian TV, are part of a network of local coordinators all over Estonia who are recycling textiles into camouflage nets on university campuses, in museums, and at social centres. There are 3,500 members in the project, both locals and refugees, with more members joining each day. A Facebook group, Aitan Kaitsta (I help to defend), helps to coordinate the work.

Information about net making, including up-to-date colour schemes for them, is shared there. The Estonian specialists have all studied textiles, fashion, design, traditional crafts, or conservation to university level. They receive advice from engineers and military experts about the best techniques for making camouflage nets and use their own craft skills to develop step-by-step instructions, which are published as free downloads in Estonian, Ukrainian and English and in tutorial videos.

The handmade camouflage nets are considered better than the mass-produced ones because they blend into the environment more naturally and are more effective at disguising vehicles and people. Since March this year, nearly 1,000 m<sup>2</sup> of camouflage netting has been made in Estonia and sent to Ukraine making use of

three tons of secondhand clothes, household textiles and sacks donated by clothing and coffee shops. They are made from old fishing nets, strips of the upcycled fabric, and unravelled jute. Sorting these materials, which must be categorised by colour for different kinds of camouflage, is a regular part of volunteers' work. Needles made for single needle looping are used for sewing fishing nets together and people with dyeing skills tint the textiles, if necessary. Despite 14-hour days at the beginning of the project and now three days a week away from their regular jobs for the Estonian coordinators, there are never enough nets. Other textile academics volunteer to work on the nets during their free time, including their lunch breaks, and some have started researching the history of camouflage to inform the project.

The Ukrainian volunteers add their own "magic" to the camouflage nets: prayers, rhymes, and greetings are written on the labels, and little dolls filled with herbs or cloth angels in blue and yellow are tied to them. Children's drawings, chocolate, and knitted woollen socks are also hidden inside the rolled-up nets. Many project participants also now knit socks for the soldiers, adding labels with their thanks and good wishes. There are benefits too for those making the nets. They make new friends, share stories, learn new languages, and experience the therapeutic effects of doing something useful with their hands which distracts them from their anxieties. Sometimes, the Ukrainian women sing while they work. Often, there is positive feedback from Ukraine which is very motivating for them. Some refugees have returned to Ukraine and continue to make nets there using the skills, knowledge and instructions they gained in Estonia. Despite the success of the project, Jaana says that she hopes "the war will be over some day and I could do textile research again."

This project is a timely reminder that textiles are key to human survival sometimes in ways we do not always appreciate. Whose current knowledge will prove crucial in the future? Our growing awareness of sustainable textile production makes its ancient and historical context ever more relevant – we can learn a lot from the past. We should all work on bringing our knowledge of the past to the fore in discussions about the future. Learning from the past also includes respecting the knowledge of those who have led our discipline down new paths. ATR 64 features the obituaries of three colleagues who have passed away this year. Even though this is sad, we must be glad that their legacies continue. Each in their own way brought

skill and passion to textile research and we honour their memories.

This year's issue also includes eight articles which range geographically from north Africa to Norway, and from the 16th century BCE to the 17th century CE. Some are about specific new textile discoveries and others document continuing analysis of old finds. The reports section has interesting news about recently started projects and updates on projects coming to an end. They all illustrate the fascinating breadth of textile research underway in European academia today. We congratulate you all on attracting the necessary funding and managing these complicated collaborations. A tremendous amount of work goes into managing research in this field, we hope that these experiences will benefit all who are working in textile research in the long run.

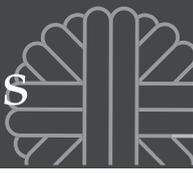
We hope you all enjoy reading this open-source journal, which is free to download and share. This is only possible through the dedication of many enthusiastic hearts, minds and hands. Please do consider offering your services if you would like to help keep this journal alive and kicking or consider sending us a contribution for publication. The deadline for articles for every issue is 1 May each year but project and conference reports may be submitted by 1 June and 1 October, respectively. The deadline for news including doctorates awarded, new publications or awards is 1 November.

Please note that it is still possible to order a printed copy of ATR from the webshop at the University of Copenhagen in Denmark ([www.webshophum-en.ku.dk/shop/archaeological-textiles-664s1.html](http://www.webshophum-en.ku.dk/shop/archaeological-textiles-664s1.html)).

*The Editors*



Fig. 1: Ukrainian refugees sort second hand clothing and household textiles for camouflage nets (Images: Jaana Ratas and Mark Raidpere)



Chiara Spinazzi-Lucchesi

# Threads and reused textiles as decorative items in Deir el-Medina, Egypt

## Abstract

Yarns and textiles can be used and reused for multiple purposes other than as clothing and household furnishing. In this paper, four different objects from the village of Deir el-Medina (Egypt) are examined. Some of them were purposely made, while others were reused strips of textiles. All of them share an evident trait, which is their decorative function. Through a detailed analysis of these unusual artefacts, it will be possible to shed light on some little known aspects of ornaments in Deir el-Medina.

**Keywords:** Egypt, Deir el-Medina, threads, fringes, ornaments

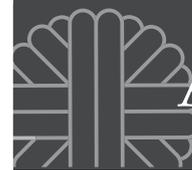
## Introduction

The small village of Deir el-Medina is located on the west bank of the Nile opposite Thebes, the ancient capital of New Kingdom Egypt (1550–1070 BCE). It used to be occupied by a small group of craftsmen, administrators, and their families, whose purpose was to build and decorate the royal tombs in the nearby Valley of the Kings. Hundreds of spinning tools have been discovered in Deir el-Medina since the beginning of the 20th century by the Italian and French excavations (Bruyère 1933, 6–7; Moiso 2016, 80–87; Spinazzi-Lucchesi 2018).

The first impression given by these numerous textile tools is that a flourishing textile production industry was located on the site, although this is not attested in the written sources, where only a few mentions can be found (Toivari-Viitala 2001, 234). While these written sources offer little detail on who was producing textiles or how it was done, they are nonetheless rich in information that presents textiles as valuable goods for exchange, and their frequent mention as part of wages or for barter has been used to demonstrate their prices (Janssen 1975). However, these sources do not offer any description of the items, and thus identifying a term for an object is often difficult.

Other information can be inferred from the iconography, but even iconographic sources give only a partial picture. The available sources are mostly funerary stelae, tomb decorations or funerary/religious statues. Although in many cases these match the extant archaeological findings, they are limited to a specific range of outfits, linked to ritualistic purposes or conventional rules (Baines 2007, 303–304; Bazin Rizzo 2017, 85–91), which may not represent the full variety of textiles used in daily life within the village. It is not possible, therefore, to fully understand which types of textiles were present in Deir el-Medina without analysing the preserved items.

Thanks to the arid conditions in the village, some textiles have been preserved. Unfortunately, most of these come from funerary contexts, as is the case with the vast majority of textiles from Pharaonic Egypt. In most cases, they are funerary shrouds and mummy bandages, with a few exceptions of tunics and loincloths, for example from the tomb of Kha (Schiaparelli [1927] 2007, 92–100). Almost no textiles have been fully published, with only summary information in the publications of the excavation reports (Schiaparelli [1927] 2007, 92–100; Bruyère 1937, 44, 58–61, 137–138), and a few isolated items because of their special status (Donadoni Roveri 1987,



93, 95; Hallmann 2017, 92–94). All these reasons make a compelling argument for studying the textiles from Deir el-Medina, not only the most rich or beautiful pieces, but also those that seem to have belonged to ordinary people.

The Marie Curie EgYarn project studies different items made of thread in New Kingdom Egypt, including textiles but also fishing nets, small strings, and decorative objects, demonstrating that not all yarns were transformed into textiles. The aim of the project is to create a dialogue between the numerous spinning tools found in Deir el-Medina (and Gurob) and the different types of thread objects. During the selection of the corpus for the project, which consists mostly of four groups (textiles, balls of yarn, fishing nets, and strings), some objects appeared different to all the others and did not fit within any of the general categories mentioned.

This contribution presents four items, each unique in the corpus, which might not directly or entirely be ascribed to the aforementioned categories, but which were nonetheless made of thread. They seem to share a common trait of conveying a decorative rather than functional meaning. The aim of this paper is to offer an in-depth analysis of each unusual item and to explore their possible usage and meaning.

Since the author has not yet found comparable pieces in New Kingdom Egypt, the hope is that this paper might form the start of a quest into unpublished collections, and that more unusual objects might come to light.

### Materials and methods

Each item will feature in a discussion of its possible use and correlation with other objects, in order to show the similarity of the techniques, and see whether this might offer some clues as to their function. They will also be discussed as a group of decorative items, trying to find their place in Deir el-Medina and, more generally, in the New Kingdom tradition. All of them were found in Deir el-Medina and are stored in the collections of the Louvre Museum in Paris, France and the Museo Egizio in Turin, Italy.

Each object has been analysed following the basic methodology for textile studies carried out in textile archaeology (for example Price and Gleba 2012, 2). Each item has been recorded in a specifically designed database, which records context and excavation information, technical features, decoration, and use (or reuse). The technical features studied include dimensions, construction, weave, thread count (where relevant), yarn details and construction (splicing), and twist angle, depending on the condition of

preservation. Objects have been photographed for study purposes and analysed with the help of a USB microscope (Dino-lite AM7515MZT).

### Descriptions

#### *Band with decorative braids (Louvre E 14479)*

This object is made up of two strips of textiles knotted together and decorated with braids (fig. 1). It was found in Deir el-Medina in the Eastern Cemetery, where burials from the first part of the 18th dynasty were located. It was discovered in Tomb 1382, and dates to the reign of Hatshepsut (1473–1458 BCE) (Bruyère 1937, 184–185). It was placed inside a basket as a grave good, apparently together with other unknown textiles. Despite the basket being well preserved, this piece is fairly poor. It is dirty, stiff, and rather fragile. Textiles from Deir el-Medina which were in direct contact with a body or found lying in the ground with no protection are in similar conditions, although the piece does not seem to be congruent with being stored in a basket (with no body in it). The basket contained a handwritten note left by the excavator, through which it was possible to connect it to its place of discovery. The excavation report and diary mention the basket, but



Fig. 1: E 14479, Louvre Museum in Paris, France (Image: Chiara Spinazzi-Lucchesi)



a



b



c



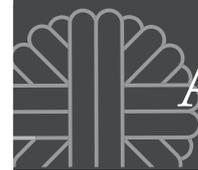
d

Fig. 2: Details of E 14479: a – large braids at one extremity; b – small braids along one of the two strips; c – highly twisted element at the beginning of braids; and d – braids inserted into the strip (Image: Chiara Spinazzi-Lucchesi)

do not contain any reference to this piece of textile in particular. The possibility that it came from elsewhere in the tomb, and that it was added to this basket by the excavators, must therefore be considered.

As mentioned, this piece of textile is made up of two strips of a tabby-woven fabric knotted together. It measures 88 cm in length and 4 cm in width. The weave is a warp-faced tabby with a count of 22 to 23

warp threads and 10 weft threads per cm. One strip is 48 cm long before the knot, and the other part is 35 cm long before the knot. Originally, the two strips might have formed a single piece that was joined where they are now broken, but this is impossible to say with certainty. One side of the strips has a plain selvedge, while the other presents a raw edge resulting from a tear in the warp direction. It is interesting to note that



the part which is knotted is also torn, so the knot was made after the rest of the textile had been sectioned off. Starting and finishing borders are not present, indicating that the strip was originally longer than its current size. The fibre has not been analysed, but it is a plant fibre, probably flax.

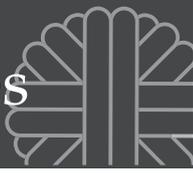
Both strips are decorated by the insertion of 22 small braids (fig. 2b, d), but the longest strip also has three large braids and an additional, thinner braid at its end (fig. 2a). Each braid is closed by a knot. The braids vary in thickness (ranging between 5.3 and 6.8 mm). Both strips show a similar arrangement of the braids: the first element after the knot is not an actual braid but a cord forming a tight helix with a Z direction, made of multiple yarns twisted in S direction, while the single (?) yarns are s-twisted (fig. 2c). On the other side of the textile, a similar, although thinner, Z-twisted cord is positioned. The braids are inserted

in the textile alongside the selvedge. The wider braids are 20 cm long, while the thinner ones measure 17.5 cm on average.

Although simple in its conception, construction and materials, this decoration appears consistent and well-structured. It is not clear what this item's function was, nor whether the braids were inserted before the fabric was torn (and reused to preserve their decorative value) or if they were inserted into a strip of textile to create a belt-like item. Its current measurements would be consistent with its use as a belt, or as a decoration for items such as vases, baskets etc. It was not used as wrapping material for the mummy because, as mentioned earlier, it was found in a basket (assuming that this was its primary context). Whatever its original purpose and shape was, its final appearance is that which we see today.



Fig. 3: S. 7639, Museo Egizio in Turin, Italy (Image: Chiara Spinazzi-Lucchesi)

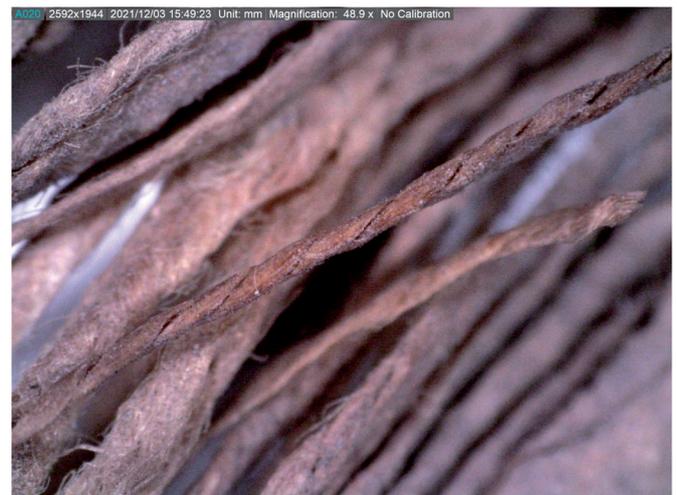


**Band with decorative fringes (Museo Egizio S. 7639)**  
 This object is characterised by long fringes interwoven on a narrow band (fig. 3). The two short edges appear incomplete, so it is not possible to assess its complete measurements, nor interpret its function with certainty. It was found during Ernesto Schiaparelli's

excavations in Deir el-Medina (Del Vesco and Poole 2018), but the precise place of discovery is unknown (as is the case with the other objects from the site in the Museo Egizio). The overall condition of preservation is good, although the material appears extremely stiff and dirty, which



a



b

c

Fig. 4: Details of S. 7639: a – knotted fringe; b – detail of the woven band; and c – detail of the fibres (Image: Chiara Spinazzi-Lucchesi)

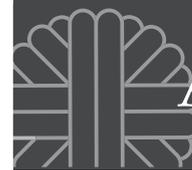


Fig. 5: S. 7799, Museo Egizio in Turin, Italy (Image: Chiara Spinazzi-Lucchesi)

makes studying the object difficult. The fringes cannot be moved or opened in any way to check the structure underneath.

The piece measures 55 cm in length and a maximum of 9 cm in width, including the fringes. The woven part is a narrow ribbon, with both selvages preserved, and is 1.2 cm wide. The structure of the woven part is rather simple (fig. 4b). It is a warp-faced tabby in which every second weft is supplemented by a group of threads passing from one selvedge almost to the other selvedge. Each group of threads is inserted in the band at its mid-point, while the extremities are left free. At this point, one of the extremities is knotted with the other, passing over one face of the band (fig. 4a). In this way, the woven textile is visible on only one side, while the other side is covered by supplementary weft threads, forming a series of knotted fringes. The insertion of the fringes and the execution of the knots are very consistent, seemingly indicating that covering one side with the fringe was intentional. The thread count is 32 in the warp and 6 to 7 per cm in the weft.

The fringes are made of twisted threads (fig. 4c), although some have opened and lost most of their twist. Each thread is formed by two single threads with no clear twist (spliced roves?), plied together in S direction (S, 2i; notation after Kemp and Vogelsang-Eastwood 2001, 58–59). In at least two cases, a third thread is visible, creating a 2-ply yarn cabled with an extra thread. On average, each fringe is made up of five threads; some have up to six threads while others only three, although this variation could be due to the

state of preservation, which led to the unravelling of some of the fringes.

The structure partially resembles that of the weft fringes inserted alongside one of the selvages of large rectangular fabrics (Cortes 2015, 199–218; Durand and Saragoza 2002, 30), which was still fashionable during the New Kingdom (Kemp and Vogelsang-Eastwood 2001, 123–132; Cortopassi and Dallel 2021, 147, figs. 5–6). In some cases, the border close to a selvedge is decorated with a group of supplementary weft threads, which are sometimes inserted continuously, and sometimes as separate elements. It seems, therefore, that there has been some adaptation of the traditional weaving technique known for garments and shrouds to create a standalone ornament.

As previously stated, this object is incomplete, and it is therefore impossible to determine its function. At first glance, it would seem reasonable to consider it a belt. Another option, assuming that only a small part is missing, might be that it was a headdress. The length of the fringes would not prevent its use in this fashion, and one can hypothesise that the ribbon-like base could have been used to support the insertion of flowers, a frequent motif in the head ornaments shown in New Kingdom iconography (for example, the female head decoration represented in the banquet scene of the tomb of Nebamun; Strudwick 2006, 172–173). However, there is also the possibility that the object was originally much longer than its present form, and other functions should thus be considered, such as the decoration of objects or furniture. Finally, since the findspot is unknown, a funerary use cannot be excluded.



Fig. 6: Details of S. 7799: a – main knot at one end of the necklace; b – lark's knots; c – pendants decorated with black substance; d – detail of a broken "bead" (Image: Chiara Spinazzi-Lucchesi)

#### ***Necklace decorated by strings and black lumps (Museo Egizio S. 7799)***

An entirely different item is a beautifully well-preserved necklace made of plant fibres (fig. 5). The necklace is made of a string whose ends are knotted together, to which multiple groups of threads are attached. The string is a cabled cord, consisting of two cables twisted in s direction, each made up of four threads slightly twisted in Z direction. Each yarn is plied in a Z direction and the single thread is s-spun (S, 4Z, Z, 2s). The string has a double knot as a closure (fig. 6a), but two other small knots are visible on one side. It measures 47 cm in diameter.

Opposite the knot, in the central part of the piece, 75 cords are attached in a simple style. They cover 12 cm of the total circumference of the necklace and are

on average 28 cm long. Each cord is made of three or four threads held together by a blackish substance (bitumen?) that forms small bead-like lumps (fig. 6c, d). These "beads" are regularly placed along each cord, every 5 to 6 mm or so, producing an effect that is both harmonious and animated. A similar technique can also be observed on S. 10039 and S. 7798, discussed below. Each cord is attached to the necklace by a lark's head knot (fig. 6b). These threads do not have a consistent structure: some are plied (S, 2s), while others appear as single s-spun threads (but sometimes it is extremely hard to see the ply in Egyptian material without opening the thread and here it was not possible). This mixture of different threads is frequently seen in other Deir el-Medina textiles (according to the author's unpublished examinations).



Fig. 7: S. 10039, Museo Egizio in Turin, Italy (Image: Chiara Spinazzi-Lucchesi)

*Bobbled fringe (Museo Egizio S. 10039)*

Due to its state of preservation, item S. 10039 is difficult to analyse and interpret (fig. 7). Although well preserved overall, the threads are completely entangled, and the artefact will be impossible to open before a proper conservation treatment. This object comes from Deir el-Medina, where it was discovered during the 1908 to 1909 excavations. That year, the Italian mission focused primarily on the village (Del Vesco and Poole 2018, 111), so this object may well have come from there.

It is difficult to gain an overall idea of the artefact. Some elements are clearly visible, while others may or may not belong to the object. One end of the object consists of a woven textile, apparently knotted (fig. 8a). It seems to be a plain tabby (1/1) with self-bands, as is common near the starting or finishing borders of New Kingdom textiles (Kemp and Vogelsang-Eastwood 2001, 109–117). From this end, a group of braids and a piece of the woven textile continue towards the centre of the object (fig. 8b), which is formed by a mixture of braids, textile, and single threads. What is clear is that each braid ends with a rounded element, likely unbaked clay, which acts as a stopper and as decoration (fig. 8c).

Although it is impossible to ascertain the function of this object, the possibility that it is a finishing border with warp threads grouped into braids appears reasonable. Besides its manufacture, it is the presence of these small clay bobbles at the end of the long braided fringes that makes this object unusual.

Although unusual, it was possible to find one parallel in the collection of the Museo Egizio (S. 7798), which was also from Deir el-Medina. At the time of the author's visit to the museum, S. 7798 was not available for study, but the Museo Egizio provided a good photograph (fig. 9). It shows a necklace composed of a textile that has been torn apart, as is the case for the first item discussed here (Louvre E 14479). The warp threads of the finishing border have been grouped in braids, which show – when complete – extremities finished by a blackish substance acting as a decorative stopper.

The available documentation on Deir el Medina textiles is too limited to permit an accurate comparison with any textile tradition potentially established on the site. Further, it has not been possible to identify any similar finishing edge within the corpus, nor within the larger group of known New Kingdom textiles. This therefore raises doubt on its dating. Since the precise context of



Fig. 8: Details of S. 10039: a – knotted portion of a textile with self-bands; b – close up of the braids and of the textile underneath; c – decorative elements at the end of the braids; x48.9 magnification (Image: Chiara Spinazzi-Lucchesi)

its finding is also unknown, S. 7798 may belong to a later phase of occupation of the village.

### Discussion

Although unusual, these finds testify to the use of simple threads and reused textiles to create ornamental items in Deir el-Medina. These can be decorated with fringes and braids, and both techniques are typical of New Kingdom textiles, including those coming from elite burials (Schiaparelli [1927] 2007, 92–100; images in TT217 in Deir el-Medina show fringed cloths, both while washing and worn by a woman: Donadoni Roveri 1999, 132). It is therefore interesting to see that the same type of decorations are used on both textiles and ornamental objects.

It is difficult to assess their purpose, since the find context is known in only one case, and this does not shed light on its use. If these items were found inside tombs, as grave goods or decorations, or in chapels, they might have offered a clearer indication of a ritual function, while their presence in houses could have been interpreted as a hint of everyday use. The lack of context also creates a problem of chronological uncertainty. There is only one case where we can be (almost) certain that the object comes from a New Kingdom grave, while in all other cases a later date cannot be excluded. Except in the case of S. 7798, where there is evidently a remarkable difference in what is so far known from Deir el-Medina textiles, all the other objects could be ascribed to the New Kingdom on the

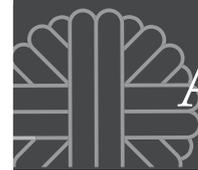


Fig. 9: S. 7798, necklace made of a reused strip of textile (Image: courtesy of the Museo Egizio in Turin, Italy)

basis of technical features alone (such as fringes and braids). However, these features are unfortunately not exclusive to the New Kingdom, and thus leave the question of their dating open.

In the band with decorative braids from Louvre (E 14479) and Museo Egizio (S. 7798), a portion of the textiles has been saved and reused. In both cases, it is not a painted or woven decoration, but there is a focus on fringes and braids. The same use of hanging elements can be seen in all the other objects studied here. These hanging or dangling elements enhance movement when worn, which is why they have been interpreted primarily as dress accessories here. Fringes are common on textiles used as decoration, as can be seen in the earliest Egyptian example, the Tarkhan dress from the the Fayoum region (Hall 1986, 27). Furthermore, their original use as part of a textile – not as standalone pieces – indicates that these decorations were manufactured and used. The decorative borders may very well have been torn from the original fabric and reused to adorn people's attire (also considering the measurements of these objects). Further, the possibility that they had other functions, such as decorating objects or furniture, cannot be ruled out. It is a known tradition in funerary contexts that statues, coffins, mummies, and other small objects can be decorated with floral garlands (as with those

found in the tomb of Kha in Deir el-Medina; Ferraris 2018, 57 fig. 69, 150). In these cases, however, the funerary purpose is explicit, underlined by the choice of specific flowers, such as lotus and melilot, which have a meaning of rebirth. The decision to decorate both garments and objects with fringes, garlands and cords might therefore not be connected to the idea of movement. One could argue, however, that garlands were also worn by the living, and their position on the wooden statues, coffins and *ushabti*, all of which bear images of the dead person and act as substitutes for the dead, recall their use in life and in the afterlife, rather than being purely decorative elements. They would thus still convey their original significance, perhaps to be found in an apotropaic purpose, as has recently been suggested for other Mediterranean areas (Olson 2022, 156).

Another interesting aspect is the question of their place of manufacture. In reality, it is not possible to know if they were produced in Deir el-Medina or elsewhere, but this is also true for all the other textiles at the site. The written sources clearly show that textiles were included in the wages received by the workmen, but they were also exchanged, both internally and externally, and, at least in some cases, homemade (Eyre 1998, 182). It is therefore impossible, given the present state of knowledge, to



distinguish a local or non-local production. However, the uniqueness of these pieces, suggests they were not part of a standardised production, and their simplicity, at least in some cases, make them good candidates for homemade items. The next phase of the EgYarn project is currently underway, developing experimental testing protocols for spinning tools and techniques. It may in the future add other information which helps to assess what could have been produced locally, and what could not.

To conclude, the items examined here appear significantly unusual among Egyptian decorative items. They suggest the possibility that some parts of textiles were reused for decorative purposes, a practice that is well known in Late Antique Egypt (for example with the decorative inserts - orbiculi, tabulae, clavi), but not yet documented for Pharaonic textiles. They also give other possibilities for how the threads were used, such as the creation of necklaces or fringed bands, which cannot be ascribed to utilitarian items such as nets and strings. They pose many questions, primarily about their function, including whether they should be researched in terms of everyday use or if they could be linked to some ritual or sacred space/object. If they were meant to decorate bodies, it would be natural to ask what their relationship is with more expensive materials, such as jewels and beads. This is particularly relevant in the case of Louvre E 14479, as this braided strip of textile was found in a tomb that also contained jewellery made of gold and beads (Bruyere 1937, 187). If the textile's findspot is correct, then clearly the tomb owner(s) could afford expensive ornaments, yet it was deemed relevant to add this reused item to the burial assemblage. Beyond material value, its importance must have therefore resided in a ritual significance or a personal meaning.

#### Acknowledgments

Thanks are due to Matilde Borla for her help in identifying relevant pieces in the vast collection of the Museo Egizio in Turin. Thanks are also due to the Fondazione Museo Egizio, and to the registry team for permission to examine the objects, as well as their help and support during the research visit. Roberta Cortopassi also provided help, discussions, and suggestions concerning the objects examined in the Louvre Museum.

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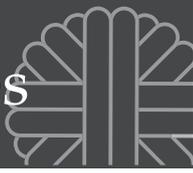
#### Bibliography

- Baines, J. (2007) *Visual and Written Culture in Ancient Egypt*. Oxford: Oxford University Press.
- Bazin Rizzo, L. (2017) Réalités et métaphores: à propos des vêtements, parures et cosmétiques à Deir el-Medina. In H. Gaber, L. Bazin Rizzo and F. Servajean (eds), *À l'œuvre on connaît l'artisan... de Pharaon! Un siècle de recherches françaises à Deir el-Medina (1917–2017)*. Milan: Silvana Editoriale, 85–104.
- Bruyère, B. (1933) *Rapport sur les Fouilles de Deir el Médineh (1930)*. Le Caire: Institut français d'Archéologie orientale.
- Bruyère, B. (1937) *Rapport sur les Fouilles de Deir el Médineh (années 1934–1935) deuxième partie: La nécropole de l'est*. Le Caire: Institut français d'Archéologie orientale.
- Cortes, E. (2015) From “Weft Fringes” to “Supplementary Weft Fringes”: Thoughts and discussion on weaving evolution in Egyptian textiles. In A. Oppenheim and O. Goelet (eds), *The art and culture of Ancient Egypt: Studies in Honor of Dorothea Arnold*. Bulletin of the Egyptological Seminar 19. New York: The Egyptological Seminar of New York, 199–218.
- Cortopassi, R. and Dallel, M. (2021) Mini-weavings from Gebel Zeit. In A. de Moor, C. Fluck and P. Linscheid (eds), *Explorers First Collectors and Traders of Textiles: From Egypt of the 1st Millennium*. Veurne: Hannibal, 144–151.
- Del Vesco, P. and Poole, F. (2018) Deir el-Medina in the Egyptian Museum of Turin. An Overview, and the Way Forward. In A. Dorn, A. and S. Polis (eds), *Out of the Box. Deir el-Medina and the Theban Necropolis in Contact* (Liège, 27–29 October 2014). Liège: Presses Universitaires, 97–130.
- Donadoni Roveri, A. M. (1987), *Civiltà degli Egizi: La vita quotidiana*. Milan: Electa.
- Durand, M. and Saragoza, F. (2002) *Égypte, la trame de l'histoire: textiles pharaoniques, coptes et islamiques*. Paris: Somogy Éditions d'Art.
- Eyre, C. J. (1998) The market women of Pharaonic Egypt. In B. Menu and N. Grimal (eds), *Le commerce en Égypte ancienne (Le Caire, octobre 1996)*. Le Caire: Institut français d'archéologie orientale, 173–191.
- Ferraris, E. (2018) *La Tomba di Kha e Merit*. Modena: Panini.
- Hall, R. (1986) *Egyptian Textiles*. Aylesbury: Shire.
- Hallmann, A. (2017) Tissu en lin peint de Sennefer. In H. Gaber, L. Bazin Rizzo and F. Servajean (eds), *À l'œuvre on connaît l'artisan... de Pharaon! Un siècle de recherches françaises à Deir el-Medina (1917–2017)*. Milan: Silvana Editoriale, 92–94.
- Janssen, J. J. (1975) *Commodity Prices from the Ramessid Period: An economic study of the village of necropolis workmen at Thebes*. Leiden: Brill.
- Kemp, B. J. and Vogelsang-Eastwood, G. (2001) *The Ancient Textile Industry at Amarna*. London: Egypt Exploration Society.



- Moiso, B. (2016) *La Storia del Museo Egizio*. Modena: Franco Cosimo Panini.
- Olson, K. (2022) Fringed clothing in Roman Iconography and Written Sources. In S. Harris, C. Brøns and M. Zuchowska (eds), *Textiles in ancient Mediterranean iconography*. Oxford: Oxbow Books, 149–159.
- Price, K. and Gleba, M. (2012) Textiles on Egyptian Mirrors: Pragmatics or Religion? *Archaeological Textiles Review* 54, 2–13.
- Schiaparelli, E. (1927) *La tomba intatta dell'architetto Kha, nella necropoli di Tebe*. Reprinted in 2007. Turin: AdArte.
- Spinazzi-Lucchesi, C. (2018) *The Unwound Yarn. Birth and Development of Textile Tools Between Levant and Egypt*. Venice: Edizioni Ca' Foscari.
- Strudwick, N. (2006) *The British Museum masterpieces of Ancient Egypt*. London: British Museum Press.
- Toivari-Viitala, J. (2001) *Women at Deir El-Medina: a study of the status and roles of the female inhabitants in the workmen's community during the Ramesside period*. Leiden: Nederlands Inst. voor het Nabije Oosten.

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Susanna Harris, Frances Houston and Jason Oliver

# Textile from the Crannog: analyses and weave experiment of a 2/1 twill weave from Oakbank, Scotland, 400 BCE

## Abstract

Oakbank Crannog on Loch Tay, Scotland, was built and occupied in the later centuries of the first millennium BCE. Starting in the 1980s and lasting several decades, underwater excavations revealed a variety of organic finds, including a piece of 2/1 twill weave textile preserved in its organic state. The textile appears to be the earliest preserved twill weave textile in Scotland, dating to 400 BCE. It was first studied in the 1990s, and recently as part of a project by the Scottish Crannog Centre (United Kingdom). In the current study, it was analysed to gain new results including a radiocarbon date from the textile, measurements for the characterisation of early fleece through wool quality analysis and updated contextual research. A reconstruction of the textile at the Scottish Crannog Centre found that the 2/1 twill weave was most readily woven on a two-beam vertical loom, and concluded that it was unlikely to have been woven on a warp-weighted loom. No additional conservation treatment or dye analysis was performed. The Scottish Crannog Centre mission is to care for and make accessible the finds of the Crannog dwellers for the benefit and education of all. The textile project involves academics, museum personnel, weavers, crafters and woodworkers, and will be a catalyst for learning and experimentation.

**Keywords:** Twill weave, two-beam loom, wool quality, Iron Age, crannog

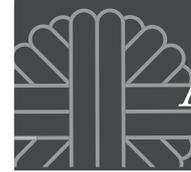
## Oakbank; an Iron Age Crannog

Crannogs are islands, also known as lake dwellings or pile dwellings, built predominantly of wood or stone at the edges of lochs in Scotland and Ireland although naturally occurring islands can also be classified as crannogs (Dixon 2004a). They were used for many purposes including dwellings, livestock stockades, kennels, food processing, and so on. The earliest Scottish crannogs are Neolithic and have been dated to c. 5,000 years ago and the most recent ones are Victorian. In the Iron Age, many Scottish crannogs served as high-status farmhouses, including Oakbank Crannog on Loch Tay, from which the Oakbank textile fragment was excavated (Dixon 1984; 2004b; Brown et al. 2022). The Iron Age in Britain marks a time of great change. Society became more hierarchical, contact with the European continent increased, the population grew, and iron technology marked a significant development (Cunliffe 2005; Pryor 2004). In 1979, the Scottish Trust for Underwater Archaeology,

based at the University of Edinburgh, undertook an underwater survey of Loch Tay in Perthshire. The aim of the survey was to locate the crannogs in the loch and to examine them for structural and dating evidence. On the basis of this work, one crannog – Oakbank Crannog – was chosen for further investigation.

Oakbank Crannog had originally consisted of a thatched roundhouse on a timber platform supported by timber foundation piles driven into the soft shallow bed of the loch. The extended family group of crannog dwellers were largely self-sufficient farmers, growing crops and tending livestock (Dixon 2004a). They utilised the networks of Scottish waterways to trade and communicate further afield via dugout boats. It was during excavations of the remains of Oakbank Crannog that the textile fragment was discovered.

Excavations were carried out throughout the 1980s and early 1990s, followed by further work in 2002, 2003 and 2005 (Dixon 1982; 2004a). Organic material was found to have survived extremely well and a



range of significant artefacts was discovered due to the anaerobic conditions of the compacted, collapsed crannog mound. This included a butter dish with remains of a dairy product adhering to the inside, a small iron dagger, one of Scotland's finest examples of a swan neck pin, a putative bridge from a seven-stringed lyre, and a piece of woven wool textile which was recovered in 1986. In 2019, the director and the curator of the Scottish Crannog Centre mooted the idea of delivering a project which would focus on the Oakbank textile. The project aims were to carry out further tests and examination of the piece, create a new museum display, and undertake experimental archaeology with community involvement.

The Oakbank textile (OB86.350) was first studied by Elizabeth Wincott Heckett whose unpublished report identified it as a wool textile in 2/1 (or 1/2) twill weave with a hem, woven with z/s single yarn (Wincott Heckett 1990). Never published in full, the results are summarised in a compendium of Scottish and Irish Bronze and Iron Age textiles (Wincott Heckett 2012). At the time, the textile was cleaned and freeze-dried providing stability and resulting in a small size increase from 60 x 70 mm to 63 x 77 mm, and a lightening of the overall colour (Wincott Heckett 1990, 1–2). Dye analysis did not reveal any dyestuff (Wincott Heckett 1990, 3) and may have been negative

due to the loss of dyestuff during centuries buried in the loch. The Oakbank textile is important due to its secure excavation context. Wincott Heckett noted the significance of 2/1 twill weave, because this is an unusual weave for the Early Iron Age in northern Europe. Nick Dixon published a summary of Wincott Heckett's results (Dixon 2004a, 155, fig. 61). In 2021, the Oakbank textile was re-examined at the University of Glasgow, where fibre identification, wool quality analysis, and contextual research were carried out. A sample of the textile was taken and sent to the Scottish Universities Environmental Research Centre (SUERC) for radiocarbon dating.

### Method

The textile was delivered to Glasgow by the curator of the Scottish Crannog Centre and examined in March 2021 using the Leica M80 and portable Dino-lite at magnifications from x7.5 to x60. The textile was photographed front and back by Aristotelis Palyvos using a Nikon digital SLR and light stand. The textile was analysed following standard procedures including the identification of textile structure, thread twist, diameter, angle, thread count per cm of weaving – an indicator of quality – and observation of thread features, preserved colour and finish. Classification of thread and weave structures follow Emery's



Fig. 1: Oakbank textile fragments, 2/1 twill weave, largest showing the front (obverse), fragment with possible hem on the left; scale 10 cm (Image: Aristotelis Palyvos)



Fig. 2: Oakbank textile fragments, 2/1 twill weave, largest showing the back (reverse), fragment with possible hem on the right, scale 10 cm (Image: Aristotelis Palyvos)

terminology (Emery 1994). Two samples were taken for scientific analysis from loose material in the storage box. Sample 1 for dating: 0.01 g of textile weighed using a precision balance, packed in aluminium foil, sealed in a plastic bag and sent to Scottish Universities Environmental Research Centre (SUERC) Radiocarbon Laboratory. Sample 2 for fibre analysis: two fragments of textile less than 5 mm sq and a length of yarn about 5 mm were removed and adhered to aluminium stubs using adhesive carbon tabs. Sample 2 is currently stored on the aluminium stubs at the University of Glasgow and can be returned to the Scottish Crannog Centre or used for future analysis.

The Oakbank textile fibres may have shrunk or expanded marginally during their time in the waterlogged deposits minimally affecting individual fibre measurements.

Fibre analysis was carried out using the Quanta 200F scanning electron microscope (SEM) at the Imaging Spectroscopy and Analysis Centre (ISAAC), University of Glasgow in August 2021. Samples were placed in the SEM chamber, examined in backscatter mode under 15KV accelerating voltage at about 10 mm working distance using magnifications of x50 to x2500. For species identification, the morphological features

of the fibres were described and identified following the terminology in two fibre atlases (Appleyard 1978, vii-viii; Teerink 1991). Wool quality analysis follows a method for SEM of archaeological textiles (Gleba 2012, 3646). Micrographs for wool quality analysis were taken at x500 magnification. Diameters of longitudinal, whole mount fibres were measured using ImageJ software. Wool diameter distributions are presented as histograms at intervals of 2  $\mu\text{m}$ . Fibres from Sample 2 were mounted longitudinally on a glass slide and examined for colour coating or pigmentation with transmitted light using the Leica DM2000.

### Results

The Oakbank textile OB86.350 is in two large pieces and several smaller ones (fig. 1–2). The largest piece measures 47 x 50 mm. The fragment with the folded edge, possibly a hem, measures 35 x 19 mm. Two detached fragments measure 11 x 10 mm and 13 x 15 mm. They are all part of the same textile.

### The textile

The Oakbank textile is woven in 2/1 twill weave. This notation indicates that the front of the textile is the side on which the weft threads pass over two warp

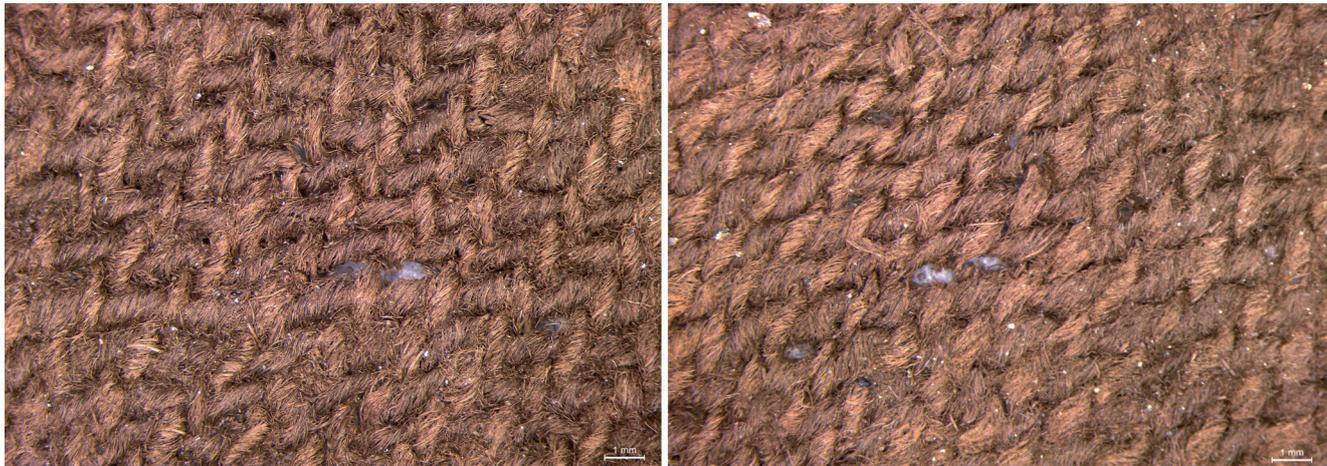
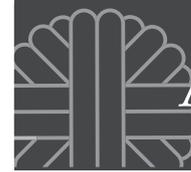


Fig. 3: Micrograph of the front (left) and reverse (right) of 2/1 twill weave structure; scale 1 mm, Leica M80 (Image: Susanna Harris)

threads. As is characteristic of this weave structure, the diagonal linear pattern of 2/1 twill weave is visible on the front where the weft threads float over two warp threads (fig. 3, left). The twill weave formation is less visible on the back, where the weft passes under only one warp (fig. 3, right). There is no selvedge or starting border. The textile is discoloured brown and covered with particles of soil due to being buried in the loch environment for many years. Despite this, the two yarn systems have distinct tones. The preserved warp threads are yellowish red (Munsell 5YR 4/6); the weft threads are reddish brown (Munsell 2.5YR 4/4). The colour difference could be either due to one or both yarns being dyed or pigmented. Observed with transmitted light, the fibres appear coated. However, whether this is due to contaminants from the waterlogged deposit or dye cannot be determined. The lighter, finer, more consistently spun yarn with a

higher thread count is likely to have been the warp (Wincott Heckett 2012, 437). The darker, thicker yarns with more variable thickness are likely the weft. There are 14 to 16 warp threads per cm. The weft threads are more consistent with 12 per cm. The Oakbank textile has a smooth finish with no evidence of fulling (processing after weaving). One edge is folded and appears to have indistinct and irregular stitches, which form a possible hem (fig. 1, fragment to the left). Compared to plain weave fabric structures, twill weave is inherently a more flexible weave. It may also be denser, because there are fewer intersections in the fabric, allowing the yarns to lie closer together.

#### *The threads*

The Oakbank warp threads are z-twisted, single yarn with a mean diameter of 0.52 mm (range 0.46 mm to 0.60 mm) and mean twist angle of 41° (range 23° to 51°) (table 1). The weft

Object	Weave structure	Twist direction	Thread diameter mean, mm	Thread diameter range, mm	Thread angle of twist, mean °	Thread angle of twist, range °	Thread count, mean	Thread count, range
OB86.350, warp	2/1	z	0.52	0.46 - 0.60	41	23 - 51	15	14 - 16
OB86.350, weft	2/1	s	0.67	0.42 to 0.91	43	30 - 57	12	9-11

Table 1: Analysis results for Oakbank textile OB86.350; thread measurement in mm, angle of twist in degrees, thread count over 1 cm

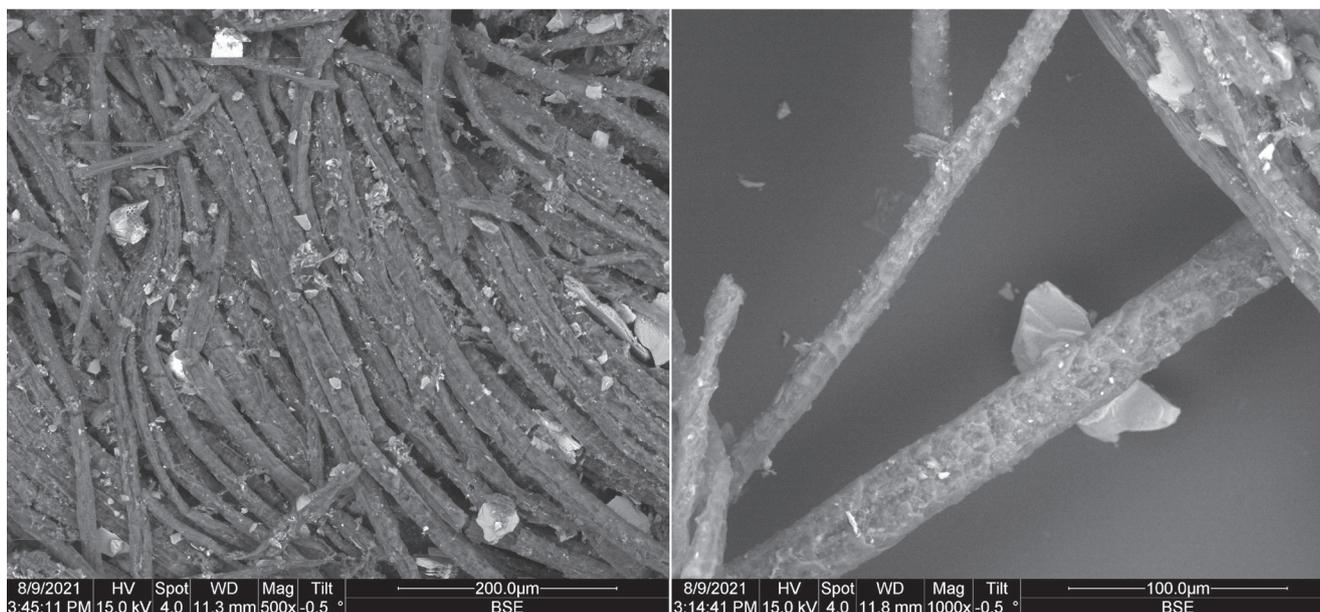


Fig. 4: Scanning electron micrograph of wool fibres – Sample 2 x500 (left) and x1000 (right) (Image: Susanna Harris, ISAAC Laboratory, University of Glasgow)

is made of s-twisted single yarn, with a mean diameter of 0.67 mm (range 0.42 to 0.91 mm), and mean twist angle of 43° (range 30° to 57°). Textiles with both z and s-twisted threads are denoted z/s. While according to the mean twist angle both appear tightly spun (Emery 1994, 12), visually, there are distinctions. The sharp profile and tight spin of the warp threads show the fibres were aligned in parallel before they were spun. This may be because the wool was combed straight prior to spinning. Such techniques create smooth, firm, relatively inelastic yarns, historically referred to as worsted-spun (Ross 1983, 18). The weft threads are looser in appearance, creating a bulkier, less regular yarn. It could be that the wool for the weft threads was prepared and spun using a different technique which left the wool fibres lying in multiple directions. Historically, this type of yarn was referred to as woollen-spun and while it was weaker than worsted, it had the benefit of providing more insulation (Ross 1983, 17).

#### **Fibre identification**

Fibres are the raw materials of textiles. The Oakbank fibres are degraded and have soil adhering. Examined longitudinally, the surface of the fibres (cuticle) has flat, overlapping scales characteristic of animal fibre. The scale pattern is an irregular mosaic; the scale margins are near with prominent, smooth margins; the diameter is irregular (fig. 4). Most of the transverse cross-sections are highly degraded. Where visible, transverse cross sections are circular to oval; some are

irregular, and a number are medullated. On the basis of these observations, the fibre is consistent with the features of sheep wool, genus *Ovis* (Appleyard 1978, 26–27).

#### **Wool quality analysis**

The range of fibre diameters and positive skewness of distribution in the warp threads, following Ryder's classification of sheep fleece, is consistent with a semi-fine or shortwool fleece type (Ryder 2000, 4). In the weft threads, the range of fibre diameters is consistent with fine wool. However, the positive skew of distribution and presence of medullated fibres means that this falls into the semi-fine or shortwool fleece type.

In Rast-Eicher's classification, there are 11 wool grades from grade F, the coarsest, to grade AAA, the finest (Rast-Eicher 2008, 155, table 89). Following this system, the Oakbank warp threads are closest to grade A fleece, with 94% of wool fibre diameters less than 30 µm, 6% greater than 30 µm and none greater than 40 µm. The Oakbank weft threads are closest to grade AA with 87% of fibres less than 25 µm, 8% greater than 25.1 µm and 1% greater than 30 µm.

Today's sheep fleece is the result of selective breeding since the Neolithic era. The domestication of sheep fleece was first studied by Michael Ryder. He adapted a method employed by the wool industry of the 1960s to understand fleece quality. This compared wool diameter distributions from a sample of at least 100 fibres from a fleece or textile (Ryder 1969, 517–520;

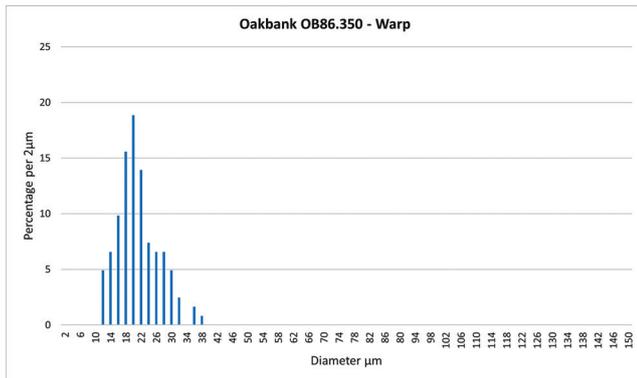


Fig. 5: Histogram of wool quality measurements of Oakbank textile OB86.350, warp (Chart: Susanna Harris)

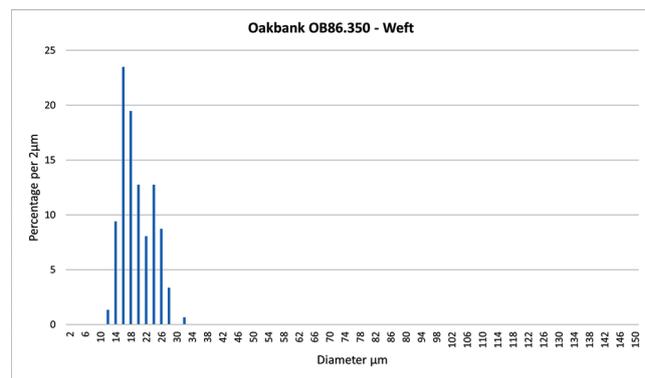


Fig. 6: Histogram of wool quality measurements of Oakbank textile OB86.350, weft (Chart: Susanna Harris)

Ryder 1983a; 1983b, 42–47). Several scholars have updated Ryder's method by introducing new grading systems and placing greater emphasis on the impact of sorting and preparing fleece on the fibre diameter distributions (Christiansen 2004; Rast-Eicher 2008; Gleba 2012). The results of the wool quality analysis of OB86.350 are presented in table 2 and fig. 5 and fig. 6.

### Dating

A single AMS radiocarbon date of Oakbank wool textile OB86.350 from SUERC provides a calibrated date of 480–390 calBCE (2360 ± 19 SUERC-99033 / GU57713; 480–390 calBCE at 95.4% probability). Dates of the large timbers used in the construction of Oakbank Crannog have been radiocarbon dated to 520–465 calBCE (Cook et al. 2010, 346). The chronology of crannogs is complex, and many remained in use for decades (Stratigos and Nobel 2018, 152–154). This places the textile in the Early Iron Age, 700–100 BCE within the full span of the Scottish Long Iron Age, 700 BCE–900 CE (ScARF Hunter and Carruthers 2012, iii, table 1, 8–10). There are three chronological divisions

of the Scottish Long Iron Age: Early Iron Age 700–100 BCE; Middle Iron Age 200 BCE–400 CE; and Late Iron Age 300–900 CE (Parker Pearson and Sharples 1997, 359). Across much of Europe, the centuries 700–100 BCE are referred to as La Tène period. Dates of comparative finds are quoted as calendar years, where possible.

### Weaving 2/1 twill at the Scottish Crannog Centre

The Scottish Crannog centre set up an experiment to weave a 2/1 twill with the aim of understanding the possible loom types used to weave it. Three heddles are required to achieve this twill. To use a warp-weighted loom necessitates creating a starting border holding the warp; in this case a tablet-woven band. This process involves stretching a length of yarn (the initial weft thread) between two anchors. The weft thread is doubled over, passes through the band warp threads, and is attached to a further anchor point some distance away. This will determine the length of the warp in the ground weave. The procedure creates a thin (tablet-woven) band, with long warp threads hanging down from one side (see observations by

Object	Number of Fibres	Median	Mode	Mean	St. Deviation	Diameter range	Skewness of distribution	Ryder Fleece type	Rast-Eicher Grade
OB86.350, warp	122	19.6	19	20.6	5.47	11-38	+0.57	Fine/semi-fine	A
OB86.350, weft	149	18.2	16	19.0	4.11	11-31	+0.61	Fine/semi-fine	AA

Table 2: Wool fibre measurements for Oakbank textile OB86.350 in micrometers (µm)



Hoffmann 1964). The band is attached to the top of the loom and the long warp threads are attached to the loom weights. However, the warps threads, having been doubled over, hang down in pairs. Groups of three threads are required for a 2/1 twill weave so, in the Crannog Centre's experiments, when the doubled threads were passed through, the second doubled thread had to be snapped and pulled back through the tablets. This proved to be an incredibly complex task and seemed counter-intuitive and impractical.

Early experimentation at the Scottish Crannog Centre with a two-beam loom to weave a 2/1 twill weave were successful, but not without problems. The two-beam loom, in contrast to the warp-weighted loom, was very easy to set up and used a single, long piece of yarn wrapped over the top beam and then passed under the bottom beam (fig. 7 and fig. 8). The beam at the top could be moved to accommodate for a change in tension as the weaving progressed. The warp threads were easily separated into groups of three, and the whole process took a little under four days; a marked contrast to the three weeks taken to set up the warp-weighted loom. Because the 2/1 twill weave required

the weft yarn to pass over two warp threads and under one warp thread, initially the experimenters were pulling out two heddles at a time, creating a 'heavy lift'. This caused the warp threads attached to the third heddle to loosen and the twill appeared on the front of the weave. With effort, the experimenters were able to separate out the third heddled yarn at the back of the weave. They are now reversing this process so that only one heddle is pulled out. This 'light lift' means the weave appears on the reverse of the woven cloth. This sped up the process significantly and made the weaving much easier.

Up to the time of publication, the experimenters have been using a medium weight, modern weaving yarn, in order to establish a weaving technique. In future, they will spin single yarn, which will then be stretched over the loom. They predict problems will arise, such as threads breaking whilst under tension, and environmental factors such as humidity affecting the tension of the yarn over time. It is possible that a form of starch or boiled cow hooves may be needed to act as a stiffener on the yarn to stop it from snapping. Further tests, including chromatography and strontium



Fig. 7. Left – From left to right, these are master weaver Ashleigh Slater, craftsperson Lorraine Welsh and experimental archaeologist Jason Oliver. Lorraine is tensioning the loom ready for weaving. Right – The finished two beam loom (Image: © Scottish Crannog Centre Trust)

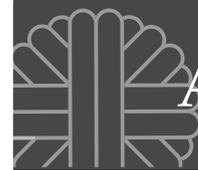


Fig. 8. Left – John Strachan, University of Edinburgh archaeology student, attaching the heddles to the warp threads. Right – Graham Liney, Crannog Centre staff, beating the weft with a weaving sword (Image: © Scottish Crannog Centre Trust)

isotope analysis will inform the experimental process and bring the Crannog Centre team closer to how the people of the past constructed the original textile. Following the practice of experimental archaeology, repetition of the experiment will be important to avoid an isolated and therefore inconclusive result (Coles 1979, 46–47). Furthermore, the results of the experiment using a two-beam loom to create a 2/1 twill will not be taken as absolute proof of the method of manufacture. However, the 2/1 twill weave does fit better on such a loom. To date, approximately 80 people have been involved in the entire process, including a master weaver, woodworkers, craftspeople, volunteers and members of the public, without whose help this project would not have evolved in such a manner.

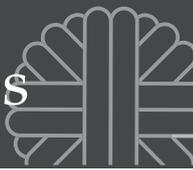
### Discussion

There is only a handful of published textiles of Early Iron Age date in Scotland. For this reason, the scope of comparative material extends beyond it both geographically and chronologically. The discussion focuses on twill weave textiles in wool.

### *Twill weave*

The earliest twill weave fabric structure in the British Isles is a tasselled herringbone twill weave horsehair band used to wrap a metal hoard from Cromaghs, County Antrim (dated 900–700 BCE) (Wincott Heckett 1998). However, the Cromaghs band is an unusual object, of narrow width and made from single horse hairs that could have been woven using non-heddle techniques. Therefore, it is technically and materially distinct from the Oakbank textile.

The most significant group of textiles dating to the Early/Middle Iron Age in Great Britain are from sites in East Yorkshire. At Rudston and Burton Fleming, cemeteries of the Arras Culture (400–200 BCE), preserved textiles were recorded on 57 metal objects, mostly brooches or pins (Crowfoot 1991, 124–125; Crowfoot 1989, 1). The majority are 2/2 twill weaves or its chevron and broken diamond variations, woven with 5 to 11 threads per cm using z or s-twisted singles yarn from 1 to 1.5 mm in diameter. There are no recognised 2/1 twill weaves. The mineralised



textiles of Wetwang Slack follow the same general pattern (Crowfoot 1991, 120, 122). Two twill weave textiles worn beneath a chain mail coat in Burial K5, Kirkburn were woven in 2/2 twill weaves, with single yarn (z/s, 13/10 threads per cm; z/z, 10/8 threads per cm) (Crowfoot 1991, 123). From West Yorkshire, a preserved organic broken diamond twill weave textile (z/z, 5/6 threads per cm) is documented from Skipworth Common (500–100 BCE) (DeRoche 2012, 446). The Skipworth textile is matted, which possibly indicates fulling (Wild 2012, 446). Scattered Early/Middle Iron Age twill weave textiles from across Great Britain follow a similar pattern (DeRoche 2012, 446). In comparison, the Oakbank textile stands out because it is a 2/1 twill weave and is relatively fine (15/12 threads per cm).

Twill weave remained the staple textile of Middle Iron Age Scotland and Romano Britain. A diamond twill weave textile (s/z, 11–14/14–16 threads per cm) was found with a mirror and other metalwork from Balmacellan, Dumfries and Galloway, dated 1–200 CE (Crowfoot 1948, 15–225–7; Bender Jørgensen 1992, 198). Textile traces on an Iron Age/Early Roman annular brooch from Craigie, Dundee, Angus, are probably 2/2 twill weave (6/5 threads per cm) (Bender Jørgensen 1992, 198).

The closest parallel to the Oakbank twill weave given by Wincott Heckett was a textile from Island McHugh crannog site in County Tyrone, identified as a 2/1 twill weave (Wincott Heckett 1990, 5). However, the Island McHugh textile is not securely dated. Reportedly of Late Bronze Age date, it could be as late as the 17th century CE, making it a poor comparison (Wincott Heckett 1990, 5).

By examining the earliest evidence for twill weave fabrics across Europe and into Turkey it has been concluded that the earliest twill weave textiles were a Bronze Age innovation, becoming the most dominant weave in the Hallstatt period in central Europe (Bender Jørgensen and Rast-Eicher 2016, 83; Grömer 2012). In the late first millennium BCE, the popularity of 2/2 twill weave is evident across much of north and central Europe: for example, textiles of the Pre-Roman Iron Age in Denmark and Sweden (500–1 BCE) are mostly wool textiles woven in 2/2 twill weave or tabbies, with 5 to 10 threads per cm, in wool single yarn with minimal surface treatment (Mannering et al. 2012, 103; Franzén et al. 2012). In Germany, La Tène textiles are typically 2/2 twill weaves, woven with single yarn or a combination of singles and S2z-ply yarn (Möller-Wiering 2012, 131). In central Europe, the Early Iron Age twill weave textiles from the Hallstatt salt mines (800 BCE to 400 BCE) were mostly wool textiles woven

using single yarn in 2/2 twill weave (5 to 15 threads per cm) and its many chevron or herringbone variations (Grömer 2005, 17; 2012, 43).

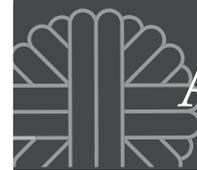
### **Wool**

The Oakbank textile is typical of the Iron Age, as the predominant textile fibre was wool (DeRoche 2012, 445; Wincott Heckett, 2012, 431). It is a very useful textile fibre being warm to the touch, a good heat insulator due to its low heat conductivity and bulkiness, and its ability to hold 40% of its weight in water yet still feel warm and dry (Harris 2010, table 18.3).

Wool is known in Scotland from the Early Bronze Age as preserved fibres possibly from a sheepskin in a cist burial in Spinningdale, Sutherland (2051–1911 calBCE) (Arabaolaza et al. 2013, 15). By the Late Bronze Age, there are preserved wool textiles in tabby, including the shroud from an oak coffin burial in Rylstone, North Yorkshire (840–590 calBCE), and preserved on a metal hoard from St Andrew's, Fife (1000–800 BCE) (Gabra-Sanders 1994, 36; Wincott Heckett 1998, 29–30; Melton et al. 2016). Iron Age textiles from the Arras Culture burial sites of East Yorkshire (400–200 BCE) also appear to be made of wool (Crowfoot 1991, 119, 122). During the Middle Iron Age in Scotland, wool continues to be the most significant textile fibre, used for the Balmacellan diamond twill weave (1–200 CE) and the Falkirk 'tartan' (about 250 CE) (Crowfoot 1948). To the south, wool was the main textile fibre at Roman forts such as Vindolanda (about 100 CE) (Wild 2012, 452). The Oakbank textile fits this pattern.

### **Wool quality**

By the Iron Age, sheep fleece was less pigmented, consisting of fibres of fine to medium diameter and contained few to no hairy kemp (Bender Jørgensen and Rast-Eicher 2016, 71; Ryder 1969, 497, fig. 2; Walton 1988, 146). A diverse array of sheep fleece qualities existed, and processing fleece was more sophisticated than during earlier periods (Rast-Eicher and Bender Jørgensen 2013, 1240). At the Hallstatt salt mines, Austria, for example, Bronze Age fleece types persisted alongside sheep with mixed fibres, and a third type of fine, white wool was used for fine yarns, about 0.3 mm in diameter (Rast-Eicher and Bender Jørgensen 2013, 1231–1232). The Oakbank textile, with its semi-fine wool, following Ryder's classification, or grade A and AA wool quality following Rast-Eicher's system, is consistent with what might be expected of a finer Iron Age fleece. As preserved, the fibre diameters (majority below 30 µm) and distribution of fibres remain indicative of a semi-fine or fine quality wool. To give a sense of the haptic qualities of this textile, in the modern wool industry, fibres between 17 µm to 30



$\mu\text{m}$  are considered fine enough to be used for clothing textiles; those with fibres over 32  $\mu\text{m}$  in diameter are deemed coarse and used for carpets (Tridico 2009, 37, fig. 3.7).

#### **Yarn**

Throughout the first millennium BCE across England and Scotland, wool was spun into single yarn with either a z or s-twist and woven in various combinations (DeRoche 2012, 446; Bender Jørgensen 1992, 20). For example, the textiles of the Arras Culture cemeteries from East Yorkshire (400–200 BCE) were spun using predominantly z-spun yarns in warp and weft (z/z), and approximately one third woven with mixed yarns (z/s or s/z) (Crowfoot 1989, 119). In textiles woven with mixed yarns, the fibres lie in the same direction creating fabrics that were “said to be thorn-proof and rain repellent” (Crowfoot 1991, 119). In one example at Burton Flemming, East Yorkshire, a textile was woven using alternating groups of z and s-twisted yarns, creating a spin pattern, possibly originally coloured, within a broken diamond twill weave textile preserved in the corrosion products of a brooch (BF20) (Crowfoot 1989, 119–121, fig. 79a–c and fig. 80). Although not as elaborate as this, the Oakbank textile with its mixed z and s-twist yarns with light and dark hues fits the broad pattern of Early Iron Age textiles. It adds to the evidence that mixed spin directions were present in textiles in Great Britain before the Roman period (DeRoche 2012, 446).

#### **Loom**

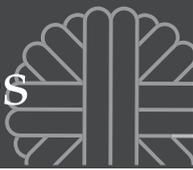
Twill weave is woven using a loom with three or more sheds created by shafts and heddles. As noted above, 2/1 twill weave is woven using three sheds. In the case of the warp-weighted loom, one shed is formed by the natural fall of the weights. Wincott Hekett proposed that the Oakbank 2/1 twill weave was woven on either a warp-weighted or two-beam vertical loom (Wincott Hekett 1990, 3–4). The characteristic features produced by different looms are apparent in the textile selvages, the starting and finishing borders. These are absent in the Oakbank textile. While archaeological evidence of loom weights is indicative of the warp-weighted loom, it is worth considering that the contemporary checked textiles of Huldremose, Jutland, Denmark (350–41 calBCE) and Gerum, Västergötland, Sweden (360–100 calBCE) have technical features characteristic of weaving with a tubular warp on a two-beam vertical loom (Hald 1980, 167–185; Gleba and Mannering 2010, 32; Frei et al. 2009, 33; Franzén et al. 2012, 361). The use of a two-beam loom to weave a tubular warp textile was

first proposed by Danish textile specialist, Margarethe Hald (Hald 1980, 167). Hald’s identification was based on the thread lock used to keep the ends of the warp together in tubular warp textiles, as seen on the Huldremose textiles. This indicates that some Early Iron Age twills in northern Europe were woven on a two-beam vertical loom with a tubular warp; a technology that was used alongside the warp-weighted loom, as evidenced by loom weights (DeRoche 2012, 449; Wild 2012, 453; Wild 2002, 10–11).

#### **Conclusion**

In summary, textile OB86.350 from Oakbank Crannog is a rare example of a preserved organic textile from Iron Age Scotland. Securely dated to 480–390 calBCE through the archaeological context and radiocarbon dating analysis, it appears to be the earliest wool twill weave in Scotland. The Oakbank textile is characteristic of earlier Iron Age textiles in Britain, and in northern and central Europe because it is a twill weave, woven with single yarn with both z and s twists. The wool used for warp and weft is notably fine, and fits with the wider European pattern of fine, well-sorted Iron Age fleeces. However, the 2/1 twill weave structure is atypical among preserved textiles and appears to be the earliest example of this type of weave in Britain. Most twill weaves of the later first millennium BCE are 2/2 twills. The thread count (15/12 threads per cm) is comparatively fine, although not exceptionally so. The two-tone warp and weft link it to a wider concern for colour in wool textiles of this period in north and central Europe. It would be worth carrying out new dye analyses using current techniques. Given the scarcity of Early Iron Age textiles in Scotland and across the British Isles, it is difficult to judge the chronological and geographical significance of this early 2/1 twill weave. Whether it was a unique example or part of a regional tradition is a matter of speculation.

The experiments with warp-weighted and two-beam vertical looms to weave 2/1 twill found the three shed twill weave was more readily woven on the two-beam vertical loom. This raises important questions about the types of loom used in Iron Age Scotland, while acknowledging that experiments can only raise possibilities of techniques, rather than prove them. In the future, the Scottish Crannog Centre aims to source fleece, spin the wool, and replicate the Oakbank weave. To date, the Scottish Crannog Centre has brought together academics, museums, weavers, crafters, and woodworkers in a creative springboard of learning and experimentation. The textile project will continue to be delivered at the new



Scottish Crannog Centre, where it, and prehistoric textile interpretation, will play a key role in the organisation's development plans as it relocates to new premises on Loch Tay, close to the original Early Iron Age Oakbank Crannog site.

### Acknowledgements

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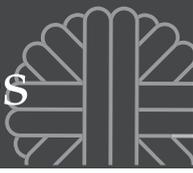
### References

- Appleyard, H. M. (1978) *Guide to the identification of animal fibres*. Leeds: Wira.
- Arabaolaza, I., Ballin Smith, B., Clarke, A., Ramsay, S. and Walton Rogers, P. (2013) *ARO5: Spinning the yarn: a cist at Keas Cottage, Spinningdale*. Published by GUARD Archaeology Ltd. [Online]. Available online: [www.archaeologyreportsonline.com](http://www.archaeologyreportsonline.com) (accessed 10 May 2021)
- Bender Jørgensen, L. (1992) *North European textiles until AD 1000*. Aarhus: Aarhus University Press.
- Bender Jørgensen, L. and Rast-Eicher, A. (2016) Innovations in European Bronze Age textiles (with contributions from S. K.Ehlers and S. H. Fossøy). *Præhistorische Zeitschrift* 91, 68–102.
- Brown, A. G., Fonville, T., Van Hardenbroek, M., Cavers, G., Crone, A., McCormick, F., Murray, E., Mackay, H., Whitehouse, N. J., Henderson, A. C. G., Barratt, P., Davies, K., Head, K., Langdon, P., Alsos, I. G. and Pirrie, D. (2022) New integrated molecular approaches for investigating lake settlements in north-western Europe. *Antiquity* 96(389), 1–21.
- Christiansen, C. A. (2004) A reanalysis of fleece evolution studies. In J. Maik (ed), *Priceless invention of humanity: textiles*. Lodz: Lodzkie Towarzystwo Naukowe, 11–18.
- Coles, J. (1979) *Experimental Archaeology*. New Jersey: The Blackburn Press.
- Cook, G. T., Dixon, T. N., Russell, N., Naysmith, P., Xu, S. and Andrian, B. (2010) High-Precision Radiocarbon Dating of the Construction Phase of Oakbank Crannog, Loch Tay, Perthshire. *Radiocarbon* 52, 346–355.
- Crowfoot, E. (1989) Textiles: Burton Fleming, North Humberside, La Tene Burials. *Ancient Monuments Laboratory Report* 29/89.
- Crowfoot, E. (1991) The textiles. In I. M. Stead (ed), *Iron Age Cemeteries in East Yorkshire. Excavations at Burton Fleming, Rudston, Garton-on-the-Wolds and Kirkburn*. Swindon: English Heritage in association with the British Museum Press, 119–125.
- Crowfoot, G. M. (1948) Two Textiles from the National Museum, Edinburgh. *Proceedings of the Society of Antiquaries of Scotland* 82, 225–231.
- Cunliffe, B. W. (2005) *Iron Age communities in Britain: an account of England, Scotland and Wales from the seventh century BC until the Roman conquest*. London: Routledge.
- DeRoche, D. (2012) England: Bronze and Iron Ages. In M. Gleba and U. Mannering (eds), *Textiles and Textile Production in Europe. From Prehistory to AD 400*. Oxford: Oxbow Books, 444–450.
- Dixon, N. (1982) Excavation of Oakbank Crannog, Loch Tay Interim report. *The International journal of nautical archaeology* 11(2), 125–132.
- Dixon, T. N. (1984) *Scottish Crannogs. Underwater excavation of artificial islands with special reference to Oakbank Crannog, Loch Tay*. Unpublished PhD Thesis. University of Edinburgh.
- Dixon, N. (2004a) *The Crannogs of Scotland: An Underwater Archaeology*. Stroud: Tempus.
- Dixon, T. N. (2004b) Underwater Archaeology and Reconstruction of a Prehistoric Crannog in Loch Tay, Scotland. *Experimentelle Archäologie in Europa* 3, 167–179.
- Emery, I. (1994) *The Primary Structures of Fabrics: an Illustrated Classification*. Washington D.C.: The Textile Museum.
- Franzén, M.-L., Lundwall, E., Sundstöm, A. and Andersson Strand, E. (2012) Sweden. In M. Gleba and U. Mannering (eds), *Textiles and Textile Production in Europe. From Prehistory to AD 400*. Oxford: Oxbow Books, 348–364.
- Frei, K. Skals, I. Mannering, U. Gleba, M. and Lyngstrøm, H. (2009) The Huldremose Iron Age textiles, Denmark: an attempt to define their provenance applying the strontium isotope system. *Journal of Archaeological Science* 36, 1965–1971.
- Gabra-Sanders, T. (1994) Textiles and fibres from the late bronze age hoard from St. Andrews, Fife, Scotland. In K. Tidow and G. Jaacks (eds), *NESAT V: Archäologische Textilfunde: archaeological textiles*. 5th North European Symposium for Archaeological Textiles, Neumünster, 4–7 May 1993. Neumünster: Textilmuseum Neumünster, 34–42.
- Gleba, M. (2012) From textiles to sheep: investigating wool fibre development in pre-Roman Italy using scanning electron microscopy (SEM). *Journal of Archaeological Science* 39, 3643–3661.
- Gleba, M. and Mannering, U. (2010) A thread to the past: the Huldremose Woman revisited. *Archaeological Textiles Review* 50, 32–37.



- Grömer, K. (2005) The Textiles from the prehistoric salt-mines at Hallstatt (Die Textilien aus dem prähistorischen Salzbergwerk von Hallstatt). In P. Bichler, K. Grömer, R. Hofmann-De Keijzer, A. Kern and H. Reschreiter (eds), *Hallstatt Textiles: Technical Analysis, Scientific Investigation and Experiments on Iron Age Textiles*. Oxford: Archaeopress, 17–40.
- Grömer, K. (2012) Austria. In M. Gleba and U. Mannering (eds), *Textiles and Textile Production in Europe. From Prehistory to AD 400*. Oxford: Oxbow Books, 25–64.
- Hald, M. (1980) *Ancient Danish textiles from bogs and burials: a comparative study of costume and Iron Age textiles*. Copenhagen: The National Museum of Denmark.
- Harris, S. (2010) Smooth and cool, or warm and soft; investigating the properties of cloth in prehistory. In E. Andersson Strand, M. Gleba, U. Mannering, C. Munkholt and M. Ringgaard (eds), *North European Symposium for Archaeological Textiles X*. Oxford: Oxbow Books, 104–112.
- Hoffmann, M. (1964) *The Warp-Weighted Loom: Studies in the History and Technology and an Ancient Implement*. Oslo: Universitetsforlaget.
- Mannering, U., Gleba, M. and Bloch Hansen, M. (2012) Denmark. In M. Gleba and U. Mannering (eds), *Textiles and Textile Production in Europe. From Prehistory to AD 400*. Oxford: Oxbow Books, 89–118.
- Melton, N., Montgomery, J., Roberts, B., Cook, G. and Harris, S. (2016) On the Curious Date of the Rylstone Log-Coffin burial. *Proceedings of the Prehistoric Society* 82, 383–392.
- Möller-Wiering, S. (2012) Germany: Bronze and Pre-Roman Iron Ages. In M. Gleba and U. Mannering (eds), *Textiles and Textile Production in Europe. From Prehistory to AD 400*. Oxford: Oxbow Books, 119–138.
- Parker Pearson, M. and Sharples, N. (1999) *Between Land and Sea, Excavations at Dun Vulan, South Uist*. S.E.A.R.C.H. 3. Sheffield: Sheffield Academic Press.
- Pryor, F. (2004) *Britain BC: Life in Britain and Ireland before the Romans*. London: Harper Collins.
- Rast-Eicher, A. (2008) *Textilien, Wolle, Schafe der Eisenzeit in der Schweiz*. Basel: Archäologie Schweiz.
- Rast-Eicher, A. and Bender Jørgensen, L. (2013) Sheep wool in Bronze Age and Iron Age Europe. *Journal of Archaeological Science*, 40, 1224–1241.
- Ross, M. (1983) *The Essentials of Yarn Design for Handspinners*. Kinross: Mabel Ross.
- Ryder, M. L. (1969) Changes in the fleece of sheep following domestication (with a note on the coat of cattle). In P. Ucko and G. W. Dimbleby (eds), *The domestication and exploitation of plants and animals*. London: Gerald Duckworth and Co, 495–521.
- Ryder, M. L. (1983a) A re-assessment of Bronze Age wool. *Journal of Archaeological Science* 10, 327–331.
- Ryder, M. L. (1983b) *Sheep and Man*. London: Gerald Duckworth and Co. Ltd.
- Ryder, M. L. (2000) Issues in conserving archaeological textiles. *Archaeological Textiles Newsletter* 31, 2–8.
- ScARF Hunter, F. and Carruthers, M. (2012) *Iron Age Scotland, ScARF Panel Report*. Scottish Archaeological Research Framework: Society of Antiquaries of Scotland. Available online: <https://tinyurl.com/vpla6yx> (accessed 20 May 2021)
- Stratigos, M. and Noble, G. (2018) A new chronology for crannogs in north-east Scotland. *Proceedings of the Society of Antiquaries of Scotland* 147, 147–173.
- Teerink, B. J. (1991) *Hair of west European mammals: atlas and identification key*. Cambridge: Cambridge University Press.
- Tridico, S. R. (2009) Natural animal textile fibres: structure, characteristics and identification. In M. M. Houck (ed), *Identification of textile fibers*. Cambridge: Woodhead Publishing Limited in association with the Textile Institute, 27–67.
- Walton, P. (1988) Dyes and wools in Iron Age Textiles from Norway and Denmark. *Journal of Danish Archaeology* 7, 144–158.
- Wild, J. P. (2002) The Textile Industries of Roman Britain. *Britannia* 33, 1–42.
- Wild, J. P. (2012) England: Roman Period. In M. Gleba and U. Mannering (eds), *Textiles and Textile Production in Europe. From Prehistory to AD 400*. Oxford: Oxbow Books, 451–456.
- Wincott Heckett, E. (1990) *Loch Tay Textile* (For the attention of Dr. Nic Dixon). University College Cork. Unpublished Report.
- Wincott Heckett, E. (1998) A Late Bronze Age horsehair ornament from Cromaghs, Armoy in Ireland. In L. Bender Jørgensen and C. Rinalso (eds), *Textiles in European archaeology. Report from the 6th NESAT symposium, 7–11th May 1996 in Borås*. Gothenburg: Gothenburg University, 29–37.
- Wincott Heckett, E. (2012) Scotland and Ireland. In M. Gleba and U. Mannering (eds), *Textiles and textile production in Europe. From prehistory to AD 400*. Oxford: Oxbow Books, 428–442.

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Kayleigh Saunderson, Karina Grömer and Lucia Clara Formato

# Missing Link: Early Roman textiles and Norican- Pannonian female dress from Pötzneusiedl, Austria

## Abstract

Cremation was the most widespread burial tradition during the Early Roman period in the provinces of *Noricum* and *Pannonia*, thus leaving a gap in the archaeological record of in situ dress components, including the textiles. In this context, the first century CE inhumation burials from Pötzneusiedl, eastern Austria, are unique, representing the only known inhumations from this period and region. Additionally, some of the women's in situ brooches carry textile remains belonging to their clothing. Their analysis provided interesting technical and functional information. The textiles demonstrate both La Tène as well as Roman characteristics, representing a missing link between the periods. The locations and microstratigraphy of the textiles also reveal how the garments were worn, and this is comparable with the pictorial evidence on the large number of tombstones of the area from the first to second century CE.

**Keywords:** Roman textiles, Roman dress, Norican-Pannonian costume, provincial Rome

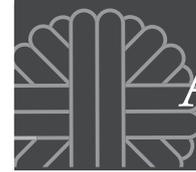
## Introduction

In the first century CE, the provinces *Noricum* and *Pannonia* in Central Europe became part of the Roman Empire. However, the local population, particularly the women did not fully adopt Roman-Italic material culture, as is evident by their clothing depicted on many tombs. These show a distinct costume that was not common in the contemporary Roman-Italic area after it had been romanised. The burials of Pötzneusiedl, situated in the later Roman province Pannonia and today's Burgenland in eastern Austria, contain some of the earliest archaeological evidence of the so-called Norican-Pannonian female costume (German: *norisch-pannonische Frauentracht*) – a form of dress particularly common in this region that still showed characteristics from the Iron Age. One example is the peplos dress, a rectangular or tubular piece of fabric fastened on the shoulders with two brooches, suggesting that the women retained these pre-Roman clothing traditions even after the area became part of the Roman Empire. The textile fragments from Pötzneusiedl were all

attached to the brooches. Therefore, they provide a rare insight into the clothing fabrics of this period of transition from the Iron Age to the Roman era. Thus, the aim was to gain much needed textile data for this period and region, and to compare Pötzneusiedl's textile qualities with those known from other Early Roman sites in the regions of *Noricum* and *Pannonia* and the earlier La Tène period. Furthermore, the focus also lay on the question of textile functions – especially in regard to how the garments were worn – and whether the findings can be compared to the clothing depicted on the numerous Norican-Pannonian tombstones.

## Methodology

The methodology for the analysis and description of the textiles followed the standard procedure as established within the European community of textile archaeologists in the last decades (for example, Gillis and Nosch 2007; Gleba 2012; Bender Jørgensen and Grömer 2013; Grömer 2014; Andersson Strand



et al. 2022). This included the visualisation of the microstratigraphy as established by the Bavarian heritage authorities (BLfD) (Nowak-Böck and Voß 2015). The textiles in question were analysed by the authors using a digital microscope (DinoLite). Due to the state of preservation and the small size of some textiles, it was not possible to determine all features. Fibre analysis using a Scanning Electron Microscope was carried out in cooperation with the Central Research Labs at the Natural History Museum Vienna. Due to the state of preservation, fibre identification was not possible for every piece.

The context information as given by the in situ evidence in the inhumation graves was analysed in detail as in similar studies (Grömer 2014, 110–117), which in this case concerns the fibula with its function of fastening a garment, the technical analysis of the textile, its microstratigraphy, and its special context, enabling possible identifications of the garments. Biological information, such as the age of the deceased, was not available at the time of study.

Pictorial evidence of the same period (first to second century Noricum and Pannonia) helped to broaden the understanding of the garment types and how they were worn, such as where exactly the brooches were pinned. One must be aware that the depictions follow certain rules within the society and a direct comparison between the placement patterns in the graves and the depictions might not be foolproof. These depictions are of idealised individuals and costumes (Paetz gen. Schieck 2012, 86), showing how people wanted to present themselves rather than documenting what they wore in daily life. These sources are slightly later than Potzneusiedl's burials, meaning that the costumes could differ.

Interpretations of the clothing worn in the burials must also be treated with caution. Since the burial is a special event, it is certainly possible that the deceased wore special, representative clothing that was not used in everyday life, but demonstrated the individual's status in society, or how this status was perceived by the remaining members of the community who buried the deceased, and presented them in an idealised manner (Grömer 2014, 117–119; Gugl and Hinker 2020, 101).

To compare the thread diameters of the analysed textiles in a broader cultural context, statistics were recorded for threads from first to third centuries CE Austria (Grömer 2014) and threads from the La Tène period (450 BCE to first century BCE) in Austria (Grömer 2014), the Czech Republic and Slovakia (Belanová-Štolcová 2012), and Switzerland (Rast-Eicher 2008). As the threads from Potzneusiedl most likely derive

from the pinned clothing, it was methodologically necessary to additionally compare the diameters of the said threads with threads from similar contexts: on the underside of fibulae deposited on the body on burial. Other textiles may have been placed with the dead as body wrappings or packaging, and therefore cannot be securely documented as clothing textiles. Even if a textile derives from a burial context, it is possible that they could be part of body wrappings or packaging for burial goods, which might have different technical characteristics from clothing textiles. Not many textiles on fibulae are known from the Roman period. This is mainly due to the tradition of cremation burials. Although the textiles found on, for example, pins must be interpreted with caution, experiments have shown that these textiles can withstand the cremation process (Grömer 2020), meaning that these threads could very well have belonged to the pinned garment.

#### **The site of Potzneusiedl**

The Roman province Pannonia (running between the Danube in the north from modern western Hungary and eastern Austria to the northern parts of Croatia, parts of Slovenia, Bosnia and Herzegovina, and Serbia) was one of the provinces established by the Romans in the mid-first century CE, in Tiberian-Claudian times. The burial site of Potzneusiedl lies approximately 15 km south of the Danube and belongs to the hinterland of Carnuntum.

Since the 1930s, stray finds from the Roman period have been made in the area of Potzneusiedl, eventually leading to the rescue excavation of a cemetery in 2011. This revealed 47 cremation and 31 inhumation burials, the latter representing the earliest and best-preserved burials known from Roman north-western Pannonia (preliminary summary in: Formato 2021, 113–118 with fig. 13). The earlier graves can be dated to the Tiberian period (14 to 37 CE), and in addition to the fibulae in the so-called *Trachtlage* (in situ position), some pottery finds also point to pre-Roman (Late La Tène) components (Formato et al. in print; Formato, Workshop AG Römerzeit, in preparation; Formato, conference Iași, in preparation). Since 2019, Lucia Clara Formato has been leading this interdisciplinary project at the Austrian Academy of Sciences at the department of the Austrian Archaeological Institute. The archaeozoological material was analysed by Konstantina Saliari (Natural History Museum Vienna) (Saliari et al., in preparation). Ancient DNA analyses were carried out by Angela Mötsch and Stephan Schiffels through the Department of Archaeogenetics at the Max Planck Institute for Evolutionary Anthropology (Leipzig, Germany) within the framework of the



Grave	Object	Ply		Twist direction		Twist angle		Thread diameter (mm)		Weave type	Thread count/cm		Fibre
99	518	single	single	z	s	<20°	<20°	0.6–0.8	0.6–0.8	tabby	~10	~10	-
	519												
101	351	single	single	s	s	20–30°	10–20°	0.4–0.5	0.4–0.5	tabby	~10	~10	wool
	352												
215	408	single		z		40–50°		1.3		single thread	-		-
215	409	single	single	s	s	20–30°	20–30°	0.5–0.7	0.5–0.7	tabby	8–10	7–10	wool
	410												
240	297	-	single	-	s	-	20–30°	~0.6	0.5–0.6	tabby	-	-	plant fibre

Table 1: Analysed features of the textiles from Potzneusiedl

ERC grant MICROSCOPE (project no. 851511). The anthropological analysis of both the inhumation and cremation burials was the responsibility of Kristin von Heyking and Franziska Schreil from AnthroArch GbR (Grafrath, D). Silvia Wiesinger and Andreas Heiss at the Austrian Archaeological Institute (Vienna) were commissioned to analyse the botanical remains. The analysis of the terra sigillata was carried out by Silvia Radbauer and that of the coins by Kathrin Siegl (both Austrian Archaeological Institute, Vienna).

Among the inhumation burials, four (99, 101, 215, 240) contained textile remains with a total of five different textiles (table 1), all adhering to fibulae. Typical for female dress, these fibulae were all found in pairs – one on each shoulder – with the exception of an additional disc fibula in burial 215 lying in the middle area of the chest.

Since the basis for dating the graves with textile remains is the subject of another article (Formato et al. 2022), the dating of the individual graves will only be briefly mentioned here. The focus will then lie on the individual types of fibulae found in the graves. Graves 240 and 99 are to be placed in the Tiberian-Claudian period. In grave 240 (Tiberian [from 20/30 CE] to Claudian), two Norican-Pannonian winged brooches type Almgren 238c lay on the shoulder area of the deceased. One of the fibulae is almost complete, while only a fragment of the perforated pin catch from the second fibula was preserved. Two Norican-Pannonian wing fibulae type Almgren 238c were also found in grave 99. The individual in grave 101 would have been buried in the Claudian to Early Flavian period. The enclosed strongly profiled brooches of type Almgren 68 were in use from the Tiberian to the Early Flavian

period, in the Eastern Alpine region partly also until the Late Flavian period. Grave 215 was built at the same time as grave 101. Grave 215 is especially interesting because it contained two Norican-Pannonian wing fibulae of different types (type Almgren 238c and type Almgren 238e). In addition, a disc brooch type Riha 7.2/type Feugère 24a was found on the chest area (Formato et al. in print).

### The textiles

All of the analysed threads from Potzneusiedl (table 1) are single yarn and most are s-spun, except for the z-spun single thread on object 408, as well as the threads of one system on 518 and 519. The spin angles vary from 10° to 40 or 50°. The lower value may be due to the poor preservation conditions, whereas

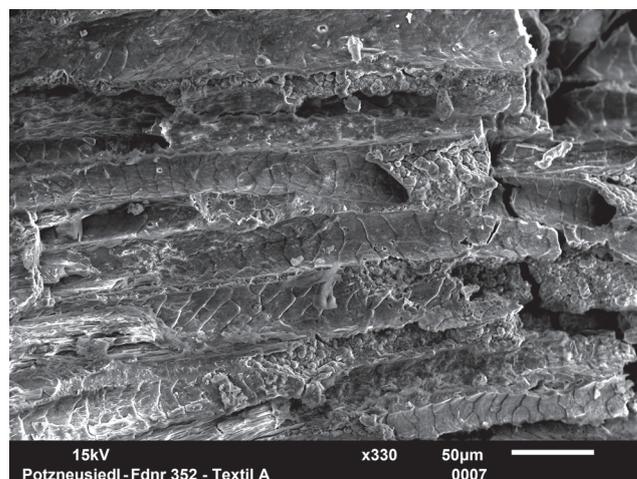


Fig. 1: SEM image of fibula 352 with clearly visible cuticles indicating sheep's wool (Image: Kayleigh Saunderson)

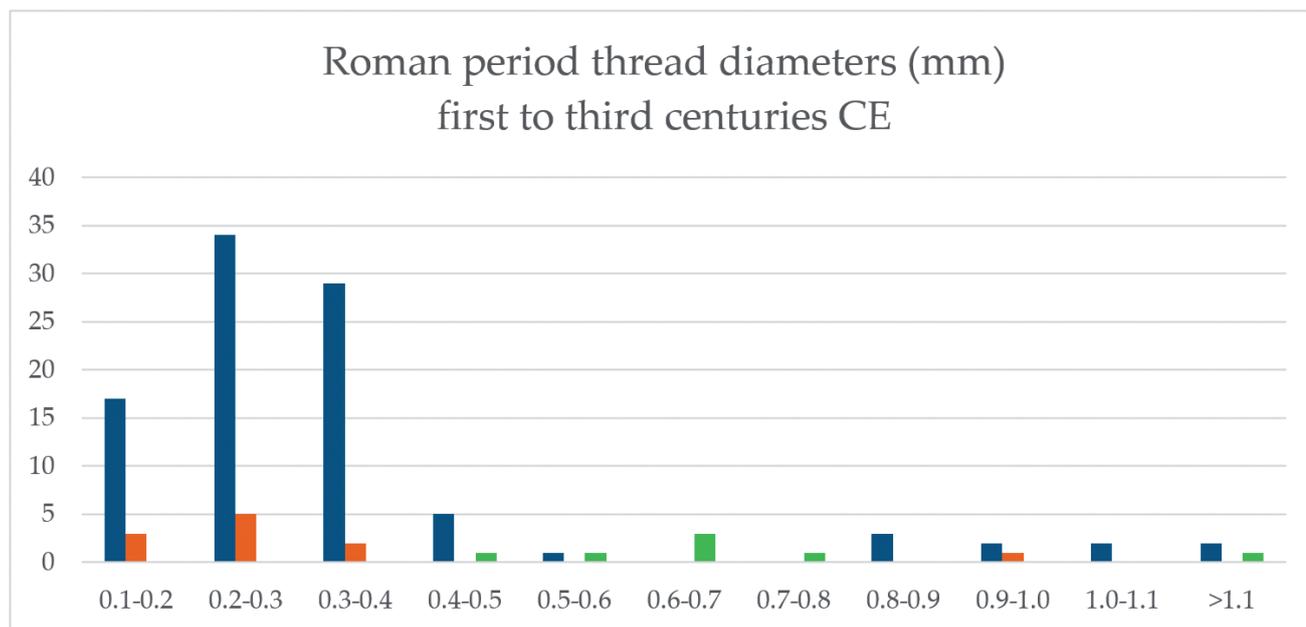


Fig. 2: Graph showing the distribution of Roman thread diameters. Blue: All thread diameters from the Roman period (excluding Late Antiquity), showing a smaller spectrum and thinner threads (based on finds from Austria, not including Potzneusiedl), N = 95,  $\bar{x}$  = 0.31 mm; Red: Thread diameters from pinned garments of the same period, N = 11,  $\bar{x}$  = 0.21 mm; Green: Threads from Potzneusiedl (Image: Kayleigh Saunderson)

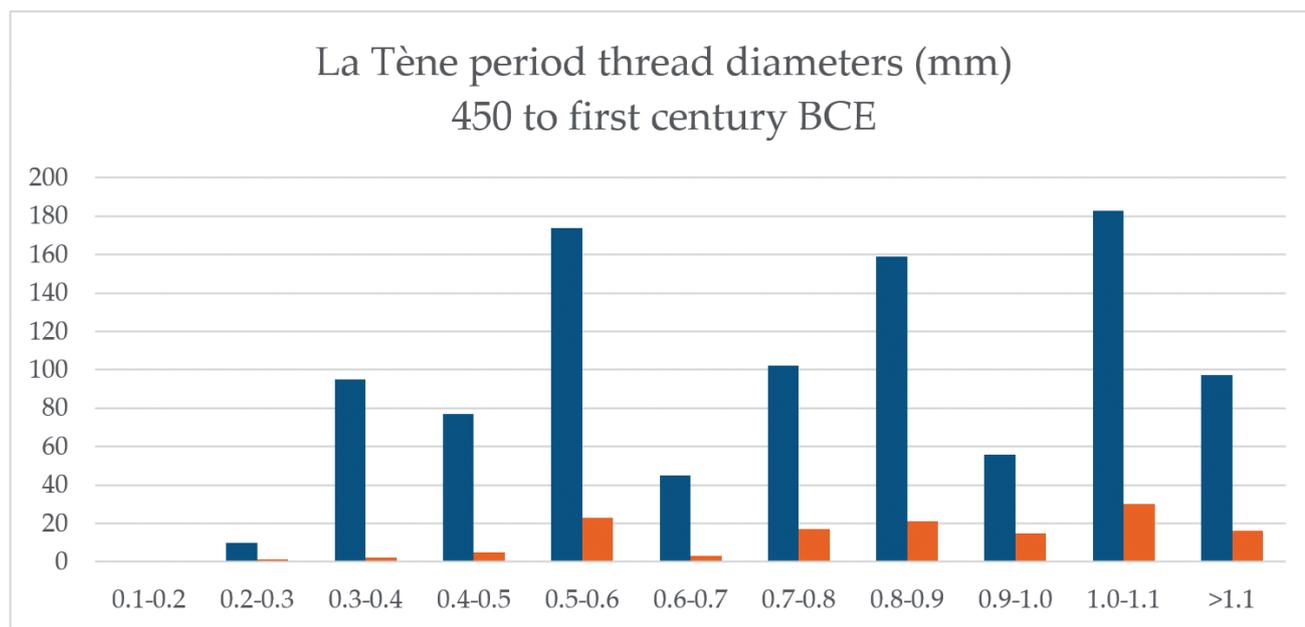


Fig. 3: Graph showing the distribution of Late Iron Age thread diameters. Blue: All thread diameters from the Late Iron Age La Tène period, showing a larger spectrum and thicker threads (based on finds from Austria, Czech Republic, Slovakia, and Switzerland), N = 998,  $\bar{x}$  = 0.78 mm; Red: Thread diameters from La Tène period pinned garments, N = 133,  $\bar{x}$  = 1.03 mm (Image: Kayleigh Saunderson)



the upper value is a single outlier. Most are 30°. The single thread on 408 is an outlier with 40–50°. The documented thread diameters lie between 0.4 and 0.8 mm, again with 408 as an outlier with a diameter of 1.3 mm. Owing to the small size of most fragments, the density of the weaves – all tabbies – was difficult to identify with precision. Only the threads on 409/410 were preserved well enough to be counted over a length of more than 1 cm, showing densities of 8–10 and 7–10 threads per cm. The densities of the textiles on 518/519 and 351/352 are approximately 10 threads per cm.

It was also possible to identify plant fibres in one case (object 297) and sheep's wool from two textiles (on 351/352, see fig. 1; 409/410). Some fragments were not fully mineralised and appeared off-white in colour with no visible dyes, though this does not mean that this represents the original colour.

Contemporary textile finds (first to third centuries CE) from Austria are quite rare but derive from various contexts. Some textiles are known from the settlement on Magdalensberg, Carinthia (Grömer 2009), others from a hoard in Deutschkreutz, Burgenland (Grömer 2007) and some even from graves. As previously noted, the common burial custom is that of cremation, which very rarely leave textile remains behind – some were also found attached to wing fibulae:

from Mantrach (showing strong traces of burning), Eichberg and Kerschbaum, all in Styria (Grömer and Sedlmayer 2012, 155–163) and Salzburg-Linzertor (Grömer 2014, 272). Early Roman textiles are also known from the later province of *Germania Superior*. For example, 100 textile fragments have been found in a Roman legionary camp in Mainz, Rhineland-Palatinate, dating to around 5 BCE, some of which can be interpreted as technical textiles, but perhaps also as garments (Mitschke 2013).

The tabby weaves as well as their thread counts are typical for the currently-known textiles of the first to second centuries CE from the Roman provinces (Grömer 2014, figs. 17 and 19). The threads from Potzneusiedl are thicker, with a large part of the known threads from the first to third centuries (fig. 2) being 0.2–0.3 mm in diameter (most thicker threads derive from military contexts) (Grömer 2014, fig. 18). Based on the current record, the amount of s- and z-spun yarns is quite balanced among Roman textiles from Austria, with a slight tendency towards more z-spun threads. Fabrics with z-spun yarns in one system and s-spun in the other are also known. These statistics stand out from Late Iron Age threads (fig. 3), which were thicker and mostly z-spun (Grömer 2014, 38). S-spun threads in the Roman period have been associated with imports from the southern provinces, where s-spun threads

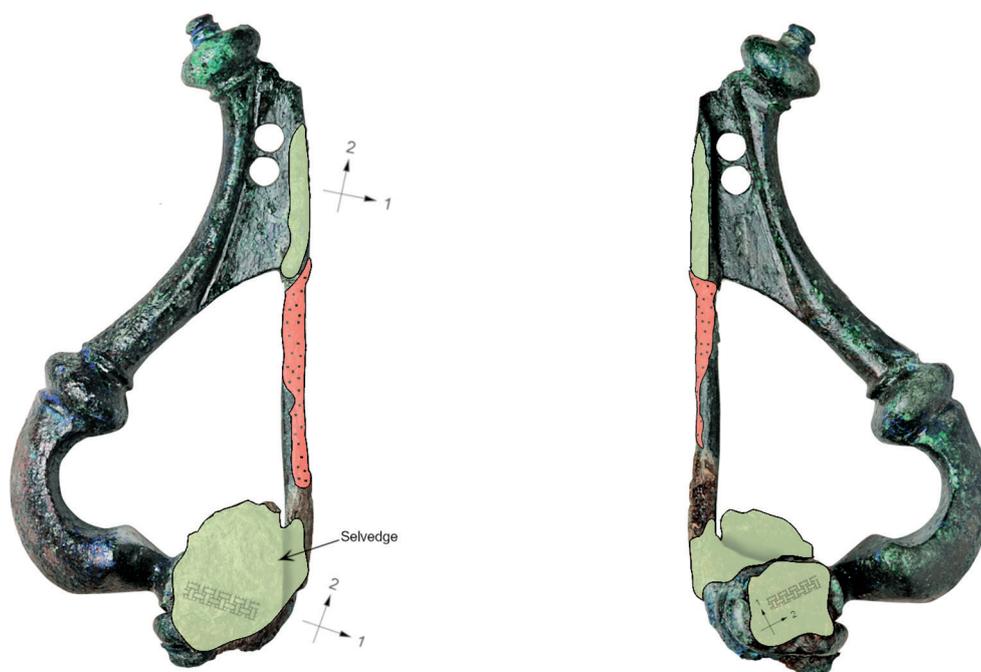


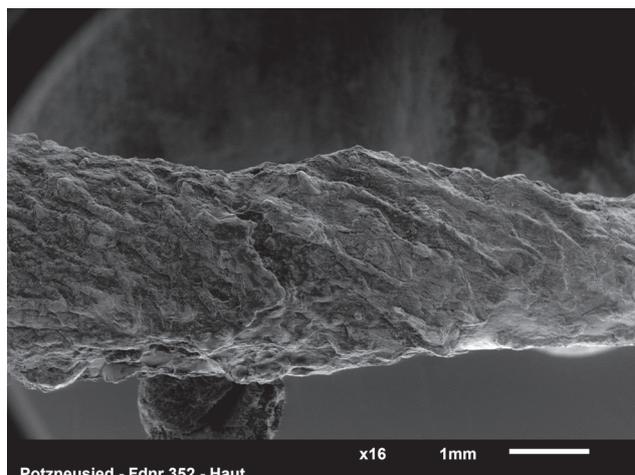
Fig. 4: Location of the textile (yellow) and the skin (red) on fibula 352 (Image: Stefan Schwarz)



were more common (Bender Jørgensen 1992, 128). Antoinette Rast-Eicher has suggested that the Roman province Pannonia could also be part of this area, based on finds from Croatia, where the s-spinning tradition could have been acquired through connections over trade routes (Rast-Eicher 2008, 168). In the case of Potzneusiedl, acculturation is the more plausible explanation for this change in spin direction, since the thread diameters match the Late Iron Age textile tradition. In both periods, the thread diameters most likely belonging to pinned garments coincide with these statistics. Therefore, the transition from the Iron Age to the Roman period is clearly visible in the textiles from Potzneusiedl, showing characteristics of both cultures. In the following, possible interpretations for the textiles are presented.

#### Graves 99 and 240

Wing fibulae 518 and 519 from grave 99 carried the same textile with s- and z-spun threads on both their springs, 518's pin and foot, as well as 519's head. The pin, in particular, indicates that this probably represents a piece of clothing fastened by the brooches.



The plant-fibre fabric on wing fibula 297, burial 240, Fig. 5: Remains of human skin on fibula 352's pin under the scanning electron microscope (Image: Kayleigh Saunderson)

was quite small. In this case, it was not possible to interpret whether it could have been part of a garment or body wrapping.



Fig. 6: Excavation photo of burial 215 with fibulae 408 (left), 409 (right), and 410 (centre) (Image: Sławomir Konik/BDA)



### Grave 101

The strongly profiled fibula 352 from grave 101 is of particular interest (fig. 4). A single layer of a wool tabby textile is located on the spring and the pin catch. Between these fragments, there are remains of skin (fig. 5) adhering to the underside of the pin. The fact that the skin is only located on this side of the pin – across its whole length – indicates that it is probably not animal skin (leather) that might have been used to protect the fabric from the heavy brooches. The pore pattern is rather difficult to identify due to the narrow and rounded fragment, although human skin seems more likely than that of a goat or cow. Taking these observations and the location of the pin on the body into account, this is probably the skin of the human individual's chest. Additionally, on the fragments on the spring, which fully cover the sides, a small piece of the fabric's selvedge could be identified. These findings suggest that this piece of clothing was gathered with the fibula and worn directly on the skin without an undergarment. Additionally, this garment was pinned together at its edges without overlapping them. The other fibula in this burial (351) carries a further, small fragment of the same textile on its spring.

### Grave 215

Grave 215 contained two wing fibulae on the shoulders (number 408 right, 409 left) and one disc fibula in the middle of the woman's chest, right below her neck (410) (fig. 6).

The springs on the wing fibulae carry small fragments of textiles. 408 carried a very poorly preserved, thicker thread, the function of which could not be determined. The fragments on 409's bow and foot,

however, allowed for further examination. This wool textile shows at least two folds in this area (fig. 7 left). The threads on 410 are very poorly preserved, preventing the identification of the fibre material, yet it was possible to determine that the textile on the front side's centre (fig. 7 right) was most likely the same fabric as the textile on 409. The microstratigraphy is not quite clear, however. On the rear side of 410, also in the centre, there is some mineralised, black organic material – possibly textile, but the structure was not visible. It seems as if organic material (the textile?) protrudes through a hole in the middle of the fibula, which will be the subject of further analysis that could offer new interpretations for the textile.

Additionally, fibula 410 carried many mineralised negatives of maggot puparia, especially on its rear side, which are to be attributed to the decomposition of the body (Formato et al. 2022, 111).

### The Norican-Pannonian costume

Within the Norican-Pannonian area, throughout the first and second centuries CE, women were depicted on tombstones wearing specific costumes, distinct from other regions of the Empire. The first to define this specific women's costume in detail was Jochen Garbsch (Garbsch 1965; 1985). He characterised it as a sleeveless dress resembling a peplos, worn over a long-sleeved undergarment and often fastened by two quite large wing fibulae (fig. 8). The dress was often gathered with a belt with three hanging straps, decorated with elaborate fittings. There is evidence from Oberdrauberg, Lower Austria, that suggests a repp band belt as carrier material for the bronze fittings (Grömer and Gostenčnik 2009).

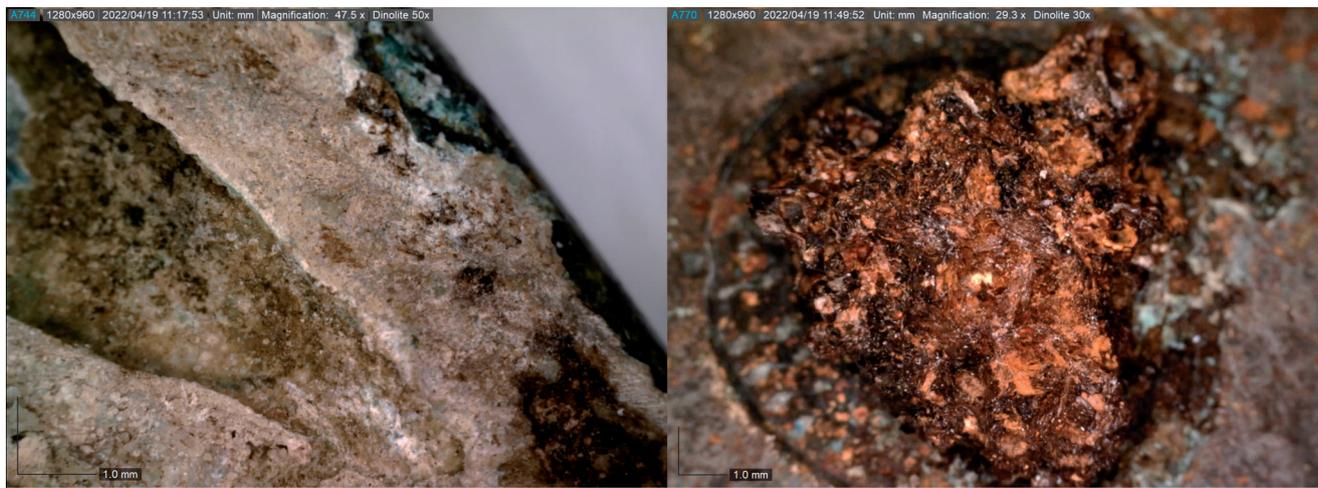
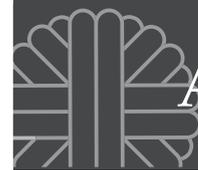


Fig. 7: Left: x50 magnification of the folds (pleats?) of the textile on fibula 409 (image: K. Saunderson); right: x30 magnification of the textile on the front surface of fibula 410 (Image: Kayleigh Saunderson; using a Dinolite digital microscope)



More recent studies on over 1,500 known portraits on tombstones in the provinces of Noricum and Pannonia were carried out by Ursula Rothe (Rothe 2012; 2013a/b) in the course of the research project *DressID – Dress and Identities in the Roman Empire*. Her studies revealed that there was in fact a large variety of women's dress in this area, including a range of regional styles (Rothe 2012, 173). As the basis for the widespread Norican-Pannonian costume, she lists a long-sleeved undergarment, sometimes clasped with a brooch in the middle; an overgarment clasped by large fibulae on the shoulders; a cloak/cape; and various types of headgear along with jewellery, mostly worn by older women. A fresco from Brunn am Gebirge, Lower Austria, shows features that are not visible on the reliefs, due to the preserved colours and their variations: a long-sleeved undergarment (white), a short-sleeved overdress (red), and a dark red skirt or sleeveless dress beneath it, visible just above the heels (Rothe 2012, 180–181). This suggests that the undergarment consisted of two pieces: probably a tunic and a separate skirt (Rothe 2013b, 189).

There are also many burial goods from the provinces Noricum and Pannonia that mirror the dress components depicted on the tombstones – paired fibula found together with belt fittings and belt clasps. Usually they come from cremation graves, laid into the grave as burial goods – sometimes even in a burnt state, as they were “worn” by the corpse during the cremation on the pyre and were afterwards collected and buried. Here especially the finds from Potzneusiedl add important data as they come from inhumation graves (Formato 2021, 113–117; Formato, conference Iași, in preparation) where textiles are still attached.

#### *Graves 101 and 215 in the context of pictorial sources*

In the case of fibula 352, with textile on the two ends of the fibula (and a selvedge) as well as human skin in between, the organic remains could indicate that the fabric represents the peplos that was worn without the fabric overlapping on the shoulders – with the borders at a distance of multiple centimetres from each other. This coincides well with some depictions on tombstones, clearly showing that the fabric did not overlap and was pinned close to its selvedges (LUPA 727 – Sárszentmiklós, 1315 – Seggauberg, fig. 9), thus also explaining the location of 352's selvedge.

Although most women on the reliefs are shown wearing an underdress, some seem to be only wearing a peplos without sleeves (Rothe 2012, 181; LUPA 920 – Sankt Georgen am Sandhof; 1160 – Sankt Johann ob Hohenburg; and perhaps also 3217 – Sankt Donat; all



Fig. 8: Reconstructed Norican girl's costume based on a relief presumably from Zollfeld, Carinthia (LUPA 923) (Image: Karina Grömer)

displayed as “girls”, Rothe 2013b, 190–191). While the lack of an underdress on the relief could be attributed to the artist's detail or the preservation, this could still represent the clothes from burial 101, which might have been worn in hot weather. Otherwise, an undergarment could have been present but simply not preserved, or the brooches shifted upwards in position together with the peplos, thus no longer

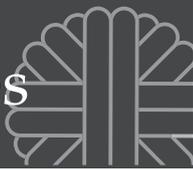


Fig. 9: Stele of a Norican “girl” wearing a pleated peplos fastened close to its edges over a long-sleeved undergarment; found in Seggau, Styria, dated to 100–160 CE; Schloss Seggau (Image: Ortolof Harl, LUPA 1315-3)

touching the undergarment (Formato et al. 2022, 111). Another reason for the peplos being worn without an undergarment could be due to mortuary processes, making it much easier to clothe a deceased person in a rectangular piece of fabric than a dress with tight sleeves.

Some images show the typical fibulae on the shoulders along with a third worn in the middle of the woman’s chest (Rothe 2012, 180; LUPA 714 and 734 – Dunaújváros, 760 and 3182 – Szentendre, 3863 – Szomód, fig. 10), appearing to fasten the undergarment worn under the peplos, which partly covers the fibula in Szentendre 3182. Interestingly, all known reliefs showing undergarments fastened with a small disc fibula derive from modern day Hungary, ergo the province of Pannonia, indicating that this type of clothing was specific to this province, which Potzneusiedl was also a part of. These depicted costumes could very well represent those worn in Potzneusiedl burial 215, where the same fabric was attached to the disc fibula and one of the wing fibula. Thus, this textile likely represents the peplos, which was worn over an undergarment clasped by the disc fibula. The folds on this wing fibula could indicate that the peplos was pleated, which can also be seen on reliefs (LUPA 1315 – Seggau, fig. 9).

### Conclusion

The technical features of the textiles from Potzneusiedl neither fully correspond with those of the Late Iron Age nor the Roman era. The s-spun threads indicate

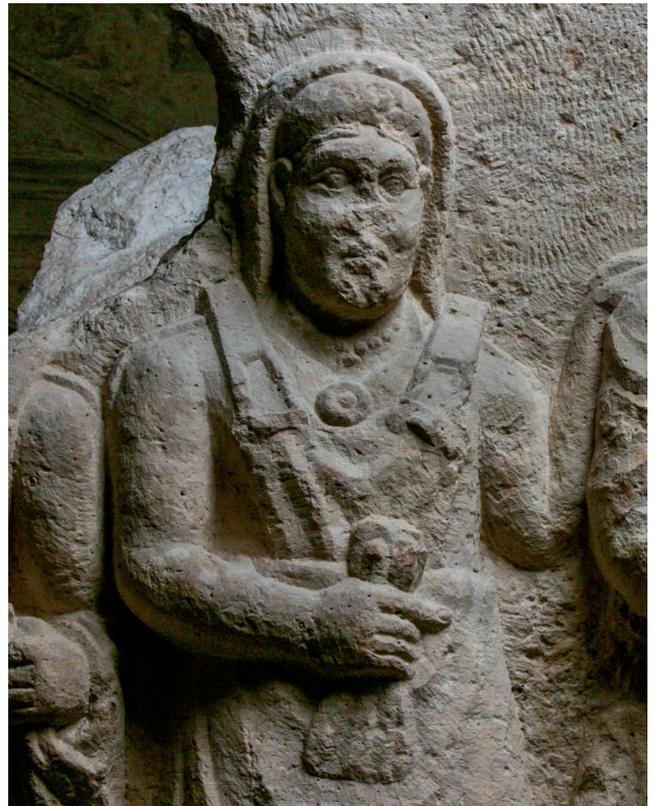
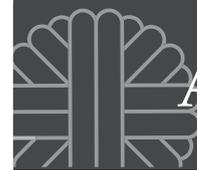


Fig. 10: Stele of a Pannonian woman wearing a peplos over an undergarment that is fastened with a disc fibula in the middle; found in Szomód, Komárom-Esztergom; Budapest – Magyar Nemzeti Múzeum (Image: Ortolof Harl, LUPA 3863-5)

Roman influences from the southern provinces and the thicker thread diameters suggest lingering textile traditions from the La Tène period. Thus, these finds from this period of cultural transition indicate that the change in textile craft was gradual, though additional data is needed to further explore this phenomenon. These retained traditions with roots in the Iron Age are also noticeable in the Norican-Pannonian women’s costumes, as evidenced by the reliefs. The textile fragments on the analysed brooches offered many hints on how these garments could have been worn, which can further be successfully compared with many of the portraits on the gravestones: a peplos garment that is pinned close to the fabric’s selvages without overlapping, perhaps worn without an undergarment, and a maybe-pleated peplos worn over an undergarment, which is fastened by a disc fibula in the middle. The distribution of pictorial evidence for wearing the small disc fibulae also indicates that this costume variation was specific to the province of Pannonia.

Thus, these findings provide valuable data thanks



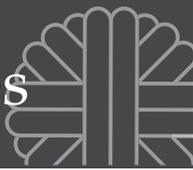
to the rare inhumation contexts and the positions of the textiles, expanding our knowledge on textile traditions and clothing as well as its correspondence with contemporary pictorial sources.

### Acknowledgements

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### Bibliography

- Andersson Strand, E., Mannering, U. and Nosch, M-L. (2022) Old Textiles, New Possibilities. Ten Years on. In A. Ulanowska, K. Grömer, I. Vanden Berghe and M. Öhrmann (eds), *Ancient textile production from an interdisciplinary perspective – Humanities and natural sciences interwoven for our understanding of textiles. Interdisciplinary Contributions to Archaeology*. Cham: Springer, 19–35.
- Belanová-Štolcová, T. (2012) Slovak and Czech Republics. In: M. Gleba and U. Mannering (eds), *Textiles and textile production in Europe: From prehistory to AD 400*. Oxford: Oxbow Books, 306–331.
- Bender Jørgensen, L. (1992) *North European textiles until AD 1000*. Aarhus: Aarhus University Press.
- Bender Jørgensen, L. and Grömer, K. (2013) The archaeology of textiles – Recent advances and new methods. In V. Bralić and A. Azinović Bebek (eds), *PORTAL. Godišnjak Hrvatskog restauratorskog zavoda 3/2012*. Zagreb: Hrvatski restauratorski zavod, 45–68.
- Formato, L. C. (2021) Die Nekropolen Leithaprodersdorf und Potzneusiedl (Burgenland, AT). Ein Einblick in lokale Bevölkerungsstrukturen im Hinterland der nordwestpannonischen Donaugrenze im Spiegel der Bestattungstraditionen des 1. und 2. Jh.s n. Chr. In C. Agricola and E. Deschler-Erb (eds), *Memento Mori. Aktuelle Forschungen zu römischen Bestattungssitten in den Nordwestprovinzen. Kölner Studien zur Archäologie der Römischen Provinzen – digital 1*. Köln: Verlag Marie Leidorf, 102–128.
- Formato, L. C., Saunderson, K. and Grömer, K. (2022) Mineralisierte organische Reste aus Körpergräbern der tiberischen bis frühflavischen Zeit aus Potzneusiedl. *Mitteilungen der Anthropologischen Gesellschaft in Wien* 151/152, 99–124.
- Formato, L. C. (Workshop AG Römerzeit, in preparation) Die Potzneusiedler Körpergräber. Eine Bestattungsgruppe im Kontaktbereich zwischen nord- und süddanubischen Traditionen am Übergang der späten Eisenzeit zur frühen, römischen Kaiserzeit. In L. Formato, L. Krieger, F. Lang, A. Maspoli, J. Rabitsch, L. Schönemann, S. Traxler and A. Wyss (eds), *Gräber in Kontaktregionen*. Workshopbeiträge der AG Römerzeit, Wien. 8–10 November 2021.
- Formato, L. C. (conference Iași, in preparation) Romans and Natives in North-Western Pannonia – The exemplary reconstruction of rural population structures using iconographic, epigraphic and archaeological sources. In L. Birliba and I. Piso (eds), *Conference proceedings of the 5th international conference on the Roman Danubian provinces: Romans and Natives in the Danubian provinces (1st C. BC–6th C. AD)*. Iași, Romania, 5–9 November 2019.
- Garbsch, J. (1965) *Die norisch-pannonische Frauentracht im 1. und 2. Jahrhundert*. Münchner Beiträge zur Vor- und Frühgeschichte 11. München: Beck.
- Garbsch, J. (1985) Die norisch-pannonische Tracht. In H. Temporini (ed), *Aufstieg und Niedergang der Römischen Welt / Rise and Decline of the Roman World*. Berlin and New York: De Gruyter, 546–577.
- Gillis, C. and Nosch, M-L. (2007) *First Aid for the Excavation of Archaeological Textiles*. Oxford: Oxbow Books.
- Gleba, M. (2012) From textiles to sheep: investigating wool fibre development in pre-Roman Italy using scanning electron microscopy (SEM). *Journal of Archaeological Science* 39(12), 1–19.
- Grömer, K. (2007) Ein Leinenbeutel mit römischen Münzen aus dem Bezirk Deutschkreutz im Burgenland. In G. Dembski and R. Lang (eds), *Ein Münzschatz aus der Umgebung von Deutschkreutz (Burgenland)*. Römisches Österreich 30. Vienna: Österreichische Gesellschaft für Archäologie, 19–21.
- Grömer, K. (2009) Gewebe vom Magdalensberg – Zeugnisse römischer Weberei. *Carinthia* 199, 61–68.
- Grömer, K. (2014) *Römische Textilien in Noricum und Westpannonien – Im Kontext der archäologischen Gewebefunde 2000 v. Chr. – 500 n. Chr. in Österreich* (with contributions from Annette Paetz gen. Schieck, Eva Hölbling-Steigberger and Kordula Gostencnik). *Austria Antiqua* 5. Graz: Grazer Universitätsverlag.



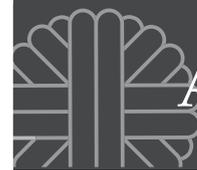
- Grömer, K. (2016) *The art of prehistoric textile making – The development of craft traditions and clothing in Central Europe* (with contributions from R. Hofmann-de Keijzer and H. Rösel-Mautendorfer). Veröffentlichungen der Prähistorischen Abteilung (VPA) 5. Vienna: Natural History Museum Vienna.
- Grömer, K. (2020) Wieviel Textil bleibt übrig bei einer Brandbestattung? Experimentelle Kremationen Inzi18 und Inzi19. In G. Schöbel (ed), *Experimentelle Archäologie in Europa. Jahrbuch 2020*. Unteruhldingen: Isensee-Verlag, 68–82.
- Grömer, K. and Gostenčnik, K. (2009) Ein Detail am Rande..... Ein Beschlag aus Oberdrauburg. *Archäologie Österreichs* 20(2), 17–18.
- Grömer, K. and Sedlmayer, H. (2012) "Ausgrabungen im Archiv": Gräber mit Textilfunden im Depot des Naturhistorischen Museums Wien (Römerzeit bis beginnende Völkerwanderungszeit). *Annalen des Naturhistorischen Museums Wien* 114(1), 149–177.
- Gugl, C. and Hinker, C. (2020) Wieder in Mode: Die „norisch-pannonische Tracht“ im Informationszeitalter. In L. Berger, L. Huber, F. Lang and J. Weilharter (eds), *Akten des 17. Österreichischen Archäologentages am Fachbereich Altertumswissenschaften, Klassische und Frühägäische Archäologie der Universität Salzburg vom 26. bis 28. Februar 2018*. Archaeo plus - Schriften zur Archäologie und Archäometrie der Paris Lodron-Universität Salzburg 11. Salzburg: University of Salzburg, 99–108.
- Mitschke, S. (2013) Textile Qualitäten im römischen Heer der Rheinprovinzen. In: M. Tellenbach, R. Schulz and A. Wiczorek (eds), *Die Macht der Toga: DressCode im römischen Weltreich*. Publikation der Reiss-Engelhorn-Museen 56. Regensburg: Schnell und Steiner, 229–237.
- Nowak-Böck, B. and Voß, H. (2015) Standardised mapping system for the digital documentation of organic materials on metal finds and in-situ-blocs. *Archaeological Textiles Review* 57, 60–69.
- Paetz gen. Schieck, A. (2012) A Late Roman painting of an Egyptian officer and the layers of its perception: On the relation between images and textile finds. In M-L. Nosch (ed), *Wearing the cloak: dressing the soldier in Roman times. Ancient Textiles Series* 10. Oxford: Oxbow books, 85–108.
- Rast-Eicher, A. (2008) *Textilien, Wolle, Schafe der Eisenzeit in der Schweiz*. Basel: Archäologie Schweiz.
- Rothe, U. (2012) Clothing in the Middle Danube provinces – garments, their origins and their distribution. *Jahreshefte des Österreichischen Archäologischen Institutes in Wien* 81, 137–232.
- Rothe, U. (2013a) Das norische Frauengewand. In M. Tellenbach, R. Schulz, A. Wiczorek (eds), *Die Macht der Toga. DressCode im römischen Weltreich. Publikation der Reiss-Engelhorn-Museen* 56. Regensburg: Schnell und Steiner, 189–193.
- Rothe, U. (2013b) Die norisch-pannonische Tracht: gab es sie wirklich? In G. Grabherr, B. Kainrath and T. Schierl (eds), *Verwandte in der Fremde*. Innsbruck: Innsbruck University Press, 33–48.
- Saliari, K., Pucher E., Boschin, F., Winkler, V. and Formato, L. C. (in preparation) Animal bones in the funerary practices at the necropolis of Potzneusiedl, Burgenland (1st–3rd century AD, Austria).

#### Internet sources

- LUPA – *Ubi Erat Lupa, Database for Roman Gravestones* (2022) <http://www.ubi-erat-lupa.org> (accessed 20 May 2022)
- OEAU – *Austrian Academy of Sciences* (2019) <https://www.oeaw.ac.at/en/oeai/research/historical-archaeology/archaeology-of-the-roman-provinces-in-the-latin-west/potzneusiedl-burial-site> (accessed 20 May 2022)

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# A chieftain's colourful garments: microinvasive analysis of Norwegian Snartemo V textiles

## Abstract

Several microinvasive methods were applied to analyse the fibre materials from the Snartemo V burial from the Migration Period (fifth century CE) in Norway. The morphological parameters of the textile fibres and furs were examined with optical (TLM) and electron microscopy (SEM, SEM-EDX and TEM) and dyes with UHPLC-PDA method. According to TLM and TEM analyses, the Snartemo textiles were spun of very fine wool, that consisted of white and naturally pigmented fibres. The dye analysis revealed colourants referring to dyer's madder, weld and woad in several textiles. The reddish hue in the warp of the wide geometrically patterned tablet-woven band was interpreted a result of the fading of the natural dark pigmentation of the wool. Respectively, the warp yarns that now appear yellow were interpreted as originally white, undyed wool. In addition, fibres from a bear's (*Ursus arctos*) fur and a Mustelidae sp. were identified in the previously unexamined Snartemo materials.

**Key words:** Microscopy, dyes, wool, fur, pigment cells, moulds

## Introduction

To provide new insights on a Migration Period chieftain's costume, microinvasive analyses were applied to the Snartemo V textile material from Norway. An updated analysis of dyes was estimated to be essential, since although there is previous research published by Penelope Walton of the Snartemo II and V textiles as result of her extensive work with Iron Age textile materials (Walton 1988a, 148) some interpretations still rely on visual analysis made by Bjørn Hougen in 1935 (Hougen 1935, 73–74) (details of previous dye research in table 1). For example, the geometrically (swastika) patterned tablet-woven band was reported as woven with red, yellow and green colours (Rolfesen 2003, 90), based on observations by Hougen. Updated results of fabrics were seen useful for garment reconstructions in order to visualise the colours of clothing and the textile craft of fifth century CE Norway.

The Snartemo V fragments are stored at the

Kulturhistorisk Museum in Oslo (KHM) on cardboard trays, often containing textile materials from several different garments. The fragments were treated with Modocoll, a conserving medium used especially in Scandinavia in the 1960s–1980s to strengthen the finds. Over the following decades, Modocoll formed a tight, glass-like layer over the fibres (fig. 1) (Geijer et al. 1961; Peacock 1992, 204). One aim of this study was to test how modern dye analytics can manage with Modocoll-treated textiles. The dye analysis performed by Walton was extraction into a series of solvent systems followed by absorption spectro-photometry of the extracts, backed up by chromatography where appropriate. Four absorption spectra were published in Walton 1988a. The extraction into solvent systems, and chemical manipulation of the extracts, was an essential part of the diagnostic procedure (Walton 1988a; 1988b). Since it was assumed by KHM that Modocoll treatment could be a problem for the currently frequently used dye analysis method, namely



UHPLC-PDA, sampling permission was granted only for 12 KHM yarns. Thus, many interesting textiles from Snartemo V and comparable materials from the Snartemo II burial remained outside this analysis.

For this study, samples were taken from the edges of the textile fragments, where the wool fibres can be worn and decayed. The aim was to estimate the effect of the sampling spot; the best-surviving wool is usually in the centre area of the fragments, but that is an impossible sampling area in microinvasive research. The fibres were measured carefully, and results were compared to the values reported by Hougen soon after the excavations (1935) and the pigment and wool type analysis by Walton (1988a).

The Snartemo V textile materials have been identified as an elite warrior's clothing (Bender Jørgensen 2003), with influences from the Roman Empire and German tribes (Bender Jørgensen 2003, 62–64). However, the Haraldskjær type z/z twill, found in the Snartemo textiles, has been identified as a north European product connected with the spread of the warp-weighted loom (Bender Jørgensen 1986, 137–140, 345–346). By examining the textile structures, thread counts and spinning properties, the fragments were sorted into groups by several scholars, providing the starting point for garment identification (Hougen 1935; Nockert 1991, 62–63; Thingnæs 2007). The groupings revealed colourful twill fragments and tablet-woven bands, as well as pelt remains (Halvorsen 2012, 282; Hougen 1935; Nockert 1991). The fabrics have been reported to be from a few centimetres to 40 cm long (Bender Jørgensen 1986, 250–251).

In addition to the KHM collection, small fragments of twill and fur from Snartemo V burials exist in a private collection near the site, in the area of Vest-Agder

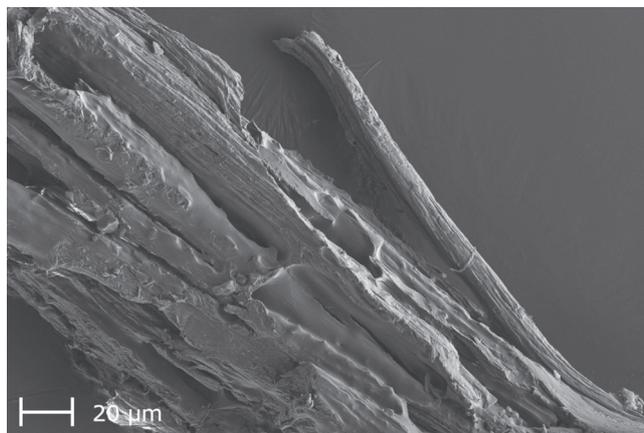


Fig. 1: Modocoll-treated wool fibres of the light-coloured yarn of the geometrically-patterned tablet-woven band (sample 2) (Image: Krista Wright)

Museum. These stray finds were collected from the archaeological site by a local schoolboy soon after the 1933 excavations and were not previously examined microscopically. Visual observation suggests there are furs from two species: a specimen from a coarse-haired, brown-coloured animal and a finer-haired, dark and brown-coloured specimen. The aim of analysing these items was to understand how they fit with the other Snartemo V findings.

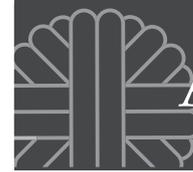
## Materials and methods

### Samples

A total of 12 samples (table 1) were taken from the KHM collections (diary number C26001) and five from the private museum collection (table 1). Sampling was microinvasive; that is, only a few millimetres of yarn or hair were cut with dissection scissors, sharp tweezers, and a scalpel from places that least damaged the fragments. Each yarn sample was 2 to 3 mm long except when the yarn was very thin. In those cases, the samples were 4 to 5 mm long. The sample preparation was not easy because the textiles were mineralised and Modocoll had made them very brittle.

Samples 1 to 3 belong to the geometrically patterned tablet-woven band. Previous research (table 1) detected indigotin and possibly a mordant dye (Walton 1988a). While sampling the yarns for this study in Oslo in 2018, it was found that there were several stitching holes and even some remains of a wool stitching yarn at the edges of the band. It has been suggested that the band was a sword baldric, although the interpretation was presented as a hypothesis (Hougen 1935, 25, 90). If serving as a baldric, the band probably would have needed a supportive material such as leather (Nockert 1991, 63), but no leather fragments have been found attached to it. A very similar-looking, geometrically-patterned tablet-woven band from Øvre Berge (450 CE, Norway) was sewn as a border of a twill fabric. Animal-patterned bands from Snartemo V, Evebø-Eide and Högom burials belonged to clothing (Hougen 1935, XVI, XVII, XVIII; Raknes Pedersen 1988, 119; Nockert 1991, 63; Thingnæs 2007; Halvorsen 2012, 281–289). Accordingly, it was not possible to exclude the idea that the Snartemo V band originally belonged to a garment.

The samples 4 and 5 may originate from twill trousers or legwear (Hougen 1935, 71; Nockert 1991, 63; Thingnæs 2007, 63–64), and indigotin has been detected in previous research (Walton 1988a). Samples 6 and 7, a dark twill, were possibly from part of a tunic (Thingnæs 2007, 63). The plied yarns (samples 8 and 9) have been interpreted as cloak remains (Thingnæs 2007, 63–64). In this plied yarn twill, madder has



previously been detected (Walton 1988a; table 1). Sample 10a is a weft of the horsehair-patterned band that bordered the tunic or cloak (Nockert 1991, 62–63; Thingnæs 2007, 63–64). It was woven using a visually blueish wool warp and two differently-pigmented horsehairs (sample 10b) as active weft and a visually reddish sheep wool yarn as the passive weft (Nockert 1991, 83–87). Horsehair has been reported to withstand wet conditions well, having good resistance to wear (Rast-Eicher 2016, 215; Kalayci et al. 2019). Because

of its silk-like lustre, it was used with long weft floats in the Migration Period bands to increase the shining effect (Nockert 1991, 88–89).

Sample 11 belonged to the plied yarn fabric in which madder has been detected previously (Walton 1988a; table 1). This textile might have been a cloak or tunic (Hougen 1935, 71; Nockert 1991, 62–63; Thingnæs 2007, 63). The two-coloured and spin-patterned fragments could have been a shroud (Hougen 1935, 70; Nockert 1991, 63; Thingnæs 2007, 63). Sample 12 was the dark

No.	Sample description, catalogue number	Yarns	Thread count/ cm	Previous dye analyses
1	Purplish yarn soumak stripe, KHM C26001:71	Sz	-	Walton 1988a: all yarns: indigotin and mordant dye
2	Yellowish warp KHM C26001:71	Sz	-	
3	Reddish warp KHM C26001:71	Sz	-	
4	Twill KHM C26001:50	z	11/10	Walton 1988a: Haraldskjær type z/z twill, indigotin
5	Twill KHM C26001:50	z	11/10	
6	Dark twill KHM C26001:42	z	11/10	Walton 1988a: Haraldskjær type z/z twill, no dyes detected
7	Dark twill KHM C26001:42	z	11/10	
8	Dark yarn of 2-coloured twill, KHM C26001:37	Sz	15/14	Walton 1988a: madder
9	Light yarn of 2-coloured twill KHM C26001:37	Sz	15/14	
10a 10b	Reddish wool weft Horsehair weft KHM C26001:72	unclear	-	No previous dye analyses
11	Dark reddish twill, warp KHM C26001:58	Sz	13/13	Walton 1988a: madder
12	2 coloured twill, dark z yarn KHM C26001:47	z/s+z	8/8	Hougen 1935, 84: two shades of brown Walton 1988a: no dyes detected, natural pigmentation
13	Red twill, warp VAM collections	Sz	13/13	No previous analyses Same fabric as number 11
14	Red twill, weft VAM collections	Sz	13/13	
16	Fur 1, VAM	-	-	No previous analyses
17	Fur 2, VAM	-	-	
18	Fur 3, VAM	.	-	

Table 1. Sampled textiles, spin directions and results of previous research



z-twisted yarn from this textile, in which the previous analysis had not detected colourants (Walton 1988a; table 1).

The samples 13 and 14 come from a private collection curated by Vest-Agder Museum (VAM). They are from a reddish Sz/Sz twill, approximately 4 x 5 cm in size. They are attached to a coarse-haired fur fragment, approximately 10 x 15 cm in size, with a small piece of dark, fine-haired fur (sample 17). In addition, the assemblage contains two more fur fragments (approximately 2 x 4 cm), with coarse light brown hairs (samples 15 and 16). From the furs, 3 to 5 hairs were sampled for analysis (table 1).

### *Macroscopic and microscopic analyses*

Textile properties such as thread count and weave were observed when cutting the yarn samples from the textiles, to ensure the identification of different fragments. Yarn properties, including thickness, spin direction, ply and number of ply twists per cm were measured under a stereomicroscope while cutting fibres with a scalpel for microscopy and UHPLC-PDA analysis.

A few fibres of each sample were picked up with sharp tweezers and placed on an objective slide to analyse their inner structure. A few drops of Entellan New mounting medium were dropped on the fibres, which were finally covered with a cover slip. Diameter

values measured with different microscopes can vary (Skals et al. 2018), so to avoid this, the samples were measured with one microscope throughout the study. These samples were imaged with a Leica DM 4500 P transmitted light microscope (TLM) with a 5-megapixel DFC420 camera and Las Core 4.5 software.

To observe the surface features, a few fibres of each sample were imaged with a scanning electron microscope (SEM), using Jeol 7500 FA for high performance SEM imaging, while Zeiss Sigma VP was applied for basic SEM imaging. The fibres were picked up with sharp tweezers and placed on double-sided carbon tape fixed on a carbon stub. The samples were then coated with a 10 nm-thick layer of carbon (C), using a Leica ACE 600 sputter coater, to increase the electrical conductivity of the samples and to ensure better imaging conditions. Energy-dispersive X-ray spectroscopy (EDX) was applied to detect mordants of organic dyes. This analysis was performed with Jeol 7500 FA, simultaneously with SEM imaging. For EDX analysis, acceleration voltage was 15 kV, while the basic SEM imaging was done with 1–2 kV.

The hairs of VAM private collection underwent careful microscopic examination with TLM and SEM, in which their scale pattern, shape of the inner fibre medulla and shape of the cross section, as well as length, diameter, and pigmentation were observed to detect the species related features (Appleyard 1978; Teerink

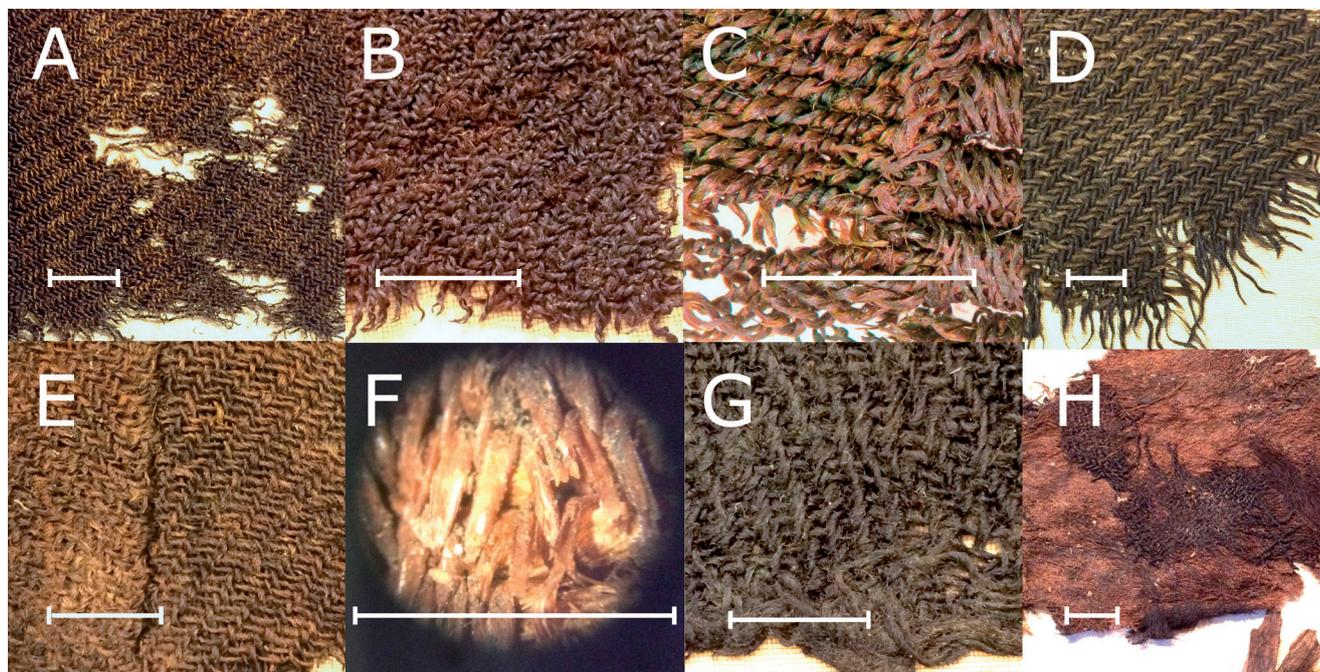


Fig. 2: Sampled textiles. A – two-coloured plied yarn twill (samples 8+9); B – dark red twill (sample 11); C – patterned tablet-woven band (samples 1–3); D – two-coloured z/z twill (sample 12); E – z/z twill (samples 4+5); F – horsehair band (sample 10a); G – dark z/z twill (samples 6+7); H – twill from private collection (sample 14) (Images: Krista Wright)



Sample	Spin angle, ply angle, ply twists/ 10 mm	Scales, Fibre diam. ( $\mu\text{m}$ )	Yarn diam. (mm)	Dyes, elements
1. Soumak stripe	10–30° spin angle 30–45° ply angle	Scales 10–14 Fibres 20–25	Tablet woven band 0.3–0.5	Alizarin, purpurin C, O, Si, S, Cu
2. Yellow warp	0–10° spin angle 20 ply twists/ 10	No scales (Modocoll) Fibres 11–20	0.3 mm	Indigotin, indigotin equivalent C, O, S, P, Al, Si, K, Ca, Fe
3. Red warp	0–10° spin angle 45–55° ply angle 20 ply twists/ 10	Scales 14–15 Fibres 23	0.3 mm	No detected colorants C, O, S, P, Al, Si, Fe
4. Twill	40–45° spin angle	Scales 15 Fibres 14–40	0.3–0.5 mm	Indigotin, isatin C, O, S, Al, Si, Fe, Cu
5. Twill	45° spin angle	Scales 8–20 Fibres 18–49	0.3	Indigotin, isatin C, O, S, Al, Si, Fe
6. Dark twill	45° spin angle	Degraded scales Fibres 17–25	0.3	Indigotin, isatin, unknown UV absorbing component C, O, Na, S, Al, Si, Fe
7. Dark twill	45° spin angle	Degraded scales Fibres 23–40	0.2–0.3	Indigotin, isatin, unknown UV absorbing component, two unknown yellow components C, O, Na, S, Ca, Al, Si, Fe
8. Twill, 2-colored, dark yarn	0–5° spin angle 45° ply angle 20 ply twists/ 10	Degraded scales Fibres 10–37	0.2–0.3	Alizarin, purpurin, rubiadin, indigotin C, O, Na, S, Ca, K, Al, Si, Fe, Cu
9. Twill, 2-colored, light yarn	0–5° spin angle 45° ply angle 20 ply twists/ 10	Scales 12–14 Fibres 16–49	0.2–0.3	Indigotin, luteolin glucoside?, unknown UV absorbing component C, O, Al, S, Fe
10a. Reddish weft	Low spin angle, unclear spin direction	Scales 9–16 Fibres 25	0.3	Indigotin, luteolin-7-glucoside?, unknown UV absorbing component C, O, Na, Al, Si, S, K, Cu
10b. Horse hair weft	Single fiber	113	-	Horse tail hair
11. Twill, warp	Ply angle 45° 9 ply twists/ 10 mm	Degraded scales Fibres 14–37	0.5–0.75	Alizarin, rubiadin, unknown yellow component C, O, P, Si, S, Fe, Cu
12. Twill, dark yarn	30–50° spin angle	Fibres 13–17 $\mu\text{m}$ , white and dark fibres	1.0	Indigotin, luteolin-7-glucoside?, luteolin?, unknown UV absorbing component C, O, Al, Si, S, Fe

Table 2: Textile, yarn and fibre properties as well as colourants



Sample	Spin angle, ply angle, ply twists/ 10 mm	Scales, Fibre diam. ( $\mu\text{m}$ )	Yarn diam. (mm)	Dyes, elements
13. Twill, warp	15–20° spin angle 45–75° ply angle 9 ply twists/ 10 mm	Fibres 11–25	0.5	No dye analysis, too small sample C, O, Si, Cu, Fe
14. Twill, weft	10–15° spin angle 30–45° ply angle 15 ply twists/ 10 mm	Scales 14–22 Fibres 15–36	0.5	No detected colorants, too small sample C, O, Al, P, Si, S, Ca, Fe, Cu
15. Fur 1	Coarse light brown hairs	Guard hair 70 Under hair 23	-	Bear ( <i>Ursus arctos</i> ) C, O, S, Al, Si, K, Cu
16. Fur 2	Coarse light brown hairs	Guard hair 74 Under hair 23	-	Bear ( <i>Ursus arctos</i> )
17. Fur 3	Fine dark hairs	Guard hair 50 Under hair 7	-	Mustelidae sp.

Table 2 (continued): Textile, yarn and fibre properties as well as colourants

2003; Rast-Eicher 2016). More recent DNA and protein sequencing methods were available (Schmidt et al. 2011; Brandt et al. 2014), but this was assumed to be unsuitable for the glass-like mineralised hairs that had clear contamination of moulds and micro-organisms. Since the analytic techniques are improving all the time, more sensitive methods could be available in the future.

To examine the natural pigmentation of the wool, samples 2, 3, 10a and 12 were analysed by transmitted electron microscopy (TEM). The fibres were embedded in epoxy (LR White) for 24 hours; the epoxy blocks were cut with a Leica 125 Ultracut microtome with Diatome's histo diamond knife into 70 nm slices. The slices were placed on holey carbon aperture slot grids (2 × 1 mm) and then treated for 10 minutes with uranyl acetate ( $\text{UO}_2(\text{CH}_3\text{COO})_2 \cdot 2\text{H}_2\text{O}$ ) to increase the contrast. The samples were imaged with FEI Tecnai 12 with acceleration voltage of 120 kV.

#### Dye analysis

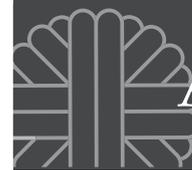
The UHPLC-PDA analysis method required a sample of 0.2 to 0.5 mg (Vanden Berghe et al. 2009, 1912). In the UHPLC-PDA method, the extraction protocol of the organic colourants was two-phased, which permitted the detection both of vat and mordant dyes (Serrano et al. 2013, 102–111). First, the sample was extracted by the addition of 50 microliters ( $\mu\text{l}$ ) dimethyl sulfoxide (DMSO) to the sample in a 1 ml vial. The vial was heated at 80°C for 10 minutes in a water bath. Next,

the DMSO fraction was removed and set apart. The remaining sample was then hydrolysed by the addition of 50  $\mu\text{l}$  of reagent (water/methanol/hydrochloric acid, 1/1/2) to the sample in the small insert vial. The vial was heated for 10 minutes in a water bath at 100°C to extract and dissolve the remaining dyestuff. After the hydrolysis, the sample was evaporated to dryness and dissolved in the first DMSO fraction. The two extractions were thus combined. Next, the samples were centrifuged for 10 minutes at 6000 rpm to remove small particles.

During the actual analysis, the organic colourants were separated from each other, and their ultraviolet-visible spectra (UV-VIS) were recorded by PDA. The UHPLC conditions consisted of a Waters Chromatography Acquity H-Class UPLC system with a BEH-Shield C18 column, and the PDA detection was made with a Waters Acquity PDA. Compounds were identified by comparison of these UV-VIS spectra and their respective retention times with known reference material (van Bommel 2018).

#### Findings

In the Snartemo V yarns, the UHPLC-PDA analysis detected several compounds (table 2). Indigotin or isatin were the most abundant (samples 2, 4, 5, 6, 7, 8, 9, 10a and 12). In addition, an indigotin equivalent was found, which is a component with a similar UV/VIS spectrum that correlates to the main component but elutes at a different retention time and often represents



an unknown by-product from the same biological source. Anthraquinones were detected, too: alizarin, purpurin or rubiadin were detected in samples 1, 8 and 11. Yellow colourants were detected often, but not always identified. Of these, luteolin or luteolin-7-glucoside were found in three yarns (samples 9, 10a and 12). Unknown yellow colourants were found in two yarns (samples 7 and 11) and unknown UV-absorbing compounds in five yarns (samples 6, 7, 9, 10a and 12). SEM-EDX analysis detected carbon (C), oxygen (O) sulphur (S), aluminium (Al), silicon (Si), phosphorus (P), calcium (Ca), potassium (K), sodium (Na), chlorine (Cl), iron (Fe) and copper (Cu) (table 2). The predominant spin direction of the Snartemo V yarns was z (table 1 and fig. 2), which is typical for Norwegian Migration Period textiles (Halvorsen 2012, 282). Only one textile had both s-spun and z-spun yarns (sample 12, a spin-patterned twill). The yarns were fine; the thinnest ones were less than 0.3 mm (samples 6, 7, 8 and 9) and the thickest ones only 1 mm in diameter (sample 12). The spinning angles were low in all yarns, from 0° to 10–15°. Ply angles were 40° to 75° and there were approximately 20 ply twists per cm. Thread counts varied from 8 to 13 yarns per cm. The fibres were 11–49 µm in diameter. One yarn (sample 10a) had a scale pattern typical of sheep wool (Rast-Eicher 2016). In several yarns the scales were long, the longest ones 22 µm (samples 1, 2, 3, 4, 5 and 12), while in others the surfaces were too damaged for

measurements or completely without scales. Pigment cells were present in samples 3, 10a and 12, while sample 2 lacks them (fig. 3).

The coarse-haired fur samples (samples 15 and 16) were identified as bear (*Ursus arctos*) according to Tóth (2017) and the reference collection. The guard hairs were a maximum of 74 µm wide and 7 to 10 mm long, broad scales transversally elongated, medulla tubular, medullary index 0.26. Pigments were arranged into lines in the cortex. The fine hairs were 23 µm wide and 5 to 7 mm long, scales broad rhomboidal, medulla tubular uniserial or missing. The dark guard hair fragments were a maximum of 46 µm wide and 5 to 7 mm long, scales rhomboidal elongated and broad, transversally elongated, medulla not preserved. Fine hairs were a maximum of 7 µm wide, scales coronal and petal elongated. The fine-haired, dark fleece (sample 17) was identified as predator hair, possibly of Mustelidae sp. (fig. 4) according to Tóth (2017) and Teerink (2003). The horsehair (sample 10b) was 113 µm in diameter, with scales waved with rippled scale margins. In addition, several microorganisms were found on the fur fibres (table 2; fig. 5).

## Discussion

### Dyestuffs

Natural colourants have been grouped into mordant dyes, vat dyes and other categories that all need different chemistry in the dyeing process (Dean 1999;

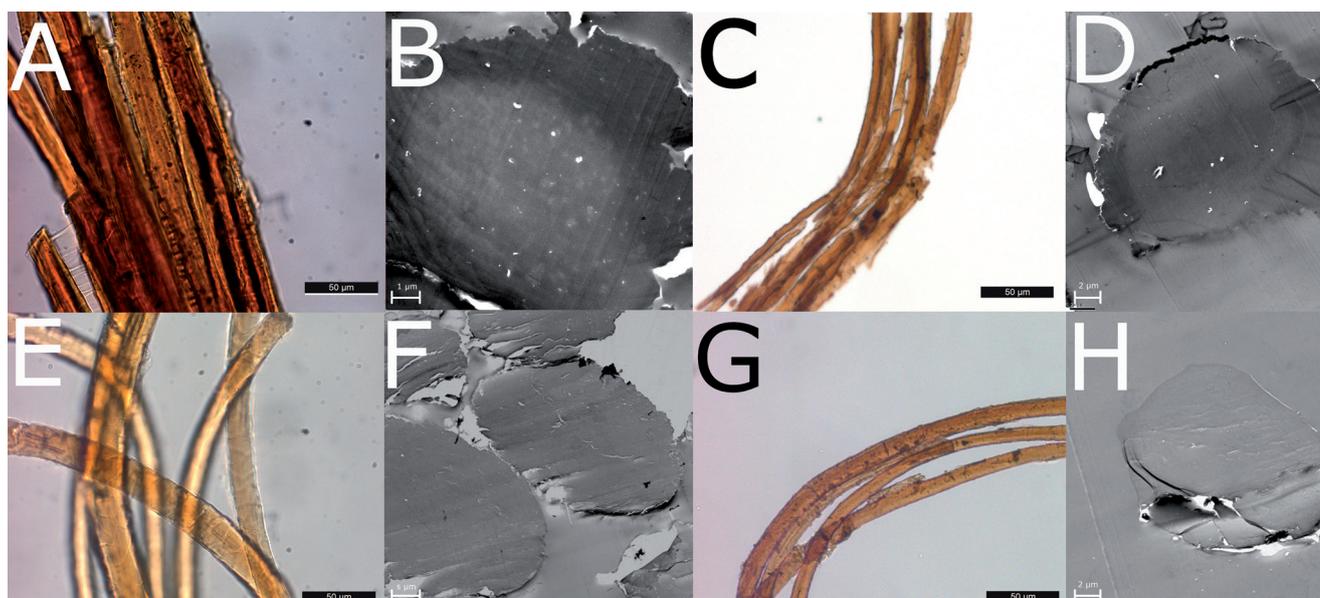


Fig. 3: A and B – reddish yarn of the patterned tablet-woven band with undyed and naturally-pigmented wool (sample 3); C and D – woad-dyed, naturally pigmented wool (sample 12); E and F – undyed white wool (sample 2); G and H – madder-dyed white wool (sample 1) (Images: Krista Wright)

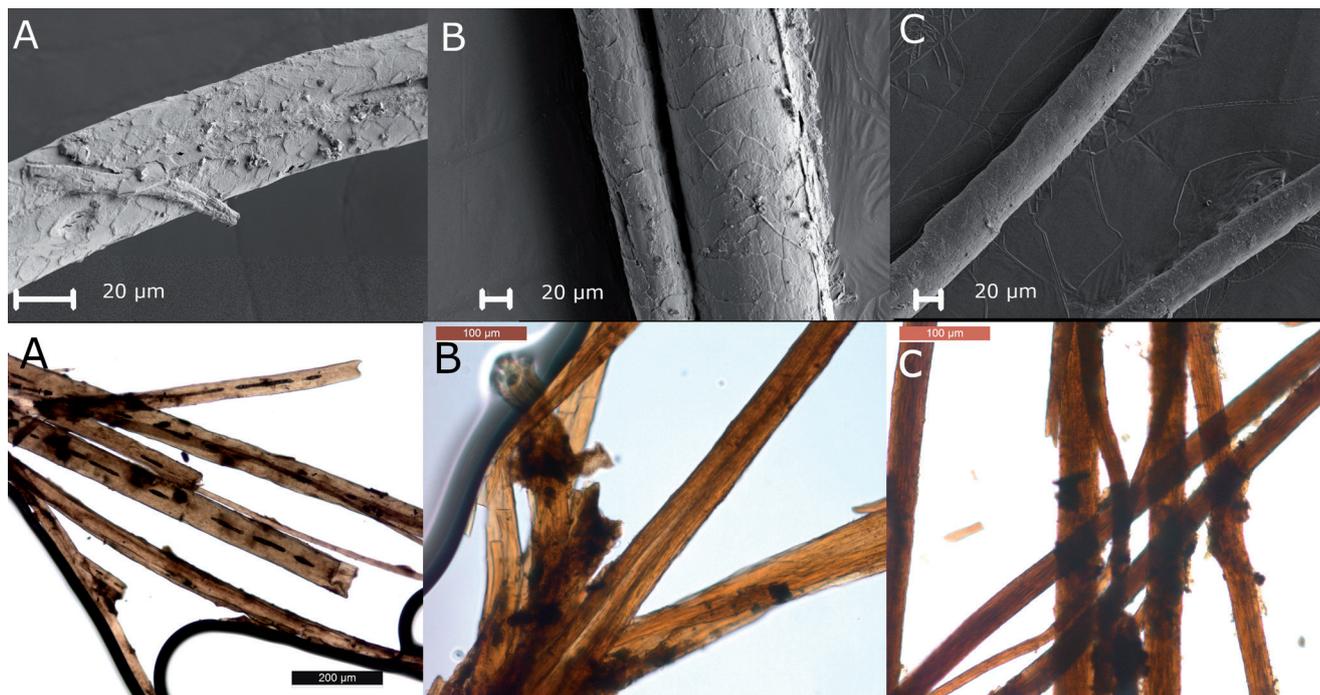


Fig. 4: A and B – brown bear (*Ursus arctos*) hairs (samples 15+16); C – Mustelidae sp. (sample 17) (Images: Krista Wright and Tuija

Cardon 2007; Hofmann-de Keijzer et al. 2013). Red anthraquinones and yellow flavonoids need a mordant that fixes the dye compounds to the wool fibres. A mordant can be metallic salt or tannin, and it can be added to the dye bath during the dyeing. Blue colour can be created with the vat dyeing technique. It needs extraction of indigotin precursors from woad, turning them into indigo pigment, with their reduction to a leuco-state in alkaline solution and oxidation for the blue (Cardon 2007; Dean 1991; Hofmann-de Keijzer et al. 2013). In the Snartemo V samples (table 2), the UHPLC-PDA analysis detected both mordant and vat dyes in 11 of 13 samples (van Bommel 2018). It was obvious that Modocoll is not a problem for this method.

Red anthraquinones (alizarin, purpurin and rubiadin) were found in the soumak stripe of the geometrically patterned tablet-woven band (sample 1), in the dark yarn of the two-coloured twill (sample 8), and in the warp of the cloak/tunic fabric (sample 11) (fig. 2). These colourants indicate the use of a *Rubiaceae* species: alizarin is the main component in dyer's madder (*Rubia tinctorum* L.), while purpurin is predominant in bedstraws (*Galium* species), and rubiadin can be found in many *Rubiaceae* species (Hofenk de Graaff et al. 2004; Cardon 2007, 127, 676; Hofmann-de Keijzer et al. 2013, 148).

Early Iron Age Scandinavian madder/bedstraw-dyed

textiles are rare when compared to more often detected woad compounds. In general, dyer's madder has a 3,000-year-old history in Europe, including, for example, the dyed textiles from Hallstatt and paintings of the Graeco-Roman and Hellenistic world (Hofmann-de Keijzer et al. 2005; 2013; Cardon 2007, 120). The oldest madder dyed textile in Scandinavia is from the Danish site, Skærsø (Walton 1988a) dated to the first century before the common era. In north Germany, purpurin of *Rubiaceae* species has been detected in Roman Iron Age Thorsberg textiles (Vanden Berghe and Möller-Wiering 2013, 103–104). *Rubiaceae* dyes have been detected in the Migration Period finds from Tegle (Vanden Berghe et al. 2009, 1918), Enebø-Eide, Tofte and Veiem (Bender Jørgensen and Walton 1986, 182; Walton 1988a), Røvsberghøj (Walton 1988a), Sande (Vedeler et al. 2018, 17) and Högom (Nockert 1991, 73–75).

The spread, trade and cultivation history of dyer's madder to Scandinavia is unclear, but it is notable that Early Iron Age Scandinavia was not ignorant of the potential of dyer's madder and/or bedstraw dyes as a source of red colour. Madder dye was probably imported (Bender Jørgensen and Walton 1986, 184). It seems likely that Migration Period dyers and weavers had an efficient trade network to obtain foreign dyestuffs: for example, non-local insect dyes such as Polish cochineal (*Porphyrophora polonica*) and

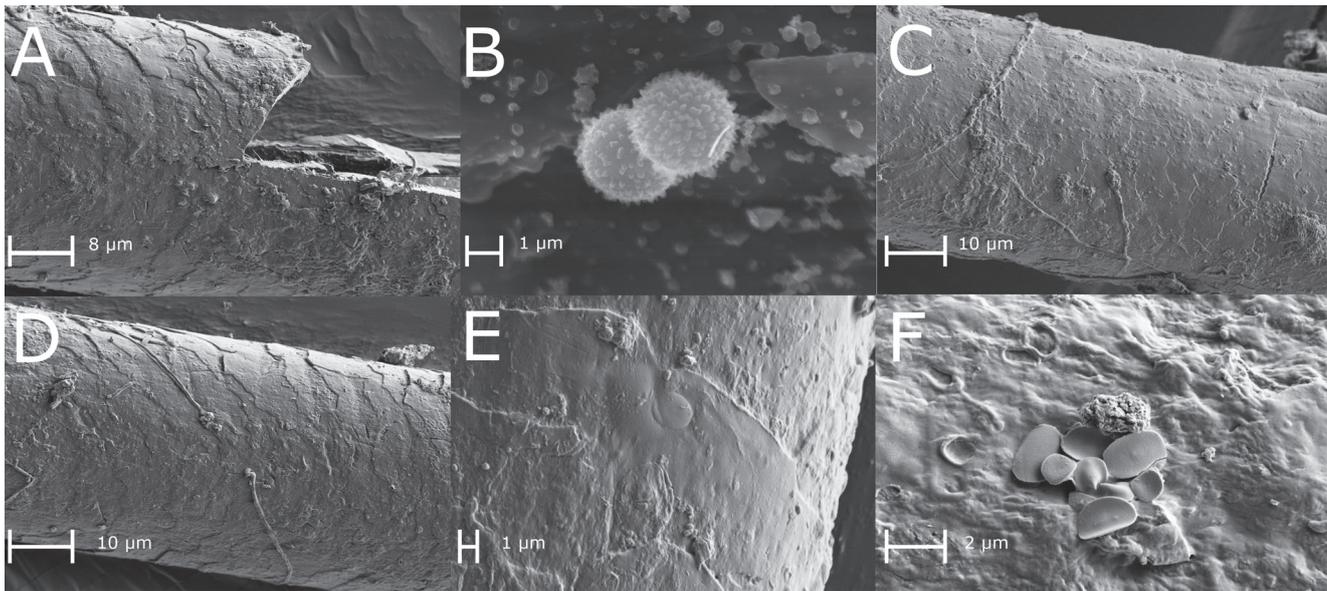


Fig. 5: Microorganisms on fur hairs: A – rod-shaped bacteria (sample 16); B – smut fungus teliospores (sample 10b); C – *Aspergillus* sp. mould (sample 15); D – *Penicillium* sp. mould (sample 15), E – amoeba-like microorganisms (sample 15); F – lenticular shaped spores (sample 15) (Images: Krista Wright)

kermes insect (*Kermes vermilio*) were imported to dye Norwegian Veien and Enebø-Eide textiles (Walton 1988a, 148, 156).

Blue colourants (indigotin, indigo equivalent and isatin) were found in several yarns (samples 2, 4, 5, 6, 7, 8, 9, 10a and 12) (van Bommel 2018). Indigotin and isatin are present in woad (*Isatis tinctoria* L.) and tropical indigo (*Indigofera tinctoria* L.). Woad is the probable source of these colourants because it is a species native to Europe. Although tropical indigo was known already in the Greco-Roman world, it was used mainly as a pigment for painting rather than a textile dye, for which purpose its importance began to rise during the Middle Ages thanks to improved seafaring (Cardon 2007, 363–364; Balfour-Paul 2011, 41–42). Woad seeds found in Early Roman Iron Age Lønne Hede in Denmark (Nordquist and Ørsnes 1971) might attest to the early availability of local Nordic woad.

In north European Early Iron Age textiles, indigotin has been detected quite often, for example in Norwegian sites, of Hallem, Veiem, Saetrang, Enebø/Eide, Snartemo, Øvre Berge (Walton 1988a), Sande (Vedeler et al. 2018, 17) and Blindheim (Bender Jørgensen and Walton 1986, 182), and in Helgeland and Tegle textiles (Vanden Berghe et al. 2009). In Danish sites textiles containing indigotin have been found at Huldremose, Krogens Mølle, Elling, Bredmose, Corselitze, Rebild, Sørgårds Mose (Vanden Berghe et al. 2009, 1914–1918), Lønne Hede (Bender Jørgensen and Walton 1986,

181; Walton Rogers 1997; Demant et al. 2018) and Røvsberghøj burials (Walton 1988a). Indigotin is also in Swedish Högom textiles (Nockert 1991, 73–75) and North German Thorsberg textiles (Vanden Berghe and Möller-Wiering 2013).

In the Snartemo V samples, a pure blue colour was present in samples 4 and 5 from the legwear. Indigotin and unknown yellow colourants in samples 6 and 7 from the dark twill of the tunic suggest a greenish fabric. One yarn system in the two-coloured twill (sample 8) had a purplish or brownish hue due to indigotin, alizarin, purpurin and rubiadin. The yarns in the other system (sample 9) contained indigotin and luteolin glucoside, which gave a green shade.

In previous research, indigotin had been detected several times with luteolin, this could be the result of contamination from surrounding archaeological context, especially if there are plant materials available, but the more likely explanation is that luteolin-based dye with woad had been used to achieve green hues (Vanden Berghe et al. 2009, 1919; Vanden Berghe and Möller-Wiering 2013). When mixing indigotin and plant anthraquinones, the intended shades of colour would have been purplish or brownish. Indigotin can migrate in burials and contaminate other textiles (Ringgaard 2010), but to evaluate this activity, more samples from the Snartemo burials would be useful.

Yellow flavonoids, luteolin and luteolin-7-glucoside were detected in samples 9, 10a and 12 (van Bommel 2018). These components occur in many plants, such



as weld (*Reseda luteola* L.), dyer's broom (*Genista tinctoria* L.), saw-wort (*Serratula tinctoria* L.) and dyer's chamomile (*Anthemis tinctoria* L.). Possible sources for luteolin are several uncultivated plants, too, such as yarrow (*Achillea millefolium* L.) and dandelion (*Taraxacum officinale* L.) (Hofmann-de Keijzer et al. 2013, 151–153). It is likely that a luteolin-containing plant was used with blue dyeing to create different nuances of green in samples 9, 10a and 12.

Furthermore, several unknown yellow components as well as UV-absorbing components were found. These could indicate unknown yellow dye sources, originating from the woad dyeing process, or be the result of a degradation process of dyes or contamination from the burial. It seems likely that an unidentified plant was used to dye the dark tunic fabric (samples 6 and 7), for which the hue was probably green instead of blue. This distinguishes the tunic fabric from the legwear fabric (samples 4 and 5), in which only indigotin and isatin were found.

Moreover, in the two-coloured twill fabric, the unknown colourants were detected in the blue/green yarn (sample 9), but not in the reddish yarn (sample 8). This possibly indicates intentional use of an unknown dyestuff instead of contamination from the burial context, as a contamination would be present in both yarns. Unknown colourants have been detected in other Scandinavian textiles, too; some of these could be lichen dyes or their degradation products, possibly originating from yellow wall lichen (*Xanthoria parietina*) or Scandinavian orchil (*Ochrolechia tartarea*) (Taylor 1983; Walton 1988a; 1988b; 2004; Vanden Berghe et al. 2009, 1918–1919). In Late Iron Age textiles, lichen colourants have been identified by UHPLC method in Finnish material (Vajanto 2015, 59). However, without a match with dye reference material, nothing certain can be said of the unknown colourants of the Snartemo V textiles.

### Mordants

Traditionally, the most utilised mordant has been aluminium, which keeps colours bright. Iron and copper mordants change the colour hues. The colours achieved depend on the quantity of iron or copper mordant: yellow colourant with iron turns the colours green or brown, or copper mordant changes the colours from more yellowish to dark brownish (Dean 1999, 59–63).

The search for mordants was challenging, since the elements detected by EDX analysis can be explained in many ways. On one hand, carbon (C), oxygen (O) and sulphur (S) are the main elements of keratin of wool. On the other hand, carbon can be explained by

the carbon coating and graphite stubs, and oxygen can be atmospheric contamination.

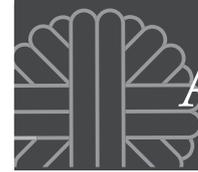
Aluminium (Al) and silicon (Si) can indicate mineralisation of fibres or sand from the burials; phosphorus (P), calcium (Ca), potassium (K), sodium (Na) and chlorine (Cl) can originate from the bones and body fluids of the chieftain's body. Aluminium, potassium and sulphur can indicate alum,  $KAl(SO_4)_2 \cdot 12H_2O$ , a well-known mordant for organic dyes. Alum can be obtained in its native state at certain geological areas, manufactured from alunite or alum shale, or be extracted from alum accumulating plant species, especially from the clubmoss species (*Lycopodium*) (Cardon 2007, 21–34; Vajanto 2015, 55, 110). Iron (Fe) and copper (Cu) have a long history in dyeing and can refer to mordant use, for example, as iron sulphate,  $FeSO_4 \cdot xH_2O$ , or copper sulphate,  $CuSO_4 \cdot 5H_2O$ , or their other chemical forms (Cardon 2007, 37–47). Alternatively, iron and copper can originate from the metallic burial goods.

The different state of preservation in the yarns of the two-coloured twill (samples 8 and 9) was interpreted as indicating two different mordants and two different dyeing methods (fig. 2a). The reddish yarn was mordanted with alum, copper and iron, and dyed in an acidic bath with red anthraquinones. That process was less damaging to wool than alkaline vat dyeing with indigotin and a possible iron mordant. With respect to the other samples, it is not possible to distinguish the intentional use of mordants from metals originating from the bronze and iron objects of the burial. Since the elements C, O, S, Al, Si, K and Cu were detected in the bear hairs, too, in-burial contamination is likely.

### Wool and yarns

In the finest yarns (samples 2, 3, 8, 9, 11, 13 and 14), only 20 to 30 individual wool fibres were used in a thread. Of these, the spin angle was very low, only  $0^\circ$  to  $5^\circ$  in samples 8 and 9. This suggested that the individual fibres were long, which helps in spinning and adds tenacity. More strength was gained by plying two threads together, with a  $45^\circ$  ply angle. Using a small number of individual fibres, it was possible to create plied yarns with a diameter of only 0.2 to 0.3 mm (samples 6 and 7). This was probably the minimum diameter and extent of twist needed in the yarns to withstand the mechanical and longitudinal stress caused by weaving. The similarities in VAM samples 13 and 14 and KHM samples 8 and 9 suggest that these are from the same reddish textile.

In many Snartemo samples there was heavy



deterioration of the fibre surface (samples 2, 6, 7, 8, 12 and 13), in which the coating scales were partly or completely lost and the microfibrillar structures were visible. These effects were possibly the result of wear on the textiles, or a heavy dyeing process, or activity of microorganisms in the grave. In some cases (samples 4, 9, 11 and 14), the fibres looked polished and/or had longitudinal cracks—these may also point to heavy use of the textiles. An undamaged surface was present only in samples 1, 3, 5 and 10a.

According to the scale pattern, sheep wool was used in the Snartemo yarn sample 10a. However, in samples 1, 3, 4, 5 and 14, the scales were quite long (the longest ones 22  $\mu\text{m}$ ). This feature did not match with the reference collection consisting of wools of Norwegian Spelsau, Villsau and adult Finnsheep, in which the scale pattern was always denser and scales shorter. Long scales (16 to 19  $\mu\text{m}$ ) existed only in lamb's wool of Jaalasheep, which is a primitive variant of Finnsheep. That feature has been found occasionally in wool of some breeds of sheep (Brax 1951, 31–37; Rast-Eicher 2016, 264–267). The long scales may have been a special feature of Migration Period sheep wool. Long scales are also a feature typical of goat fleece, in which the underwool hairs are approximately 20  $\mu\text{m}$  (Rast-Eicher 2016, 251, 253–258). It is difficult to distinguish hairs of sheep from hairs of goat, but raw fibre from a goat kid has been identified among the Norwegian Roman Iron Age textile materials, in the Sætrang find (Hougen 1935, 65–67; Walton 1988a, 147, 150). It can be challenging to find wool that has the same parameters as the Snartemo yarns, so it might be useful to test fine goat wool when spinning yarn for textile reconstructions.

In microscopy measurements (table 2), the finest fibres were found to be 11  $\mu\text{m}$  in diameter, while the coarsest ones were 49  $\mu\text{m}$ , and the typical diameters were 20 to 25  $\mu\text{m}$ . According to Walton (1988a, 149), the wool in the Haraldskjær type z/z twill was a hairy medium type (14 to 82  $\mu\text{m}$ ), in the spin-patterned twill the wool was a medium type (13 to 54  $\mu\text{m}$ ) and in the other Haraldskjær z/z twill the wool was a generalised medium type (12 to 49  $\mu\text{m}$ ) – in these, the mode values were between 22 and 31  $\mu\text{m}$ . All the results were very similar to the 22 to 44  $\mu\text{m}$  diameters reported by Hougen (1935, 84). This suggests that sampling at the fragment edges can give reliable results of the morphology of fibres and does not require sampling in the best-preserved centre area of the textiles. In microinvasive sampling, edge yarns can be used both for dye analysis and fibre analysis.

The horsehair (sample 10b) was 113  $\mu\text{m}$  in diameter. It corresponded well with horse tail (75 to 400  $\mu\text{m}$ )

and mane (50 to 200  $\mu\text{m}$ ) (Von Bergen 1961; Kalayci et al. 2019). The distance between the scale margins is relatively short, which might indicate that the hairs were from the tail. Under SEM, the surface of the horsehair appeared relatively intact.

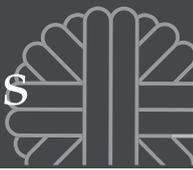
### *Wool pigmentation*

In three cases, the chromatographic analysis gave unexpected results (van Bommel 2018). The visually reddish warp (sample 3) yarn of the geometrically-patterned tablet-woven band contained no dyestuffs. The yellowish yarn (sample 2) of the same band contained blue colourants, but that can be explained by contamination from the neighbouring blue warps. It seems that no yellow colourants were used to dye this warp yarn. In addition, no red dyes were detected in the visually reddish weft yarn (sample 10a) of the horsehair-patterned band either. It contained indigotin, luteolin-7-glucoside and an unknown UV-absorbing component. These are possibly contamination from the visually blueish warp.

Visually reddish yarns with no extracted colourants have been explained with condensed tannins (Vajanto 2015; Demant et al. 2018) and the natural pigmentation of wool (Bruselius Scharff 2018). Pigment granules have been detected in TEM observations, by imaging cross-sections of the wool fibres (Bruselius Scharff and Jørgensen 2017; Bruselius Scharff 2018). In waterlogged and slightly acidic conditions, the pigment granules are very vulnerable and can be damaged, and these appeared as empty granule holes in the cross-section images (Bruselius Scharff 2018, 237, 240).

Previous research has reported pigmented yarns in the two-coloured twill (Walton 1988a), and because of this, sample 12 was used as a reference for the samples 2, 3 and 10a. In the TEM images of the Snartemo samples (fig. 3), dark granules and empty granule holes were found in samples 3, 10a and 12, while sample 2 lacks any pigment cells. Accordingly, the horsehair-patterned band had dark, naturally pigmented wool weft yarns (sample 10a); possibly the detected blue and yellow dyes were contamination from the visually bluish warp. The visually yellowish hue in the warps (sample 2) of the geometrically-patterned band was explained by white and undyed wool because no pigment cells were detected. The yellowish hue was probably degradation of keratin, which turns yellowish with ageing due to fraction of sulphur bonds (Asquith and Brooke 1968; Timar Balázs and Eastop 1999, 51).

Since only a few fibres were sampled, it was not possible to estimate the frequency of the pigmented fibres in the yarns. The visually homogeneous hues in yarns 3, 10a and 12 suggested a systematic selection of pigmented wool.



### Furs

The VAM private collection samples 15 and 16 matched hair references of bear (*Ursus arctos*), and it was reasonable to assume that they belong to the same bear pelt material as found previously (fig. 4). According to Hougen, bear hairs were found both at the bottom layers of the burial, but also attached to and between textile layers – possibly a waterflow had occurred in the burial chamber and spread the bear hairs across the burial items (Hougen 1935, 16, 72).

The Snartemo burial was one of the most richly furnished Migration Period warrior graves in which bear skin remains have been found (Grimm 2013). Bear hairs together with remains of bear claws indicated the wrapping of the deceased in a bear pelt or furnishing the grave pit with pelts (Hougen 1935, 16). The interpretation for the use of bear skins in pre-Christian ritual practices has been investigated in Old Norse mythology, which may offer a proper cultural context for interpreting the Snartemo find. In this context, skins have been seen as attributes of *berserkers* (etymologically *ber*, ‘bear’ and *serker*, ‘skin, cloth’), who were legendary soldiers dressed in bearskins associated with the god Odin (Ström 1980; Price 2002, 366–378; Bender Jørgensen 2003, 69–71; Gräslund 2006, 125; Hedeager 2011, 91–95; Pluskowski 2006, 120–121). Although skin-wearing soldiers have been illustrated, for instance, on helmet-plates in Sweden, this does not necessarily mean that the soldiers were literally dressed in skins. It has been suggested that the men were as fearless and strong as bears, or even that they acted as *berserkers* in battle being mad or furious (*berserkerang*) (Price 2002, 364, 366–378; Gräslund 2006, 125; Back Danielsson 2007, 42–43; Hedeager 2011, 93–95). However, a short cape made of bearskin, called a *sieppuri* in Finnish, is known from historical Sámi populations (Schwindt 1893, 145; Sirelius 1912, 47–52; Itkonen 1948, 339). The remains of this kind of garment may also have been identified in an 11th century female grave in Luistari, Finland (Kirkinen et al. 2020). These examples suggest that garments made of bear pelts may have been used earlier, too.

Remains of Iron Age fur garments are scanty and hard to interpret, since the skin material itself (collagen) does not usually survive. Hair (keratin) survives better, but without clear textile structures such as seams and stitching, it is difficult to interpret them as garments. For example, hare fur with sinew thread has been identified in the Enebø burial, but the purpose of the item is unknown (Raknes Pedersen 1982, 80). Even if the fur material is rich, interpretation of the function of pelts has been difficult. In the Högom grave (Nockert 1991, 31, 106–107), hairs of bear,

reindeer/roe deer, beaver, marten, sable, polecat, pinniped, or muskrat were found under and around the body. Only beaver fur was suggested to have had a clothing function as a cap from its location around the head area of the body; the rest of the furs were interpreted as pelt remains used for furnishing the burial (Nockert 1991, 36).

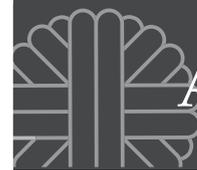
Dark, fine fur material (sample 17) from the VAM private collection was not easy to define because of the fragmentary nature of the hairs. The hairs originated from a Mustelidae sp. (for example, pine marten, sable and stoat), which are difficult to determine by species. The fur sample contained not only dark, soft fibres, but also the light brown hairs of a bear. This was probably contamination, since the dark fur was in direct contact with the bearskin fragment. Possible Mustelidae hairs were found in sample 14 too, attached to sheep wool yarn, but without other hair finds from the same context, their identification was not possible, and their role in clothing remains unresolved.

Mustelidae furs have been exploited especially for linings, trimmings, and collars, as well as for pouches and fur-lined sheaths and scabbards (Ågren 1995; Rast-Eicher 2016, 181; Kirkinen 2019). In the Migration Period female burial from Sande, small pieces of possible marten fur had survived underneath the clasp on the right arm side (Vedeler et al. 2018, 20). The fur was interpreted as a stola or fur lining of a cloak rather than a blanket (Vedeler et al. 2018, 21).

### Moulds

In archaeological research, identification of moulds, bacteria and other microorganisms has been marginal (Ivanova and Marfenina 2015); in forensic science, the use of mycological evidence has become increasingly common (Tranchida et al. 2021). Since different species thrive in different microclimates, it could be possible to discover the time of year of the burial and what environmental processes (such as long frost or water flow) it has undergone (Lipkin et al. 2021). Microorganisms can also indicate conditions during the excavation, storage in museums or non-museum conditions, and the state of conservation. Some of these are health risks. Although it was not possible to explain in detail all the findings, their documentation was relevant for archaeological research in the future.

Several 0.3 µm long rod-shaped particles were found on a bear hair (sample 16) (fig. 5). These were interpreted as bacteria, possibly *Bacillus mesentericus*, *B. cereus* or *B. subtilis*, that are common in soil (Hearle et al. 1998, 397). On the horsehair (sample 10b), SEM imaging revealed spherical particles that were 3 µm



in diameter. These were most likely smut fungus teliospores from *Ustilago* or *Tilletia* genus (Sánchez-Elordi et al. 2016). Smut is a plant disease, and probably the hairs were contaminated by spores spread in the air either in the burial context or afterwards.

In addition, the Snartemo bear furs had suffered mould attacks (fig. 5). In sample 15 and 16, the most often detected mould species are *Aspergillus* and *Penicillium* species (Hearle et al. 1998, 397). *Aspergillus* has round or ellipse-shaped conidia while *Penicillium* moulds have fan-shaped conidia at the end of hyphae. In the references, the fan-like structures were often broken, with only short phialide at the end of hyphae. Possibly, both mould species were in sample 15. Other evidence of mould attack was unidentified amoeba-like round and flat objects, 1–2 x 2–3 µm in size, and unidentified lenticular-shaped spores, 1 x 1.5 µm in size, forming groups with same-sized granules of elliptical form and uneven surfaces.

### Conclusions

The microanalysis methods (TLM, SEM, SEM-EDX, TEM, UHPLC-PDA) used on the textile materials of the Snartemo V burial brought new information that can be applied to the reproduction of Migration Period-style yarns and fabrics. The chieftain was resting under a blanket that had dark green and light-coloured yarns. He had blue legwear and a dark, blueish-green tunic. He had another bright red tunic or upper body garment, too. This was bordered with a tablet-woven band, woven with a dark, naturally pigmented weft, shiny horsehair wefts, and a green warp. His cloak was woven with green and reddish-brownish yarns. When new, the wide, geometrically-patterned band had a striking appearance, woven with white, naturally black and blue warps with red soumak stripes. It was possibly sewn to a fabric as a border instead of serving as a baldric as previously suggested.

It became clear that microinvasive sampling can be very fruitful and bring a lot of new information. In the Snartemo burial V, dyed textiles were not a rarity: of 13 samples, 11 contained plant dyes. Moreover, it was proven that Modocoll treatment is not a problem for the UHPLC analysis of textiles and adequate sampling for dye analysis and wool morphology studies can be done by utilising the edges of the fragments.

The different colourants showed that the dyers of these textiles were able to perform two different dyeing techniques, mordant and vat dyeing, and that they had knowledge of over dyeing and mordanting. Colourful yarns were used as a decorative element in the tablet-woven bands, to create textured twill with differently coloured warp and weft and to weave monochrome

fabrics. Both white and pigmented wools were used, either dyed or undyed, which increased the amount of available colour tones. The detected colourants, dyer's madder, woad and weld, were not from local sources, but transported to Iron Age Norway either as dyestuffs or as dyed yarns or textiles. Along with imported dyes, local bedstraws and yellow yielding plants were probably utilised too.

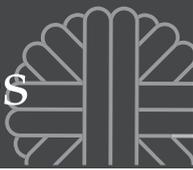
Bear and Mustelidae species fur were interpreted as indicating the use of pelts as wrapping, as well as furnishing of the Snartemo V burial. It was not possible to exclude the possibility that furs were part of the chieftain's clothing. Systematic fibre research would be helpful in fully understanding the role of the pelts and furs of this burial. The detected micro-organisms indicate inadequate storage conditions, but they also bring information about burial conditions and time. This is an area that would be useful to study further in archaeological textile research.

### Acknowledgements

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### References

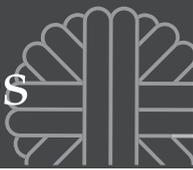
- Appleyard, H.M. (1978) *Guide to the identification of animal fibers*. Leeds: Wira.
- Asquith, R. S and Brooke, E. (1968) Yellowing of Wool Keratin on Exposure to Ultraviolet Radiation. *Journal of the Society of Dyers and Colourists* 84(3), 159–165.
- Ågren, T. (1995) Fur in Birka: an Examination of Hair Residue on Penannular Brooches. *Laboratio Arkeologi* 8, 50–58.
- Back Danielsson, I.-M. (2007) *Masking Moments. The Transitions of Bodies and Beings in Late Iron Age Scandinavia*. Doctoral dissertation. Stockholm: Department of Archaeology and Classical Studies, University of Stockholm.
- Balfour-Paul, J. (2011) *Indigo. Egyptian Mummies to Blue Jeans*. London: The British Museum Press.
- Bender Jørgensen, L. (1986) *Förhistoriske textiler i Skandinavien. Prehistoric Scandinavian Textiles*. Nordiske Fortisminder series B, volume 9. Copenhagen: Det kgl. nordiske Oldskriftselskab.
- Bender Jørgensen, L. (2003) Krigerdragten i folkevandringstiden. In P. Rolfsen and F. A. Stylegar (eds), *Snartemofunnene i nytt lys*. University Museum of Cultural Heritage, Occasional Papers 2. Oslo: Universitetes kulturhistoriske museer, 53–79.
- Bender Jørgensen, L. and Walton, P. (1986) Dyes and Fleece Types in Prehistoric Textiles from Scandinavia and



- Germany. *Journal of Danish Archaeology* 5, 177–188.
- Brandt, L. Ø., Schmidt, A. L., Mannering, U., Sarret, M., Kelstrup, C. D., Olsen, J. V. and Cappellini, E. (2014) Species Identification of Archaeological Skin Objects from Danish Bogs: Comparison between Mass Spectrometry-Based Peptide Sequencing and Microscopy-Based Methods. *PlosOne* 9(9), 1–10.
- Brax, E.K. (1951) *Suomalaisen villain käyttöarvosta kutomateollisuudelle. Arvosteltuna sen rakenteellisten ja fysikaalisten ominaisuuksien perusteella. Value of Finnish wool for Weaving Industry*. Unpublished Doctoral dissertation. Helsinki: Helsinki University of Technology.
- Bruselius Scharff, A. (2018) The Assessment of Natural Pigmentation in Archaeological Wool. In M. Bravermanová, H. Březinová and J. Malcolm-Davies (eds), *NESAT XIII. North European Symposium for Archaeological Textiles XI*, 22–26 May 2017 in Liberec. Prague: Technical University of Liberec and Institute of Archaeology of the CAS, 235–242.
- Bruselius Scharff, A. and Jørgensen, L. B. (2017) Evaluating transmission electron microscopy as a method for assessing the condition of archaeological wool. In J. Brigland (ed), *ICOM-CC 18th Triennial Conference: Linking Past and Future*. Copenhagen: International Council of Museums, 1–8.
- Cardon, D. (2007) *Natural Dyes. Sources, Tradition, Technology and Science*. London: Archetype Publications.
- Dean, J. (1999) *Wild colour. The Complete Guide to Making and Using Natural Dyes*. New York: Watson Guptil publications.
- Demant, I., Frandsen, L. B., Ræder Knudsen, L., Lorange, T., Bruselius Scharff, A., Vanden Berghe, I., Skals, I., Lund Hansen, U. and Mannering, U. (2018) Lønne Hede – an Early Roman Iron Age burial site with well-preserved textiles. In Römisch-Germanische Kommission des Deutschen archäologischen Instituts (ed), *Bericht der Römisch-Germanischen Kommission, Band 99*. Berlin: Gebr. Mann Verlag, 205–293.
- Grimm, O. (2013) Bear-skins in northern European burials and some remarks on other bear-related furnishings in the north and middle of Europe in the 1st millennium AD. In O. Grimm and U. Schmölcke (eds), *Hunting in northern Europe until 1500 AD. Old traditions and regional developments, continental sources and continental influences*. Neumünster: Wachholtz Verlag, 277–296.
- Geijer, A., Boström, H. and Axelsson, H. (1961) Modocoll som prepareringsmedel för textilier. *Svenska museer* 1, 11–14.
- Gräslund, A.-S. (2006) Wolves, serpents, and birds. Their symbolic meaning in Old Norse belief. In A. Andrén, K. Jennbert and C. Raudvere (eds), *Old Norse Religion in Long-term Perspectives: Origins, Changes, and Interactions. An International Conference in Lund, Sweden, June 3–7, 2004*. Vägar till Midgård 8. Lund: Nordic Academic Press, 124–129.
- Halvorsen, S. (2012) Norway. In M. Gleba and U. Mannering (eds), *Textiles and textile production in Europe – From Prehistory to AD 400*. Ancient Textiles Series 11. Orford: Oxbow Books, 275–290.
- Hearle, J. W. S., Lomas, B. and Cooke, W. D. (1998) *Atlas of Fibre Fracture and Damage to Textiles*. Cambridge: Elsevier Science & Technology.
- Hedeager, L. (2011) *Iron Age Myth and Materiality. An Archaeology of Scandinavia AD 400–1000*. London and New York: Routledge.
- Hofenk de Graaff, J., Roelofs, W. G. T. and van Bommel, M. R. (2004) *The Colourful Past: Origins, Chemistry and Identification of Natural Dyestuffs*. Riggisberg: Abegg-Stiftung and London: Archetype Publ.
- Hofmann-de Keijzer, R., van Bommel, M. R. and Joosten, I. (2005) Dyestuff and element analysis on Textiles from the prehistoric Salt-mines of Hallstatt. In P. Bichler, K. Grömer, R. Hofmann-de Keijzer, A. Kern and H. Reschreiter (eds), *Hallstatt Textiles. Technical Analysis, Scientific Investigation and Experiment on Iron Age Textiles*. BAR International Series 1351. Archaeopress: Oxford, 91–96.
- Hofmann-de Keijzer, R., van Bommel, M. R., Joosten, I., Hartl, A., Proaño-Gaibor A. N., Heiss, A. G., Kralofsky, R., Erlach, R. and de Goot, S. (2013) The colours and dyeing of prehistoric textiles from the salt mines of Hallstatt. In K. Grömer, A. Kern, H. Reschreiter and H. Rösel-Mautendorfer (eds), *Textiles from Hallstatt. Weaving Culture in Bronze Age and Iron Age Salt Mines*. Budapest: Archaeolingua, 136–162.
- Hougen, B. (1935) *Snartemo funnene*. Studier i folkevandringstidens ornamentik og tekstilhistorie. Norske oldfunn VII. Oslo: Universitetets oldsaksamling.
- Itkonen, T. (1948) *Suomen lappalaiset vuoteen 1945. Part 1*. Porvoo: WSOY.
- Ivanova, A. and Marfenina, O. (2015) Soil fungal communities as bioindicators of ancient human impacts in medieval settlements in different geographic regions of Russia and southwestern Kazakhstan. *Quaternary International* 365, 212–222.
- Kalayci, E., Avinc, O. and Yavas, A. (2019) Usage of horse hair as a textile fiber and evaluation of color properties. *Annals of the University of Oradea: Fascicle of Textiles, Leatherwork* XX(2), 57–62.
- Kirkinen, T. (2019) *Between skins – animal skins in the Iron Age and historical burials in eastern Fennoscandia*. PhD thesis, University of Helsinki. Helsinki: Unigrafia.
- Kirkinen, T., Vajanto, K. and Björklund, S. (2020) Animal hair evidence in an 11th century female grave in Luistari, Finland. *Archaeological Textiles Review* 62,

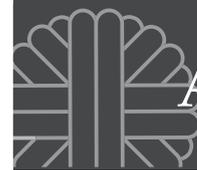


- 109–125.
- Lipkin, S., Ruhl, E., Vajanto, K., Tranberg, A. and Suomela, J. A. (2021) Textiles: Decay and Preservation in Seventeenth to Nineteenth-Century Burials in Finland. *Historical Archaeology* 55, 49–64.
- Nockert, M. (1991) *The Högom find and other Migration period textiles and costumes in Scandinavia*. Archaeology and environment 9, Högom part II. Umeå: Riksantikvarieämbete.
- Nordquist, J. and Ørsnes, D. (1971) Pige i blått. *Skalk* 1971(3), 9–15.
- Peacock, E. E. (1992) Drying archeological textiles. In L. Bender Jørgensen and E. Munksgaard (eds), *Tidens tand nr. 5. Archaeological Textiles in Northern Europe – Report from the 4th NESAT symposium, 1st–5th May 1990* vol. 5. Copenhagen: Konservatorskolen, Det Kongelige Danske Kunstakademi, 197–207.
- Pluskowski, A. (2006) Harnessing the hunger. Religious appropriations of animal predation in early medieval Scandinavia. In A. Andrén, K. Jennbert and C. Raudvere (eds), *Old Norse Religion in Long-term Perspectives: Origins, Changes, and Interactions. An International Conference in Lund, Sweden, 3–7 June 2004*. Vägar till Midgård 8. Lund: Nordic Academic Press, 119–123.
- Price, N. (2002) *The Viking Way. Religion and War in the Late Iron Age Scandinavia*. Aun 31. Uppsala: Uppsala University.
- Raknes Pedersen, I. (1982) The Analyses of the Textiles from Enebø-Eide, Globben Norway. In L. Bender Jørgensen and K. Tidow (eds), *Textilsymposium Neumünster, Archäologische Textilfunde. 6.5.–8.5.1981*. Neumünster: Textilmuseum Neumünster, 74–80.
- Raknes Pedersen, I. (1988) The Analysis of the Textiles from Blindheim, Giske. In L. Bender Jørgensen and E. Munksgaard (eds), *Archaeological Textiles. Report from the 2nd NESAT symposium 1.–4.5.1984*. Arkæologiske skrifter 2. Copenhagen: University of Copenhagen, 116–125.
- Rast-Eicher, A. (2016) *Fibres. Microscopy of Archaeological Textiles and Furs*. Budapest: Archaeolingua.
- Ringgaard, M. (2010) *To par strixstrømper oc en nattrøie naccarat: Filtede og strikkede tekstiler fra omkring år 1700, fundet i Københavnske byudgravninger – og sammenhænge mellem tekstilers farve og bevaring*. Doctoral dissertation. Copenhagen: University of Copenhagen.
- Rolfen, P. (2003) Snartemosverdet – kopier og NS-propaganda. In P. Rolfen and F. A. Stylegar (eds), *Snartemofunnene i nytt lys*. University Museum of Cultural Heritage, Occasional Papers 2. Oslo: Universitetes kulturhistoriske museer, 81–131.
- Sánchez-Elordi, E., Vicente-Manzanares, M., Diaz, E., Legaz, M. E and Vicente, C. (2016) Plant-pathogen Interactions: Sugarcane Glycoproteins Induce Chemotaxis of Smut Teliospores by Cyclic Contraction and Relaxation of the Cytoskeleton. *South African journal of botany* 105, 66–78.
- Schmidt, A. L., Gilbert, M. T. P., Cappellini, E. and Velgaard Olsen, J. (2011) Identification of animal species in skin clothing from museum collections. In ICOM-CC 16th Triennial Conference: *Triennial Conference in Lisbon, The Role of Conservation*. Lisbon, 19–23 September 2011, 1–8.
- Schwindt, T. (1893) *Tietoja Karjalan rautakaudesta ja sitä seuraavilta ajoilta Käkisalmen kihlakunnan alalta saatujen löytöjen mukaan*. Suomen Muinaismuistoyhdistyksen Aikakauskirja 13.
- Serrano, A., van Bommel, M. R. and Hallet, J. (2013) Evaluation between ultrahigh pressure liquid chromatography and high-performance liquid chromatography analytical methods for characterizing natural dyestuffs. *Journal of Chromatography A* 1318, 102–111.
- Sirelius, U. T. (1912) Über einige Traggeräte und Umschlagetücher bei den finnisch-ugrischen Völkern. *Suomen Muinaismuistoyhdistyksen Aikakauskirja XXVI*, 29–58.
- Skals, I., Gleba, M., Taube, M. and Mannering, U. (2018) Wool textiles and archaeometry: testing reliability of archaeological wool fibre diameter measurements. *Danish Journal of Archaeology* 7(2), 161–179.
- Ström, Å. (1980) Björnfällar och Oden-religion. *Fornvännen* 75(4), 266–270.
- Taylor, G. W. (1983) Detection and identification of dyes on Anglo-Scandinavian textiles. *Studies in Conservation* 28, 153–160.
- Teerink, B. (2003) *Hair of West-European Mammals: Atlas and Identification Key*. Cambridge: Cambridge University Press.
- Thingnæs, S. (2007) *I enden av en tråd – om textilhåndverk i folkevandringstid*. Hovedfagsoppgave i arkeologi. Oslo: Det humanistiske fakultetet, University of Oslo.
- Timar Balázs, Á. and Eastop, D. (1999) *Chemical principles of textile conservation*. London and New York: Routledge.
- Tóth, M. (2017) *Hair and Fur Atlas of Central European Mammals*. Nagykovácsi: Pars Ltd.
- Tranchida, M. C., Pelizza, S. A. and Eliades, L. A. (2021) The use of fungi in forensic science, a brief overview. *Canadian Society of Forensic Science Journal* 54(1), 34–46.
- Vajanto, K. (2015) *Dyes and dyeing methods in Late Iron Age Finland*. Doctoral dissertation, archaeology. Helsinki: University of Helsinki.
- Vanden Berghe, I., Gleba, M. and Mannering, U. (2009) Towards the identification of dyestuffs in early Iron Age Scandinavian peat bog textiles. *Journal of Archaeological Science* 16, 1910–1921.
- Vanden Berghe, I. and Möller Wiering, S. (2013) Dye



- Analyses on the "Prachtmantel" from the Thorsberg. In J. Banck-Burgess and C. Nübold 2013 (eds), *The North European Symposium for Archaeological Textiles XI, held in Esslingen am Neckar in 10–13 May 2011*, 101–105. Rahden/Westf.: Verlag Marie Leidorf GmbH.
- Van Bommel, M. R. (2018) *Dyestuff analysis from samples of the Snartemo textile, Vest-Agder museum, Norway*. University of Amsterdam, Unpublished analysis report.
- Vedeler, M., Kristoffersen S. and Rødstas, I. M. (2018) Dressed for Ritual, Dressed for Life. A Migration Period Grave from Sande in Norway. *Medieval Archaeology* 62(1), 1–27.
- Von Bergen W. (1961) *Wool Handbook I*. New York: Textile Book Publishers Inc.
- Walton, P. (1988a) Dyes and wools in Iron Age textiles from Norway and Denmark. *Journal of Danish Archaeology* 7, 144–158.
- Walton, P. (1988b) Dyes of the Viking Age: a summary of recent work. *Dyes in History and Archaeology* 7, 14–20.
- Walton Rogers, P. (1997) Analysis of Samples from Lønne Hede in Denmark. *Archaeological Textiles Newsletter*, Spring issue, 14–16.
- Walton Rogers, P. (2004) Fibres and dyes in Norse textiles. In E. Østergård (ed), *Woven into the Earth: Textiles from Norse Greenland*. Aarhus: Aarhus University Press, 79–92.

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Cary Karp and Anne Marie Decker

# Three objects catalogued as *vantsöm* in the collections of the Museum der Kulturen in Basel, Switzerland

## Abstract

The looped structure termed a slip stitch in the craft glossary of crochet can be produced both with a hook and an eyed needle. These implements are not equally amenable to working this structure into complex constructs such as the toe and heel of a sock. This article describes the examination of three objects that have been misidentified as nalbinding. Two of them are certain to have been crocheted and the third is highly likely also to instantiate that technique. The provenance of the objects is recorded as “Coptic Egyptian” on anecdotal evidence and without ascription of specific dates. If scientific dating were to establish that any of them approaches even the youngest age this might imply, the accepted date for the advent of crochet would require major revision.

**Key words:** Looped fabric structures, nalbinding, slip stitch crochet, provenance, museology, dating

## Introduction

The collections of the Museum der Kulturen in Basel, Switzerland, include three items made from looped yarn that are recorded as being of Egyptian origin. The catalogue records (unpublished but made available to the present authors at the museum) are headed “Aegypten, Koptisch, Fostat” with no indication of a date beyond that implied by the term Coptic. This was an accepted indicator of age at the time but has since been widely deprecated. Question marks appear with these attributions in the catalogue records for two of the objects: a small pouch with the catalogue number III 16702 and a child’s sock number III 16706. There is no indication of corresponding uncertainty in the record for a second child’s sock, number III 16705.

A description published in 1955 (detailed below) does associate specific dates with material originating in Fustat, at the location of what is now Old Cairo. It places a ceiling on the date of anything manufactured there to 1168 CE. However, artefacts of indeterminate later date that can only be set in relation to the time of their recovery, and made elsewhere, have been found at the site. The authors of that report therefore question the value of reference to Fustat as an indication of either

chronological or geographic origin in the absence of corroborating technical and stylistic evidence.

In the application of the system for classifying textile techniques developed in Basel – first sketched by Fritz Iklé (1935), then worked into a rigorous format by Kristin and Alfred Bühler-Oppenheim (1948), and brought to its present form by Annemarie Seiler-Baldinger (1973) – these three objects are categorised as *Vantsöm* (“mitten stitch” in Swedish). This term is now widely taken to be a synonym for what is referred to as “nalbinding” in anglophone discourse (Ger. *Nadelbinden*; Swe. *nålbindning*; lit. “needle binding”). However, in 1964 when the three objects were formally accessioned to the museum collections, the Basel classification system treated *vantsöm* as a subcategory of nalbinding, reserving it for the compound rather than simple stitch structures in that repertoire. The various labels applied to this craft merit further study, with emphasis on their polyglot nuance and derivation. The English terms used here, both above and in the remaining text, are followed by the corresponding German terms in the museum’s records.

The examination underlying the present report was



Fig. 1: Sock III 16706, displaying a range of structures commonly associated with crochet (Image: Cary Karp)

triggered by stylistic indications that *vantsöm* is not the appropriate classification for the stitch structure of any of the three items, nor is nalbinding. If so, the distinction between *vantsöm* and nalbinding would be relevant to a further review of how the terminology developed, but neither to the description of these specific objects nor the method of their production. This also highlights the need for the separate consideration of nomenclature, procedure, and structure that has become a basic principle in the systematic analysis of the often-fragmentary textile objects in museum collections.

#### Sock III 16706

The first object considered here is a child's sock (inventory number III 16706). Although catalogued as *vantsöm*, that attribution can be discounted on the basis of its visible details (fig. 1). The fabric includes structures that would not have been produced with a single eyed needle, which is the definitive implement used for all tool-based varieties of nalbinding, including those the Basel system recognises as *vantsöm*. The sock includes various crochet (*Häkeln*) stitches that are first attested in the craft literature in the 19th century. As implied by the name of that craft, its characteristic structures include elements that reflect the working of loops with a hook. The most complex of the structures seen in this sock is termed "double treble crochet" in the current UK glossary (*Doppelstäbchen*).

#### Pouch III 16702

The primary structure of the pouch (inventory number III 16702) (fig. 2) has a similarly fundamental position in the atlas of crochet stitches where it is now commonly termed a slip stitch (*Kettmasche* or *Kettenmasche*; current convention in the craft literature leaves "slip stitch" unhyphenated even when used adjectively as in "slip stitch crochet"). It is attested from the mid-18th century in Europe and remains in practice on a smaller scale in its eastern and northern regions (Karp 2020). Active traditions of unknown age are also found in northwest Africa (Ventura 2012) and central Asia (Ohrenstein 2011).

Unlike the structures in sock III 16706 that can only be labelled as crochet, a basic slip stitch can be produced using an eyed needle. Nonetheless, it has yet to be demonstrated that this implement is a practicable alternative to a crochet hook for the shaped construction details of a slip stitched sock, such as the toe and heel of sock III 16705 presented in the following section. It might be assumed that an eyed needle would be more readily applicable to the less complex pouch. However, although it is not certain how all of the stitching on its flap was produced, there are pivotal structural attributes in it that cannot have



Fig. 2: Pouch III 16702, displaying structures commonly associated with slip stitch crochet (Image: Cary Karp)

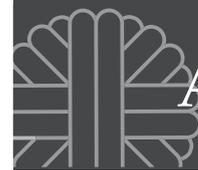


Fig. 3: Sock III 16705, again with the structures of slip stitch crochet, aggregated in cuff, toe, and heel designs that indicate the non-viability of an alternate nalbound production technique (Image: Anne Marie Decker)

been nalbound.

As will be discussed below, the two techniques work in opposite directions to produce a slip stitch structure. As it appears in the outer rows of the flap and across the opening of the pouch, the structure can easily have been crocheted beginning at the edge of the flap and worked outward. If nalbound, it would have been worked inward from the edge. This would encase the innermost loops of the border stitches in the fabric when working the flap and body. Since the orientation of a nalbound structure as it would appear in the flap is not reflected in the edge, the application of that technique is precluded. Additionally, both the pouch and the sock III 16705 display

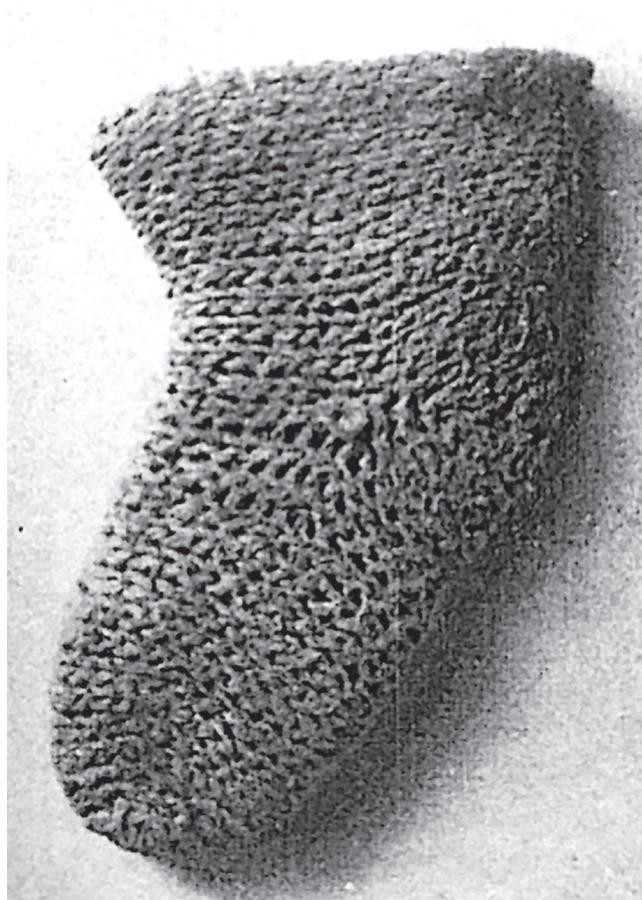
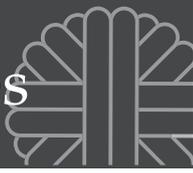


Fig. 4: Sock III 16705, photographed prior to 1955 (Image: unidentified photographer)

structural details that have not been observed in any other comparable nalbound objects regardless of their dating or provenance. The pouch is a non-noteworthy example of slip stitch crochet.

#### Sock III 16705

The slip stitch structure of pouch III 16702 is also seen in the other child's sock (inventory number III 16705), albeit with the faces of the fabric reversed (fig. 3). The exposed side of the sock corresponds to the inside of the pouch, which is visible on its open flap. It is possible to produce fabric of this basic structure with either face toward the worker. Additionally, there is nothing unusual about an object made with this structure being turned inside out subsequent to its manufacture. The first printed instructions for slip stitch crochet, published in France in 1785 (cited fully below), prescribe that method for fashioning a glove. In either case, the inside of sock III 16705 shows clear signs of wear and there is little doubt that the fabric was turned toward its present orientation before the



sock was last taken into use.

It is the one of the three objects that is unequivocally catalogued as “Coptic” *vantsöm* and has also been discussed most extensively in published texts. Although the basic fabric structure is correctly illustrated where it appears in the documents considered here, as with pouch III 16702, the reported production method is questionable. Similar uncertainty attaches to the unmodified term Coptic as used in the cited texts to designate an historical period. However, determining the precise date ranges intended by the respective authors is without bearing on the actual age of the objects. Specific (but unverified) dates are also indicated in documents cited below.

### The first published report

Sock III 16705 was described and illustrated prior to its accession, in the May 1955 instalment of a ten-part article titled *Nichtgewebte Textilien vor 1400* (Non-Woven Textiles Before 1400) by Regina Flury-von Bültzingslöwen and Edgar Lehmann (Flury-von Bültzingslöwen and Lehmann 1955). This included a photograph which can be compared directly with the preceding one (fig. 4).

The sock was acquired in Cairo by Alfred Bühler, the director of what was then the Museum für Völkerkunde in Basel, with six other pieces of ostensibly comparable footwear. They were all intended for donation to the museum but had not been formally transferred at the date of publication. The Flury-von Bültzingslöwen and Lehmann article explicitly gives a first preview description of those objects.

The information about their provenance would have originated with Bühler: “According to the statements of the dealers in Cairo, these pieces are supposed to be from Fustat” (Flury-von Bültzingslöwen and Lehmann 1955, 40). It is unclear who wrote the immediately following comments about that site:

“Fustat, in the southwest of modern Cairo, emerged from an Arabic encampment in 641 [CE]. The Egyptians themselves burned it fully to the ground in 1168 to prevent it from being seized by invading Crusaders. Archaeologists now regard it as the great ‘trash heap’ of Cairo, that is, the site where finds of all kinds of daily necessities from the Islamic centuries can be excavated from the earth” (Flury-von Bültzingslöwen and Lehmann 1955, 40).

This commentary ends with an exhortation to the textile industry to revisit Fustat physically and do as much as possible to rectify the stratigraphic record in preparation for further controlled digging. However, “the retrospective ordering of previous random finds has to follow technical and stylistic evidence”

(Flury-von Bültzingslöwen and Lehmann 1955, 40). (All translations in this article were done by the first-named author.) In the absence of such evidence, objects found there can only be dated by extrapolation from the time of their recovery. On the basis of the technical detail noted during the examination of the objects of present concern, they could have been retrieved from the “trash heap” at any time from the early-19th century until shortly before their sale to Bühler.

This renders reference to Fustat in itself useless as an indicator of origin in either geographic or chronological regards. That point is made in the Flury-von Bültzingslöwen and Lehmann article while discussing sock III 16705, which is the only one of the three objects investigated here that it also considers. The “Coptic” and Fustat chronological and provenance attributions were carried into the museum’s documentation system without indicating how they might have been weighed against other technical and stylistic evidence. The further analysis of sock III 16705 therefore requires the determination and assessment of such evidence before the ascribed nexus can be taken as anything other than anecdotal or, as also needed, its categorisation as *vantsöm* is confirmed or rejected.

The sock was accessioned to the museum’s collections during the last year of Bühler’s directorship (in 1964 as noted above) and recorded as a “Child’s sock, Egypt, Coptic, Fustat” (*Kindersöckchen, Aegypten, Koptisch, Fostat*). It is not clear how pouch III 16702 and sock III 16706 were acquired and came into the same registration sequence, although it is plausible that some degree of similarity had been noted as the accession queue was formed. Their dating is only presumed and their labelling as *vantsöm* has to be treated as a legacy annotation pending substantive corroboration. As has already been noted, the incorrectness of that attribution for sock III 16706 is obvious, and pouch III 16702 includes detail that cannot have been nalbound. This increases the care with which sock III 16705 needs to be scrutinised.

### Later documentation

The physical description of sock III 16705 in the article is: “Baby’s sock, 10 x 5 cm. The thread is left-twisted undyed plant fibre and is knotted at a few points. Loose binding in a variant of the otherwise usual *vantsöm*. Very well preserved” (Flury-von Bültzingslöwen and Lehmann 1955, 38–39). The length indicated on the museum’s catalogue card is 4 cm longer.

The measurements taken during the current examination match the dimensions recorded by the museum. However, the shape of the sock in the latter

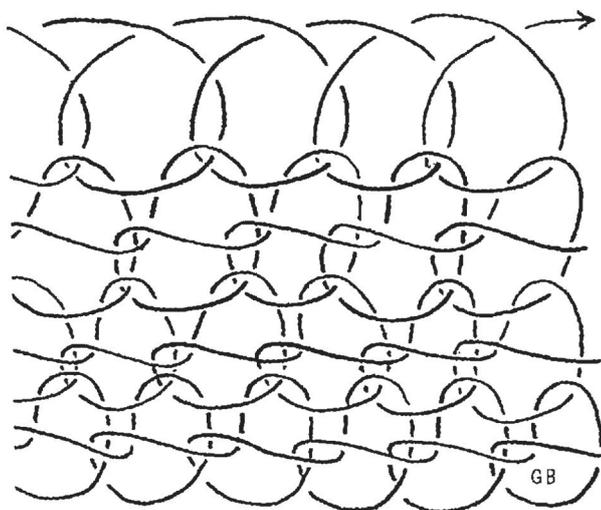
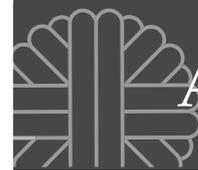


Fig. 5: The primary structure of sock III 16705, properly labelled a slip stitch regardless of the technique employed in its production, with the face of the fabric in figs. 3 and 4 oriented to match the face of the photographs (Image: Gudrun Böttcher)

photograph (fig. 3) differs somewhat from that seen in the earlier one (fig. 4). This is an effect of the sock having been opened during its examination. When flattened again afterwards it appeared as it does both in the earlier photograph and more recent ones taken by the museum, presumably after 1964. The differences in its recorded length are assumed to reflect a similar effect during previous handling.

Gudrun Böttcher, a prolific contributor to the procedural and structural documentation of nalbinding, describes the sock in an article published in 2004 (Böttcher 2004a, 177–179). This includes a number of drawings of looped fabric structures of which one is explicitly labelled “Häkeln: Kettenmaschen” (crochet: slip stitches). That drawing shows one of the four variant forms of the slip stitch most commonly seen in earlier crochet, with textbook accuracy. Irene Emery includes a photograph of the same variant, described as “plain crochet”, in *The Primary Structures of Fabric* (Emery 1966, 43). Annemarie Seiler-Baldinger presents a less common variant “Kettenmasche” in the 1991 edition of her *Systematik der Textilen Techniken* (Seiler-Baldinger 1991, 32) which Böttcher lists as a source in all of her articles noted here.

Böttcher cites the Flury-von Bültzingslöwen and Lehmann article as having called her attention to the material in Basel and says that sock III 16705 represents a form of nalbinding that she had only seen in one other object. This is a 19th century cap found in the

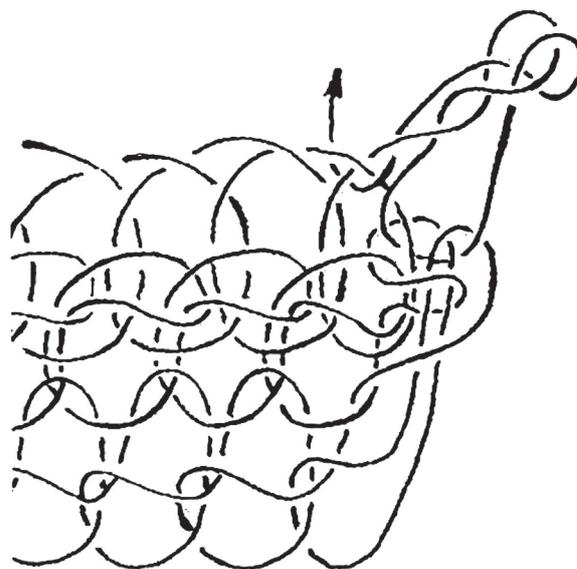


Fig. 6: The selvedge of the ear flap on a 19th-century Iranian slip stitch cap, with the yarn path drawn as required for nalbinding but consistently showing loops pulled through loops and no single strand drawn through a closed loop (Image: Gudrun Böttcher)

Netherlands that she records as closely resembling slip stitch crochet (Böttcher 1999, 125–136) – which for the reasons discussed here, it actually is – but concludes nonetheless that “since in my opinion techniques such as weaving, sprang, knitting, or crochet could immediately be excluded, I looked toward nalbinding” (*da meiner Ansicht nach Techniken wie Weben, Sprang, Stricken, oder Häkeln sofort auszuschließen waren, forschte ich in Richtung Nadelbindung*). She clarifies the difference with drawings of the same primary structure as produced by the two working techniques. The sock is not mentioned in the article from 1999, suggesting that Böttcher had not yet seen it when preparing that text. She later discusses both the sock and cap (Böttcher 2004b, 3–7) and includes two drawings of the primary fabric structure of the sock, seen from both sides (one shown in fig. 5). Except for the arrow, this is again a textbook illustration of the slip stitch structure. The same variant also appears in the description of the cap despite the *a priori* assertion of it being impossible to produce as crochet.

The form correctly presented as a crocheted slip stitch (Böttcher 2004a, 175) is also found in pouch III 16702 and sock III 16705. One plausible factor in the inconsistency of the analyses may be a lack of familiarity with the techniques of slip stitch crochet beyond the formation of its basic stitch. In consequence, evidence of procedures such as the slip stitch crocheting of a selvedge may easily have

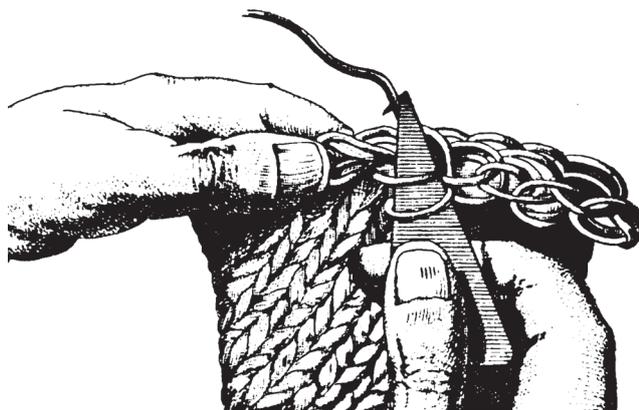
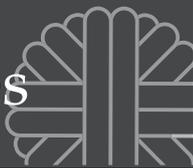


Fig. 7: Slip stitch crochet as illustrated by Roland de la Platière in the *Encyclopédie Méthodique* (1785)

gone unrecognised. Slip stitch crochet is no longer a common mode of fabric production and the basic slip stitch is normally used only to move the position of the hook in the fabric as invisibly as possible.

Many of Böttcher's subsequent drawings illustrate complex ways of using nalbinding to produce structures that can be crocheted with ease. A description of a 19th century cap from Iran with a classic slip stitch structure is provided with a demonstration of how it can be nalbound, adding interpretive detail to the drawings without indicating its extent (Böttcher 2006, 23–31). Crochet is again not considered as an alternative despite the depiction of construction details that are readily made as crochet but are otherwise alien to nalbinding. The intricate path taken by the needle emulates what would be a simple turning of the work when using a hook (fig. 6).

### The slip stitch

The oldest drawing of a slip stitch that has yet come to light was published in 1785 in what are also the earliest known illustrated instructions for any form of yarncraft (de la Platière 1785, 40). It is one of the two basic forms of that stitch applied to the production of a glove (fig. 7). The loop in a new stitch is worked through the front side of the corresponding stitch in the preceding round using a characteristic flat hook. The present-day glossary terms this form of the slip stitch “front loop only”, abbreviated to FLO. Since there is only one loop, the instruction is more correctly read as “front of the loop only”, or better still, replaced by an instruction to insert the hook into the loop from below. The instructions also note that the back of the loop (BLO; inserting the hook into the middle of the loop) can be used for a different effect, which is the form Böttcher illustrates as specific to crochet. Finally,



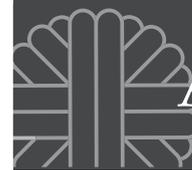
Fig. 8: Slip stitch crochet being worked by Othman Ribatallah, Morocco, 2012 (Image: Carol Ventura)

also as mentioned above, the face of the fabric shown in the working position is turned toward the inside of the finished glove. The only accurately drawn detail of the fabric is the stitch actively being worked.

The flat hook is a distinctive attribute of many regional schools of slip stitch crochet. A similar image appears in an explanatory text about its present-day practice in Morocco, noting that it includes both the FLO and BLO variants (Ventura 2012) (fig. 8). The form shown is the primary one found in sock III 16705. It is not known how far back this regional manifestation can be traced. Without suggesting an actual sequence of events, the technique can credibly have been brought to northwest Africa from the east with the Ottoman imperial forces or from the west with the French colonial forces. However, it can with equal credibility have been carried in the opposite directions.

It may not be purely coincidental that this path coincides with the one that knitting is believed to have followed as it was transmitted from its putative point of origin in or near the Nile Valley to both western and eastern Europe. Sorting this out is complicated further by an attested slip stitch tradition of unknown age using a stylised flat hook, in the Pamir Mountains, which are crossed by the Silk Road (Ohrenstein 2011). It similarly remains to be determined whether the Iranian cap noted above can be seen as further evidence of an eastward bridge.

It might be possible to regard the slip stitch as a universal construct, that is, something that can reasonably be developed by a community at any time and any place without external influence. Nothing precludes such a thing from being transmitted from one community to another. However, if parallel independent development is plausible, it is usually pointless to posit a transmission path unless there is



robust additional evidence of it.

The slip stitch has not been found to the same ubiquitous extent as have other looped structures that are widely regarded as universal. Further uncertainty is added by the possibility of two communities that developed slip stitch techniques entirely on their own subsequently coming into contact with each other, with sparse material evidence making it difficult to distinguish between transmission and coincidence. Tools such as hooks and eyed needles are certainly universal, as is the production of looped fabric (which includes knitting, nalbinding, and crochet). It is less clear that hooks with a flat broadly tapered shape appearing concurrently with the slip stitch at the various locations where they are used in tandem to make fabric, are a random phenomenon.

### General discussion and observations

The FLO and BLO forms of the slip stitch both have additional structural variants. If the legs of the loop do not cross over each other the stitch is “open”. When they do cross over each other the stitch is “closed”. In the procedural vocabulary of crochet, corresponding reference is made to the direction in which the yarn is wrapped around the hook. There is no equivalent terminology in the nalbinding glossary since the slip stitch is not part of the repertoire of that craft. Böttcher is virtually alone in having published descriptions of how slip stitched objects can be produced with an eyed needle. The one noteworthy exception is an analysis by Audrey Henshall of a pair of small child’s booties made in Scotland circa 1790 (Henshall

1952, 27–28) that have since also been demonstrated to be slip stitch crochet (Karp 2020). Both Böttcher and Henshall support their conclusions in graphic rather than narrative form and do not provide a seed terminology for discussing either structural detail or technical procedure.

All variants of the slip stitch can be produced with equal ease and fluid transition from one to the other if worked with a crochet hook. When using an eyed needle, the free end of the working thread and its entire length, are pulled through each new loop. The thread thus crosses over itself and forms stitches that are intrinsically closed. This difference between loop-led and end-led production methods makes, for example, open-stitch knitting easy with knitting needles but effectively impossible as nalbinding. The same does not apply to closed-stitch knit structures, which can be produced with either technique. Further comparison of nalbinding and knitting digresses from the primary topic of this article but is justified by a pervasive need for differentiating nalbound and knitted structures. The next segment of the discussion of loop-led techniques will therefore be instantiated by knitting.

Distinguishing between fabric produced as cross-knit nalbinding and as closed-stitch (also termed twisted or crossed-stitch) knitting requires the consideration of secondary details that can only be produced by one of the two methods. For example, a single end-led thread can be drawn fully through a closed loop, but a loop-led thread cannot, except when a sequence of loop-led stitches is deliberately ended by pulling the entire remaining working thread through the final

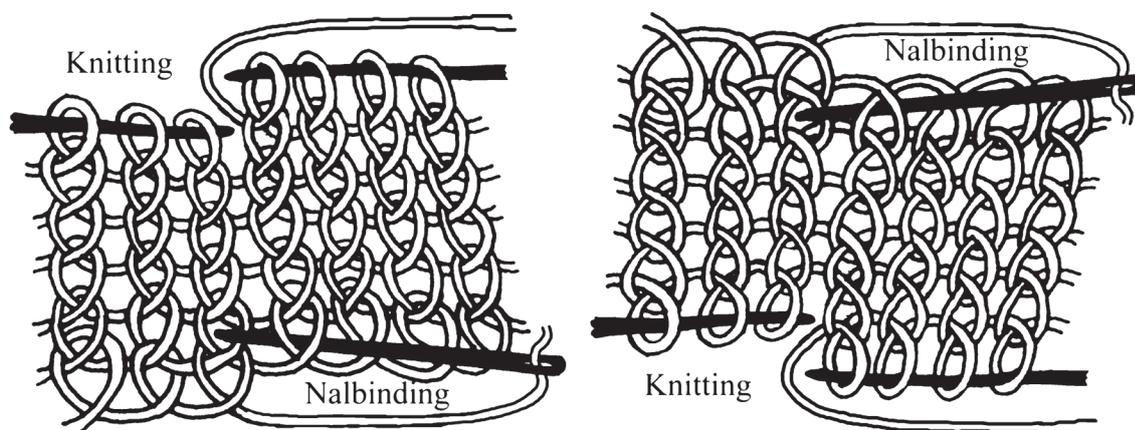
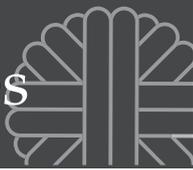


Fig. 9: The opposite directions in which knitting and nalbinding are worked shown in both orientations. The second loop of the top row on the right is a pierced loop in a medial position (Image: Anne Marie Decker)



loop. This means that if a pierced loop is found in a medial position in fabric that otherwise has a strictly cross-knit structure, the fabric can have been nalbound but not knitted (fig. 9).

Increases and decreases are also commonly used as differentiating criteria but they are composites of basic stitch structures and more properly regarded as construction details. In that context, it is essential to note that the loops produced by end-led techniques and loop-led techniques are orientated in opposite directions. The two drawings of identically structured fabric in fig. 9 are correctly positioned for knitting on the left, and for nalbinding on the right. The tool is held at the top of the fabric in both cases but if the knitted loops are seen as pointing upward, the nalbound loops point downward. This means that an increase in the one technique is a decrease in the other. It also means that, say, a sock knitted starting at the toe and ending at the cuff, would correspond to one that is nalbound starting at the cuff and ending at the toe.

The same conditions attach to fabric with a slip stitch structure. Returning to the main topic by substituting “crocheted” for “knitted” in the preceding paragraph, the discussion can proceed directly to a detailed consideration of the manner in which sock III 16705 was constructed. The same basic considerations apply to pouch III 16702 as will also be discussed further. Sock III 16706 can only be described as crochet. If sock III 16705 is seen as “toe up” slip stitch crochet there is nothing the least bit noteworthy about it. Had it initially been catalogued as such, the only thing that might have triggered subsequent comment is the reference to Coptic in its alleged dating. In any ensuing discussion, that would not have been taken to demonstrate the existence of crochet over a millennium before it can otherwise be attested, but rather that the attribution of its dating was incorrect.

If presented as nalbinding there is a substantial body of other socks of commensurate age with which it can be compared. However, neither the cuff-down working direction, the spiral afterthought heel, nor the slip stitch are seen in any other object in that corpus. That absence can be explained in part by the extreme complexity of shifting between the crossed FLO and open BLO variants of the slip stitch when leading the end of the working element with an eyed needle, and the ease with which that transition can be effectuated by leading one loop into another with a hook. This all suggests a need for particular caution before accepting that sock III 16705 was nalbound, to say nothing of it being taken as “Coptic” on the say-so of a dealer in Cairo who claimed that it came from Fustat.

## Conclusion

The radiocarbon dating of sock III 16705 can potentially inform efforts at clarifying the trajectory along which the production of slip stitch fabric may have been transmitted among the regions noted above. It can similarly provide a basis for recalibrating the chronology of that process, if it is determined actually to have occurred. There is further potential for demonstrating the craft of crochet to be older than has thus far been determined, even if (as is prudent to expect) it proves not to date from the late-first or early-second millennium CE, which is the youngest an object manufactured in Fustat could be. More importantly, it could establish northern Africa as a significant locus in the early development of crochet.

The categorisation of all three objects discussed here as *vantsöm* conceals them from the notice of researchers into the history of crochet and muddles the basis for the similar study of nalbinding. The Coptic association also confuses the otherwise attested chronology of the emergence of construction details such as spiral afterthought heels. Without prejudice to the determination of the method by which they were produced or the dating of their manufacture, both pouch III 16702 and sock III 16705 can and should be reclassified as having a slip stitch structure. There can be no similar discussion about sock III 16706. This is both structurally and technically crochet in its contemporary form, for which there is otherwise no evidence prior to the 19th century. There is no basis for maintaining that the other two objects were produced by any technique other than crochet but determining the date of their origin and archaeological provenance is of potentially pivotal historiographic significance.

## Acknowledgements

Particular gratitude is due to Isabella Bozsa, then the Acting Curator of the African Department, for her support prior to and during a visit to the museum to examine the objects and associated documentation reported here.

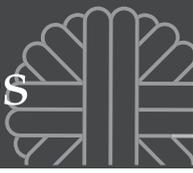
## Bibliography

- Böttcher, G. (1999) Nadelbindung – ‘Schlafmütze’ in Dokkum. *Experimentelle Archäologie Bilanz* 1998, 125–136.
- Böttcher, G. (2004a) Versuche und Ergebnisse bei der Rekonstruktion von Nadelbindungstextilien. *Report from the 8th North European Symposium for Archaeological Textiles*, 171–177.
- Böttcher, G. (2004b) Nadelbindung – Koptische Textilien in Basel und Trier. *Archaeological Textiles Newsletter* 29, 3–7.



- Böttcher, G. (2006) Kappe eines Derwiches in Nadelbindungstechnik. *Archaeological Textiles Newsletter* 42, 23–31.
- Bühler-Oppenheim, K. and Bühler-Oppenheim, A. (1948) *Grundlagen zur Systematik der gesamten textilen Techniken*. Basel: Museum für Völkerkunde.
- Emery, I. (1966) *The Primary Structures of Fabrics*. Washington D.C.: The Textile Museum.
- Flury-von Bültzingslöwen, R. and Lehmann, E. (1955) Nichtgewebte Textilien vor 1400. *Wirkerei- und Strickerei-Technik*. Bisingen: Manuscriptdr.
- Henshall, A. (1952) *Early Textiles Found in Scotland*. Edinburgh: Society of Antiquaries of Scotland.
- Iklé, F. (1935) *Primäre textile Techniken*. Basel: Gewerbemuseum.
- Karp, C. (2020) Evolution in Early Crochet. *Piecework* Winter 2020, 47–51.
- Ohrenstein, D. (2011) The Sock Artisans of De Pamiri. *Interweave Crochet Magazine* Winter 2011, 49–52.
- de la Platière, R. (1785) *Encyclopédie Méthodique; Manufactures, Arts, et Métiers* 1. Paris: Panckoucke.
- Seiler-Baldinger, A. (1973) *Systematik der Textilen Techniken*. Basel: Pharos Verlag.
- Seiler-Baldinger, A. (1991) *Systematik der Textilen Techniken*. Basel: Wepf & Co.
- Ventura, C. (2012) The Lesson, *Tapestry Crochet*, Summer 2012. <https://www.tapestrycrochet.com/blog/?p=2297> (accessed 26 July 2022)

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Jaana Riikonen and Juha Ruohonen

# Fulled red hose: a grave find from Ravattula Ristimäki in south west Finland dated to the early 13th century

## Abstract

Ristimäki (Cross Hill) inhumation cemetery in the Ravattula village in Kaarina in south west Finland dates to the Late Iron Age and Early Medieval Period (12th to 13th centuries). In addition to the cemetery, this site has the remains of the earliest known church in the country. In one woman's grave (41/2016), rich in textiles and 14C-dated likely to the early 13th century, the leg coverings of the deceased were interpreted as hose. In the grave, there were pieces of the leg parts of hose and their fastening braids. The fulled fabric was woven in twill probably from locally produced wool and dyed red with madder (*Rubia tinctorum* L.). Cultivated madder was an expensive imported product in Finland, and its use became more common only later in the Middle Ages. Red hose showed the influence of European medieval fashion, which is unique in Finnish textile material of this era.

## Keywords

Burial textiles, costume, leg coverings, hose, dye analyses, fibre analyses, Late Iron Age, Middle Ages, Finland

## Introduction

In south west Finland, Christianity became a more prominent religion around the year 1000 and the tradition of cremation burials changed to inhumation ones. The custom of burying individuals in full dress, occasionally with grave gifts, continued for 200 years. In the local chronology, the latest period of the Iron Age has been called the Crusade Period (about 1025 CE to 1200 CE). After this period, the Iron Age gave way to the Middle Ages. This transition period is of great interest in south west Finland because it sheds light on the Christianisation process of early society there (Purhonen 1998, 134; Hiekkänen 2010, 325–327, 340–341).

In Finland, the preservation of organic material such as bones and textiles is poor due to the acidity of soils. However, the preservation of animal fibres such as wool is better than vegetal fibres, especially in contact with metal, particularly those containing copper. Some wool garments were ornamented with small bronze spirals, and their oxides have prevented destructive

microbes from growing. Textiles have usually been found in graves with abundant furnishings, and these grave finds reveal details about the clothing of the wealthier members of society (Lehtosalo-Hilander 1984, 2–4; Arponen 2008).

The best points of reference for excavated Finnish burial textiles can be found in the areas of modern day Estonia and Latvia. As early as the Late Iron Age, these areas were inhabited by Finnic and Baltic peoples such as Estonians, Livs and Latgallians. Common features in these people's dress were bronze spiral and ring decorations (Lehtosalo-Hilander 1984, 60–61; Bender Jørgensen 1992, 100; Riikonen 2005, 31–32; Rammo and Ratas 2016; Žeiere 2017, 117, 122).

The majority of the Finnish Late Iron Age archaeological textile finds are from women's graves, where the findings are concentrated around the chest and waist areas. Towards the foot of the grave, there has seldom been enough metal to preserve organic material. Aprons decorated with bronze spirals reached the wearers' calves, and underneath the hems of the aprons, there

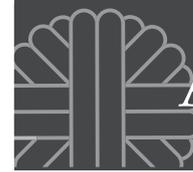


Fig. 1: Ravattula church and Ravattula Ristimäki cemetery is located near Turku, in south west Finland (Image: Juha Ruohonen)

are sometimes the remains of a shinbone and textile. However, there are very few remains of leg coverings or shoes (Tomanterä 1982, 43–44; Lehtosalo-Hilander 1984, 4–5; Hirviluoto 1987, 14).

This paper presents an archaeological leg covering from the early 13th century grave (number 41/2016) excavated in the Ravattula Ristimäki inhumation cemetery and studied with microscopy in the conservation laboratory. Fibre identification was made with a transmitted light microscope. Dye analyses were performed by chromatographic method. The grave was abundant in textiles and these fragments were the sources for a reconstruction of the clothing. The deceased's outer garment and the leg coverings demonstrated a new European fashion influence, which is unique in the Finnish archaeological textile material of the medieval era.

#### **The site: Ravattula Ristimäki**

Ristimäki cemetery in Ravattula, in the town of Kaarina in southwest Finland, is known for the oldest

known church remains in Finland (fig. 1). A wooden church was built at the site in the second half of the 12th century and it continued in use into the first half of the 13th century. The site, a low hillock of forest called Ristimäki (Cross Hill), is located next to the River Aurajoki, approximately four kilometres from the medieval cathedral of Turku (Åbo in Swedish), on the coast of the Baltic Sea. As part of a comprehensive study of this site by the Department of Archaeology at the University of Turku, part of the remains of a stone wall surrounding the area and 61 inhumations from a total of about 400 graves were excavated from 2010 to 2016 (Ruohonen 2017; 2019).

The earliest graves in Ravattula Ristimäki date from the beginning of the 12th century and the cemetery was in use until the first half of the 13th century, the Early Medieval Period (Ruohonen 2019) in local chronology. In Ristimäki, all the burials are classified as fully Christian or at least Christian-influenced based on the grave orientation and the overall lack of tools and weaponry, which were common grave gifts



in many other Late Iron Age sites (see Purhonen 1998, 133; Hiekkänen 2010, 340–341). Additionally, some individuals were buried fully dressed with metal items such as penannular brooches, belt buckles, knives, knife sheaths, and bronze spirals, whereas most of the excavated burials did not contain any artefacts, and in those cases, there was metal only in the iron nails of the coffins.

Textile fragments of both wool and vegetal fibre were found in 17 graves out of the 61 excavated in total, although most of the fragments were small and poorly preserved. Nevertheless, garments and accessories were identified in 12 burials (Kirkinen et al. 2020, 47). The female bodies were mainly clothed in peplos-style mantle dresses, well known from other crusade period cemeteries in south west Finland (Lehtosalo-Hilander 1984). The dress was complemented with an apron decorated with bronze spirals, and an undergarment made of vegetal fibre. The deceased was often covered with a shawl decorated with bronze spirals, and sometimes with headgear, and equipped with mittens made in a single needle looping technique.

Due to the acidic soil, bone was not preserved and most often there was only some tooth enamel or a discoloured soil layer suggesting the position of the deceased although human scalp hair was found in several of the Ristimäki women's graves (Kirkinen et al. 2020, 48–49).

#### Grave 41/2016

At the end of October 2016, grave 41 (TYA 933:853:1–26) was excavated north of the church. The find level of the body was at a depth of approximately 110 cm and it was largely covered by the remains of wool textiles. The bone material was very poorly preserved. The areas where the skull and feet were was only discernible by the difference in the colour of the soil and the number of roots compared to the surrounding earth.

The female in the grave measured 160 cm to 165 cm. She was buried in a 173 cm long and about 40 cm wide coffin with her arms folded on her waist. On her chest, there was a small penannular brooch made of silver (fig. 2). It was the only piece of jewellery found in the grave. The textile remains on the upper part of the body had survived in significantly worse condition than those towards the legs.

The AMS radiocarbon result (Ua-64904: 823+29) dated the piece of wool leg covering to the late 12th or 13th centuries. The calibrated (calibration curve Intcal20: Reimer et al. 2020) result with 68.2% probability gave the years 1210 to 1265 calCE and

with 95.4% probability the years 1170 to 1275 calCE (Bronk Ramsey 2005). Since the site was abandoned by the mid-13th century at the latest, it is possible to date the grave to the early 13th century.

The deceased was covered with a spiral decorated shawl but there was no evidence of any organic material underneath the furnishings. However, this does not necessarily mean that a lining or filling was completely absent from the coffin. The remnants of furs and feathers indicated the use of burial furnishings in many other Ristimäki graves (Kirkinen et al. 2020, 52–53). The pollen analysis revealed rye (*Secale*) pollen in the coffin (Pätsi 2019, 24, 29). This flowering rye reveals that the burial occurred in June.

#### Methodology

Grave 41/2016 was lifted as five blocks of soil (each about 40 x 30 cm) which comprised the area from the shoulders of the deceased to her calves. The surface

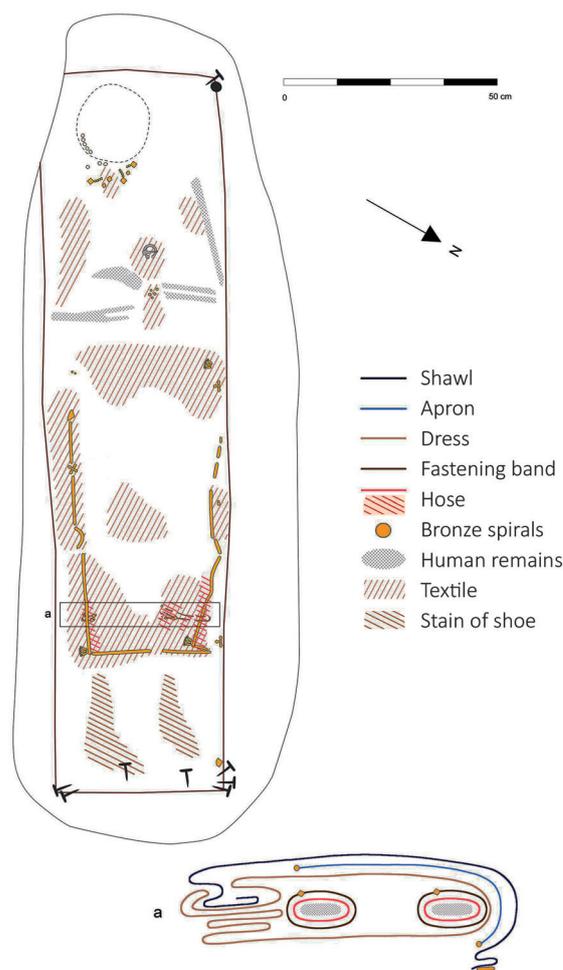
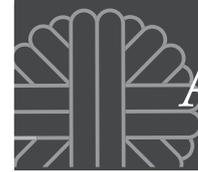


Fig. 2: Ravattula Ristimäki grave 41/2016 with a schematic cross section (Image: Siiri Tuomenoja and Jaana Riikonen)



of the block was moistened by sprinkling it with water. A thin plywood plate was pushed underneath and each block was wrapped in plastic before it was moved. The intact parts of the grave were X-rayed and frozen for future research.

The micro-stratigraphic excavation under a stereomicroscope took place in the conservation laboratory of the Museum Centre of Turku (*Turun museokeskus*) from 2017 to 2018. Sand and soil were removed with brushes, dental instruments, scalpels, and fine metal tweezers. Thin roots were growing through the folds of the fabric which looked like stitches. In some cases, they were cut with a scalpel and the folds of the fabric opened. The fabric pieces were straightened on plastic plates, another plate was set over them, and then they were dried slowly in a refrigerator. The wool textiles were not mineralised but when they dried, they were no longer elastic. The textiles became fragile, resembling old paper. Mechanical cleaning was the only conservation method used for the textiles.

The direction of the warp, binding, twist of the yarn, thread count, seams and other details of the textile were studied. The blocks were documented with digital photography and with 1:1 scale drawing on plastic sheets. All organic materials were sampled for identification. The excavated soil from the block, as well as soil samples taken in the field, were analysed for macrofossils and minuscule fibres. Samples for pollen analyses were taken from the find level of the blocks. Thread samples were taken from the textiles for fibre and dye analyses. The thread diameter was measured before the yarn was separated into fibres for the fibre analysis. Fibre identification was made with transmitted light microscopy. A total of 23 samples were collected for the chromatographic dye analysis performed by High Performance Liquid Chromatography and photo diode array detection system (HPLC-DAD).

## Results

The body was clad in a wool dress on which the preserved part of the hem is about 160 cm wide. In the measured areas, the dress is more than 70 cm long and reaches the calves. A tablet-woven band was found between the dress folds. Leg coverings fastened with braid were found under the dress hem. An apron decorated with bronze spiral tubes situated low on the body was missing its ties, or they were not preserved. Parts of a spiral-decorated diagonally plaited braid on the body's neck and right shoulder belonged to a headband of the type known from other south west Finnish graves

(Appelgren-Kivalo 1907, Tafel VII: 1, 2; X: 1a). A rectangular shawl about 150 cm in length covered the body from the shoulders to the feet. It was decorated with cross-shaped spiral ornaments and lined with a tubular tablet-woven band. A small silver penannular brooch located at the middle of the chest was broken, and two vegetal fibre tabby fragments a few millimetres in size were detected among the brooch pieces. The deceased probably wore a shirt made of plant fibre. The brooch was most likely fastened to a wool cloth, the function of which is still unknown.

All the fabric fragments found in the grave were made of wool and woven in 2/2 twill weave, apart from the tabby fragment. There are five different types of twill weaves, and they all have an S-plyed warp and a Z-spun weft (Karisto et al. 2020). These types of fabric are typical in Finland from the Late Iron Age to the Early Middle Ages (Bender Jørgensen 1992, 99, 140). The fabric density is 10–12 threads per cm in the warp and 8–10 threads per cm in the weft of the dress; about 14/8–10 threads per cm in the apron; 12–14/9–11 threads per cm in the shawl; and 12/10–12 threads per cm in the unknown wool twill textile. Tubular selvages were identified in the apron and shawl fabrics.

On the left side of the coffin, under the blue shawl and the blue apron (Vanden Berghe 2019, 25–26), there were several folds of fabric with the warp following the direction of the coffin. The cloth had four longitudinal flat-felled seams preserved, and the hem was probably made up of six fabric pieces of different widths (about 20–57 cm) sewn together. None of the pieces tapered upwards as is typically seen in medieval gowns with gores. Four hem edges had been turned onto the reverse side and hemmed, and simple starting borders fringed the other two pieces. Since the same fabric was also detected in the upper part of the grave, it was interpreted as a dress. The binding structure of the twill weave created a colour effect in the warp and weft: two light and two dark yarns alternate one after the other in the fabric. This type of fabric has been identified in only two other Finnish Iron Age burials situated a few kilometres apart along the River Aurajoki near Turku (Turku Kirkkomäki grave 1/1950, KM 12687:5; Turku Kurala Ristimäki grave VIII, KM 14349:99). The dress fabric in the Ravattula Ristimäki grave had been strengthened by darning near the hem edge, indicating that the dress had been worn. A fragment of a patterned tablet-woven band, 8 cm long, was most likely the waistband (Karisto et al. 2020, 6–8).



Fig. 3: Fulled twill wool and plaited tassel ends of the tablet-woven band on top of the right shin in Ristimäki grave 41/2016 (Image: Museum Centre of Turku/Riikka Saarinen)

#### *Fulled red fabric and tablet-woven bands*

The X-ray image taken from the block of soil around the legs of the deceased revealed bronze spiral tubes at the edges of the apron, a spiral decoration on the shawl, and smaller spiral decorations. Under the remains of the shawl and apron was the dress fabric with several seams, and under it, attention was first focused on the right shin of the deceased. Here, there was fulled wool fabric and on top of it two decorative, tasselled band ends (TYA 933:853:21) (fig. 3). The whole object was turned upside down and under the shin two similar fragments of the 6 mm wide tablet-woven band were preserved nearly one on top of the other (fig. 4). The band was tied around the leg approximately 8 cm above the hem of the apron and the dress. There was fabric around the leg both above and below the band. The largest surviving piece of fabric is approximately 5 cm wide and 12 cm long. In small pieces of the fulled fabric there are holes which were possibly made by stitches (fig. 5) (Riikonen 2019, 175–176).

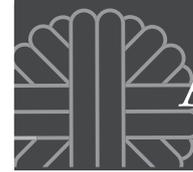
The leg covering is made in a 2/2 twill, but due to the fulling, the surface is fluffy, making the thread



Fig. 4: Fulled twill wool and patterned tablet-woven band under the right shin in Ristimäki grave 41/2016 (Image: Sue Salminen)

count impossible to measure. The decomposition of the textile and the small roots growing through the fabric also made the direction of the warp difficult to determine. It was possibly parallel to the shinbone. One of the yarns in the fulled fabric was S-ply of two z-spun strands, both with a tight twist and fluffy as is the case for carded wool yarn. This plied yarn is the warp, the weft was made of z-spun single yarn. The weft had an even higher twist and was thicker than the warp (Kirjavainen 2018, 6).

The fabric covering the left leg of the deceased (TYA 933:853:20) was not as well preserved as the right one but there was still an 18 cm long piece with what seemed like a diagonally cut top edge. A tablet-woven band that was only 3 mm wide went twice around the leg about 6 cm below the top edge (fig. 6). The fabric continued toward the foot for approximately 10 cm until it reached the spiral decorated hem of the apron. It is not known how far down the fabric would have continued below the apron hem. The distance between the hem of the apron and the feet of the deceased was about 20 cm (Riikonen 2019, 177).



The narrow tablet-woven bands are worked in three colours in the same pattern. A small, checked pattern was constructed with eight tablets using the threaded-in technique. A tubular selvedge woven with one tablet on both sides of this narrow band was recognised with support of the holes and impressions left by an inserted weft on both edges of the band. The ends of the bands were finished with two 20 mm long plaited tassels, which were elaborately decorated with bronze spirals (Karisto et al. 2020, 11; Karisto and Pasanen 2020, 74–97). After the fastening band was tied twice around the leg covering, the tassel ends of the band were arranged horizontally on the leg.

#### *Fibre analyses*

The results of the fibre analysis indicated that the quality of the wool in the textiles in grave 41/2016 fell between coarse and very coarse types. The yarns were spun from a wool type consisting of fine underwool and coarser fibres and guard hairs which may have originated from various individual sheep of local origin (Kirjavainen 2018). Both the wool and the resulting yarn had uneven features. Wool selecting,

sorting, teasing, and spinning was in the hands of capable spinners who produced durable yarn despite the uneven and variable fibre material available (see Kirjavainen and Riikonen 2007a, 171).

None of the yarn in the fulled fabric had dead or kemp fibres. The fibre diameters varied between 20  $\mu\text{m}$  and 100  $\mu\text{m}$ . However, despite the wide range, the quality of the yarn was quite even (fig. 7). The yarns were spun from coarse or very coarse wool. It seems that when the fleece was sorted and treated, the coarsest fibres (around 80  $\mu\text{m}$  to 100  $\mu\text{m}$  in diameter) were pulled out because the fabric was destined for fulling and coarse fibres would stick out from the fulled fabric surface. Compared to the other fabrics in the grave, the fibres in the leg coverings were the finest and best sorted. The cloth resembles medieval fulled fabrics (*sarka* in Finnish) but its fibre distribution is much finer compared to the medieval ones (Kirjavainen 2018, 6–7; Karisto et al. 2020, 10). The wool is most likely local and the origin of the legwear was defined as domestic production. However, the exact origin of the wool or the sheep breed cannot be confirmed without extensive isotope and aDNA analyses.



Fig. 5: Fragments of fulled twill fabric of the right leg covering in Ristimäki grave 41/2016 with what may be stitch holes in the largest (Image: Jaana Riikonen)



### *Dye analyses*

The fibres of the dress seemed to be reddish-brown under the transmitted-light microscope but, according to the dye analysis, this wool has its natural colour and the yarns were undyed (Vanden Berghe 2019, 24).

Traces of blue indigotin were found in the apron, shawl, and tablet-woven bands. Most probably, the source of dyestuff was woad (*Isatis tinctoria* L.) (Vanden Berghe 2019, 16, 25). Large-scale cultivation of woad flourished in central and western Europe from the 11th century onwards, and dried woad balls were imported to the Baltic Sea area, including Finland. The predominant colour in Iron Age textiles which have been analysed is blue (Peets 1998a, 307; 1998b, 289; Vajanto 2015, 56–58).

The yarn of the right leg band that looked blue contained indigotin; the yarn that looked yellow was undyed wool; and the brownish-red looking yarn had been dyed with madder (Vanden Berghe 2019, 25). Thus, the fastening band of the leg covering was blue, red, and white in colour.

The fibre sample of the fulled fabric had a clear red hue and the dye analysis showed that the yarn of the leg covering contained alizarin and purpurin, so it had been dyed with madder (*Rubia tinctorum* L.) (Vanden Berghe 2019, 17, 24). Cultivated madder gives a much richer shade of red than the madder species growing locally in the wild. Madder was professionally cultivated in central and western Europe and the red colour substance of the roots was a valuable product. Prehistoric textiles dyed with madder were very rare and most likely imported in Finland. Madder dyeing was not common until the Middle Ages (Kirjavainen 2002, 348, 350; Vajanto 2015, 51–52, 62).

### **Discussion**

#### *Foot and leg coverings in Late Iron Age Finland*

Wearing fabric or leather legwear comprising separate parts for the leg and the foot is an ancient custom in Europe and was part of the folk costume of certain peripheral regions until quite recently. Several northern peoples used softened hay or pieces of



Fig. 6: Remains of fulled fabric and tablet-woven band on top of the left shin in Ristimäki grave 41/2016 (Image: Jaana Riikonen)

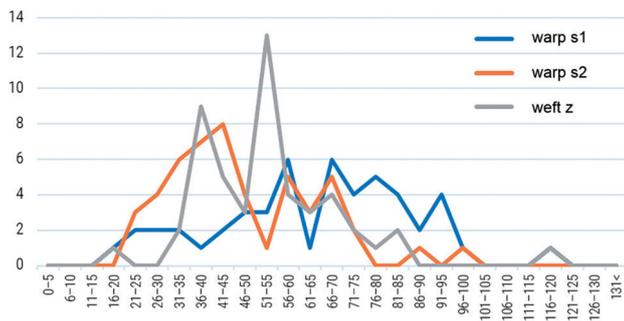


Fig. 7: The fibre distribution of the warp and weft yarns of the fulled red fabric. The Y-axis shows the number of measured fibres; the x-axis shows the cross section of fibres in micrometres ( $\mu\text{m} = 0.001 \text{ mm}$ ) (Image: Heini Kirjavainen)

fur with the hair turned inwards as protection and insulation inside their shoes during the winter (Sirelius 1916, 222–223; Itkonen 1948, 372–373; Kaukonen 1985, 94). However, although shoe hay may have been the choice for everyday use, the feet would probably have been covered differently for festive occasions or when preparing the deceased for the afterlife.

The remains of a leather shoe with one to three layers of fabric inside were found in south west Finland in the Raisio Ihala cemetery grave IV (KM 14676:158). The textile has not been identified more accurately, but it is thought to have been a “part of a foot wrap” (Itkonen 1960, 43; Hirviluoto 1987, 14). So far, no finds have been made in Finland that would confirm what the ancient Finns wore inside their shoes but foot wraps are known from the Liv graves in Latvia (Zariņa 1988, 102; Žeiere 2005, 79).

In later centuries, rectangular foot wraps were part of folk costume in Finland. In winter, they were made of wool, and in summer of linen. In the peripheral regions and as late as the 19th century, the legs were sometimes protected with leg coverings (*kalsut* in Finnish) that reached from ankle to knee. They were either made from a single piece of fabric or sewn into a straight tube and tied with ribbons (Sirelius 1916, 220–222; Kaukonen 1985, 94). A quite similar simple leg wrapper that dates to the Roman Iron Age has been found in Denmark: the bog finds in Søgaaards Mose included pieces of cloth that had been wrapped around the legs and tied below the knee and above the ankle with long cords (Hald 1980, 34–36, 335, figs. 19, 20).

Leg bindings were also part of ancient attire in Finland and the Baltic countries (Zariņa 1988, 102; Žeiere 2005, 79; 2017, 123, 127–128; Riikonen 2006, 208–209; 2019, 160–171, figs. 7–11; Rammo and Ratas 2016). Long, narrow, wool leg bindings, often of blue,

were wrapped spirally around the legs and tied with braids. Remains of leg bindings woven in broken twill have been identified in at least four Late Iron Age women’s graves in south west Finland (Turku Kirkkomäki grave 27, KM 27025:27203, Kirjavainen and Riikonen 2007b, 135, 137, table 1; Turku Kirkkomäki grave 31, KM 27196:31066, 31075, 31086, Riikonen 2019, 169–170; Halikko Rikala grave 47, KM 13298:141, Riikonen 2019, 166–167; the Ravattula Ristimäki grave 20/2016, TYA 993:214:29, Riikonen 2019, 168–169).

Most likely, socks made in a single needle looping technique were more common in Iron Age Finland than the one fragment of a looped sock dated to the 12th century suggests (Piikkiö Huttalanmäki, grave G2, TYA 388:57; Luoto 1989, 48–49, 51). The textile fragment lying on a piece of shinbone indicates that the looped sock reached at least halfway up the shin (Riikonen 2019, 159, figs. 1a–b).

#### *Ravattula Ristimäki red hose*

What kind of leg coverings were these red pieces of fulled fabric that were tied with narrow, colourful tablet-woven bands below the knee? They could not have been leg bindings: the remains next to the left leg clearly show that it was not a strip but a wider piece of fabric. In addition, the diagonal twill weave and the red dye do not support the leg-binding interpretation. If the fabric did not continue further down the leg towards the foot than what has been preserved, they could have been leg wrappers that covered the shin from the ankle to the knee, similar to the ones found in Denmark dating to the Roman Iron Age (Hald 1980, 34–36, 335, fig. 19, fig. 20) or the ones used in Finland as part of folk costume into the early 20th century (Sirelius 1916, 220–222; Kaukonen 1985, 94). However, these wrappers below the knee, and, to remain in place, they had to be tied around the ankle, or so that the band encompassed the length of the shin. A separate sock or cloth wrap was still needed to protect the foot.

The wool for the red fabric in Ristimäki grave 41/2016 was carefully chosen and sorted, and it was treated and woven in a characteristic Finnish 2/2 twill weave with plied warp and a single yarn weft (see Bender Jørgensen 1992, 99–100) for a specific purpose. The yarns or the fabric were dyed with a rare and expensive imported dye that required special knowledge. The finished fabric was fulled, which demanded even more work. The fabric was sewn into leg coverings that reached above the knee. Narrow patterned bands were woven and tied with elaborate tassels and bronze spirals to fasten them.



Fig. 8: Reconstruction of the Ristimäki hose and the fastening bands (Image: Jaana Riikonen)

All these features indicate that the legs of the deceased in the Ristimäki grave 41/2016 were not covered in a traditional way. Her dress is also different from a typical Late Iron Age woman's dress – a mantle dress made from one piece of fabric, with the warp crosswise in the grave (Lehtosalo-Hilander 1984, 54) – because it was sewn together from many fabric pieces and had a longitudinal warp. Altogether, they suggest that the leg coverings were also a new fashion, something that points forward to the Middle Ages: a hose sewn from red fabric with fastening bands (Riikonen 2019, 179).

Most likely, the deceased from the early 13th century grave wore sewn fabric hose that reached above the knee (fig. 8). Fulled fabric was easier to sew and could be made with narrower seams since it does not fray. Fulled wool is warm and absorbs moisture, so it would work well covering the foot inside the shoe. It is evident where the tablet-woven band is tied: the narrow part between the knee and the calf. The middle point of the band was

first placed in front of the shin, then the band ends were wrapped around the leg and tied together in front with the spiral decorated tassel ends arranged horizontally on the leg (Riikonen 2019, 180).

Currently, there are no known contemporary counterparts for the Ristimäki hose. Information about medieval foot and leg coverings in Finland is very scarce. No fragments recognisable as hose have been identified so far among 14th and 15th century textiles from urban archaeological contexts (pers. comm. Kirjavainen 2019). Interpreting sources from different eras is challenging because the differences between hose and trousers was vague for a long time, and the names given to pieces of clothing varied (Owen-Crocker 2004, 255–256). There are long leg coverings for men from 14th century London called hose. It can be deduced from manuscript illuminations that bias-cut legwear was already in use in England in the 11th or 12th centuries. The bias cutting allows for more elasticity to the garment but also uses more fabric. Men's long hose usually reached from foot to thigh and was attached to a belt with cords, whereas women's hose is thought to have reached from the foot to below the knee and was held in place with bands tied around the leg. The hose for both men and women had a seam at the back (Crowfoot et al. 1996, 185–187). A pair of long hose from the early 14th century was discovered in Sweden on a man found in Bocksten bog, and similar examples have been found in the medieval Herjolfsnes graves in Greenland (Nockert and Fredriksson 1997; Østergård 2004, 223).

The dye analyses have shown that from the dozens of yarn samples taken from women's graves in Ristimäki, the only ones identified as dyed with madder are the red fulled fabric and the red yarn in the tablet-woven band (Vanden Berghe 2019, 17). The late 14th century *vadmal* finds that were woven from local wool, dyed with madder, and found during the urban Turku archaeological excavations are proof of professional dyers working in the area at the time (Kirjavainen 2002, 349). The madder dyed textiles from Ristimäki were most likely woven from locally produced wool as the fibre analysis suggests, and the origin of the hose was defined as domestic production. The import of rare and expensive red dyestuff dates to the early 13th century in the Turku region (Kirjavainen and Riikonen 2007a, 172). The craft of dyeing with madder was later influenced by the medieval European tradition as well as the use of alum (Peets 1998b, 290; Kirjavainen 2002, 348, 350; Vajanto 2015, 51–52).



### Conclusion

The findings in Finnish Late Iron Age women's graves are usually concentrated around the chest and waist area, and only in a few cases have there been textile finds around the legs, the remains of a shoe, or fabric inside a shoe. The grave found in Ravattula Ristimäki brings significant new information to what is known about early leg coverings. The deceased woman was wearing hose made of red, fulled fabric, tied below the knees with narrow patterned tablet-woven bands. But not even in this case was there any textile to be found near the feet. Among other features, the quality and the red madder colour hint at fabric hose that was common later in the Middle Ages. The Ristimäki hose are the only examples so far found in the northern Baltic Sea Region, with

no currently known contemporary equivalents. In addition, the wool dress of the deceased, sewn from several differently sized fabric pieces, points towards an outfit that was at variance with the conventional Late Iron Age Finnish woman's outfit (fig. 9).

The grave dates to the early 13th century, which was a time of great societal and religious change in south west Finland. During this century, the influence of the kingdom of Sweden and the Catholic church grew, as did the connection to west European medieval culture. According to the archaeologist Markus Hiekonen, the formation of parishes began and the communities started to pay tithes during the 1220s or 1230s (Hiekkanen 2010, 343). At the same time, Finland's first episcopal see was moved to the banks of the River Aurajoki, 3 km from Ristimäki,



Fig. 9: Reconstruction of the Ravattula clothing: a small silver brooch was fastened to the likely undyed twill wool cloth, the purpose of which is still unknown. The reconstructed brooch was used to fasten the long, narrow head cloth. Red was used as an alternative (as shown in the reconstruction) to the natural grey wool fabric because the colour fits well with the red hose (Image: Anne-Mari Liira)

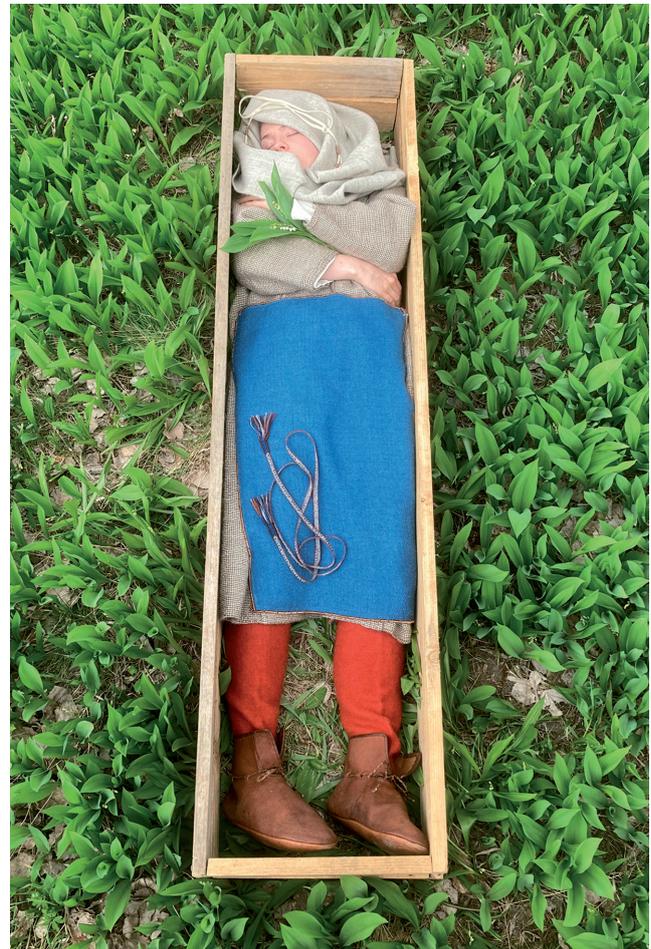
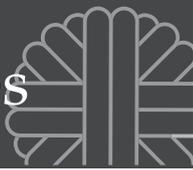


Fig. 10: The body in Ristimäki grave 41/2016 was probably dressed in an undergarment of plant fibre, a wool dress and a head cloth, and the red hose. The fastening bands of the hose did not show because they were under the dress hem. An apron was low on the body, apparently without ties. Before the coffin was closed, the body was also covered with a blue shawl (Image: Jaana Riikonen)



attracting more people and helping to spread new ideas and commodities. Later, around the year 1300, the city of Turku was founded closer to the mouth of the river and the cathedral was built there (Harjula et al. 2018, 319).

One novelty in 13th century Finland was western European female fashion. At first, only some features of dress were adopted by the wealthiest in society, such as the madder red dye and certain pieces of clothing. Gradually, the traditional Iron Age dress was completely abandoned and some of the old craft techniques forgotten. The transition was faster in south west Finland than in eastern Finland, where women still dressed in the style of the Viking Age outfits into the 13th and 14th centuries (Lehtosalo-Hilander 1984, 58–59).

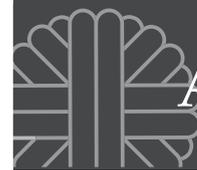
The woman in the Ristimäki grave 41/2016, who was buried beside the church wall, was covered with a blue apron and shawl decorated with bronze spiral ornaments, and she had a spiral-decorated headband. All the blue spiral-decorated textiles and tablet-woven bands preserved in the grave represent the old Iron Age tradition and crusade period fashion of a wealthy rural woman. But her tailored dress and red hose under it reveal the influence of new western European medieval fashion (fig. 10).

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### Bibliography

- Appelgren-Kivalo, Hj. (1907) *Suomalaisia pukuja myöhemmältä rautakaudelta – Finnische Trachten aus der jüngeren Eisenzeit*. Helsinki: Osakeyhtiö F. Tilgmann' in kirja- ja kivipaino.
- Arponen, A. (2008) Arkeologisen materiaalin konservointi. In P. Halinen, V. Immonen, M. Lavento, T. Mikkola, A. Siiriäinen and P. Uino (eds), *Johdatus arkeologiaan*. Gaudeamus, Helsinki, 225–235.
- Bender-Jørgensen, L. (1992) *North European textiles until AD 1000*. Aarhus: Aarhus University Press.
- Bronk Ramsey, C. (2005) OxCal 3.10 [https://c14.arch.ox.ac.uk/oc\_3\_10r.exe]
- Crowfoot, E., Pritchard, F. and Staniland, K. (1996) *Textiles and Clothing c. 1150–c.1450*. Medieval finds from Excavations in London 4. London: HMSO.
- Hald, M. (1980) *Ancient Danish Textiles from Bogs and Burials. A Comparative Study of Costume and Iron Age Textiles*. Copenhagen: The National Museum of Denmark.
- Harjula, J., Immonen, V., Ratilainen, T. and Salonen, K. (2018) Koroinen historian käännekohtassa. In J. Harjula, S. Hukantaival, V. Immonen, T. Ratilainen and K. Salonen (eds), *Koroinen. Suomen ensimmäinen kirkollinen keskus*. Turun Historiallinen Arkisto 71. Turku: Turun Historiallinen Yhdistys, 319–326.
- Hiekkanen, M. (2010) Burial practices in Finland from Bronze Age to the Early Middle Ages. In B. Nilsson (ed), *Från hedniskt till kristet. Förändringar i begravningsbruk och gravskick i Skandinavien c:a 800–1200*. Runica et mediaevalia, Opuscula 14. Stockholm: Sällskapet Runica et Mediaevalia, 271–379.
- Hirviluoto, A.-L. (1987) Raision emännän muinaispuku. *ABOA, Turun maakuntamuseo, vuosikirja* 49/1985, 8–17.
- Itkonen, K. (1960) Esihistoriallinen nahkajalkine Raisiosta. *Suomen Museo* LXVII, 40–43.
- Itkonen, T. I. (1948) *Suomen lappalaiset vuoteen 1945*. Ensimmäinen osa. Helsinki: Porvoo.
- Karisto, M., Kirjavainen, H., Riikonen, J. and Ruohonen, J. (2020) *Ravattula Costume. The Study of the Grave Find*. Turku: Suomen muinaistutkimuksen tuki ry.
- Karisto, M. and Pasanen, M. (2022) *Tablet-Woven Treasures. Archaeological Bands from the Finnish Iron Age*. Salakirjat: Vantaa.
- Kaukonen, T.-I. (1985) *Suomalaiset kansanpuvut ja kansallispuvut*. Helsinki: Porvoo.
- Kirjavainen, H. (2002) Medieval archaeological textiles in Turku. In G. Helmig, B. Scholkmann and M. Untermann (eds), *Centre, Region, Periphery: Medieval Europe Basel 2002 vol. 2*. 3rd International Conference of Medieval and Later Archaeology, Basel (Switzerland), 10–15 September 2002. Hertingen: Folio-Verlag, 346–351.
- Kirjavainen, H. (2019) Doctoral researcher, Archaeology/ University of Turku, Finland, personal communication, 2 September 2019.
- Kirjavainen, H. and Riikonen, J. (2007a) Changing textile crafts in Turku, SW Finland: from tradition to innovation. In J. Klápště and P. Sommer (eds), *Arts and Crafts in Medieval Rural Environment: RURALIA VI –Conference, Dobogókő, Hungary, 22–29 September 2005*. Turnhout: Brepols, 167–174.
- Kirjavainen, H. and Riikonen, J. (2007b) Some Finnish Archaeological Twill Weaves from the 11th to the 15th Century. In A. Rast-Eicher and R. Windler (eds), *Archäologische Textilfunde. Archaeological Textiles*. NESAT IX, Braunwald, 18–20 May 2005. Ennenda, 134–140.
- Kirkinen, T., Riikonen, J., Dove, C. and Ruohonen, J. (2020) The Identification and Use of Fur and Feathers Excavated from the Late Iron Age and Early Medieval (12th–13th centuries) Ravattula Ristimäki Cemetery in Kaarina, Southwest Finland. *Fennoscandia Archaeologica* XXXVII, 45–59.

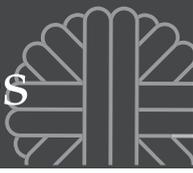


- Lehtosalo-Hilander, P.-L. (1984) *Ancient Finnish Costumes*. Helsinki: Suomen Arkeologinen Seura ry.
- Luoto, J. (1989) Piikkiön esihistoria. In T. Havia and J. Luoto (eds), *Piikkiön historia I: Esihistoria ja Ruotsinvallan aika*. Piikkiö: Piikkiön kunta, 13–77.
- Nockert, M. and Fredriksson, D. (1997) *Bockstensmannen och hans dräkt*. Årsbok: Varbergs museum.
- Østergård, E. (2004) *Woven into the Earth. Textiles from Norse Greenland*. Aarhus: Aarhus University press.
- Owen-Crocker, G. R. (2004) *Dress in Anglo-Saxon England*. Revised and enlarged edition. Cambridge: The University Press.
- Peets, J. (1998a) Indigovärvist Läänemere piirkonnas ja Eestis muinas- ja keskajal. *Muinaisaja teadus* 5, 291–307.
- Peets, J. (1998b) Teaduseelsest keemiast ja muinaseestlaste tekstiilivärvideist. *Muinaisaja teadus* 5, 279–290.
- Purhonen, P. (1998) *Kristinuskon saapumisesta Suomeen. Uskontoarkeologinen tutkimus*. Suomen muinaismuistoyhdistyksen aikakauskirja 106. Helsinki: Suomen muinaismuistoyhdistys.
- Rammo, R. and Ratas, J. (2016) *Vasken välkettä Viron vaatteissa. Spiraalikoristelun tuhatvuotinen perinne*. Turku: Suomen muinaistutkimuksen tuki ry.
- Reimer, P., Austin, W., Bard, E., Bayliss, A., Blackwell, P., Bronk Ramsey, C., Butzin, M., Cheng, H., Edwards, R. L., Friedrich, M., Grootes, P. M., Guilderson, T. P., Hajdas, I., Heaton, T., Hogg, A., Hughen, K., Kromer, B., Manning, S., Muscheler, R., Palmer, J., Pearson, C., van der Plicht, J., Reimer, R., Richards, D. A., Scott, M., Southon, J., Turney, C., Wacker, L., Adolphi, F., Büntgen, U., Capano, M., Fahrni, S., Fogtmann-Schulz, A., Friedrich, R., Köhler, P., Kudsk, S., Miyake, F., Olsen, J., Reinig, F., Sakamoto, M., Sookdeo, A. and Talamo, S. (2020) The IntCal20 Northern Hemisphere Radiocarbon Age Calibration Curve (0–55 cal kBP). *Radiocarbon* 62(4), 725–757.
- Riikonen, J. (2005) Iron Age Aprons from Southwestern Finland. And other cloths and pendants worn on the waist. In S. Mäntylä (ed), *Rituals and relations. Studies on the society and material culture of the Baltic Finns*. Suomalaisen Tiedeakatemian toimituksia, Humaniora 336. Helsinki: Finnish Academy of Science and Letters, 13–30.
- Riikonen, J. (2006) Broken Twill in Finnish Late Iron Age Textiles – Weaving Pattern of Special Garments. *Arheologija un etnografija XXIII, Veltijums seno apgērbs petniecī arheoloģei Dr. habil. hist. Annai Zariņai 85 gadu jubileja*. Rīga: Latvijas vēstures instituta apgads, 206–219.
- Riikonen, J. (2019) Sukkia ja sääriseiteitä. Jalan ja säären verhot myöhäisrautakauden Suomessa. In J. Harjula, V. Immonen and J. Ruohonen (eds), *Puukenkien kopinaa. Henrik Asplundin juhlakirja*. Karhunhammas 19. Turku: Arkeologia, Turun yliopisto, 155–187.
- Ruohonen, J. (2017) Ristimäki in Ravattula: on the remains of the oldest known church in Finland. In J. Harjula, S. Hukantaival, V. Immonen, A. Randa and T. Ratilainen (eds), *New Visits to Old Churches: Sacred Monuments and Practices in the Baltic Sea Region*. Cambridge: Cambridge Scholars Publishing, 46–60.
- Ruohonen, J. (2019) Identifying a Stone Structure in the Medieval Church at Ravattula in Finland. Reflections on Free-Standing Crosses in Northern Europe. *Zeitschrift für Archäologie des Mittelalters* 46, 113–135.
- Sirelius, U. T. (1916) *Suomen kansanpukujen historia*. Helsinki: Suomalais-ugrilaisen Seuran Aikakauskirja XXXI.
- Tomanterä, L. (1982) Esihistoriallisista jalkineista. In P.-L. Lehtosalo-Hilander, S. Sarkki and L. Tomanterä (eds), *Euran puku ja sen edeltäjät*. Eura: Euran muinaispukutoimikunta, 43–48.
- Vajanto, K. (2015) *Dyes and Dyeing Methods in Late Iron Age Finland*. Helsinki: University of Helsinki.
- Zariņa, A. (1988) *Libiešu apģērbs 10.-13. gs*. Rīga: Zinātne.
- Žeiere, I. (2005) Archaeological evidence of ancient Liv costume in Latvia. In S. Mäntylä (ed), *Rituals and relations. Studies on the society and material culture of the Baltic Finns*. Suomalaisen Tiedeakatemian toimituksia, Humaniora 336. Helsinki: Finnish Academy of Science and Letters, 73–83.
- Žeiere, I. (2017) *Arheologiskais tērps. Tā darināšana, valkāšana un komplektēšana mūsdienā Latvijā*. Rīga: Latvijas Nacionālais kultūras centrs.

#### Unpublished sources

- Kirjavainen, H. (2018) *Kuituraportti Ravattulan Ristimäen haudan 41 vaatekappaleista*. Archives of the Department of Archaeology, University of Turku.
- Pätsi, S. (2019) *Ristiretkiajan haudan kasviaineisto siitepölyanalyysin valossa*. Pro gradu-tutkielma. Turun yliopisto, Biologian laitos. Archives of the Department of Biology, University of Turku.
- Vanden Berghe, I. (2019) *Analysis report. Archaeologic textiles from Ravattula Ristimäki site in Finland*. KIK-IRPA Royal Institute for Cultural Heritage, Department Laboratories, Brussels. Archives of the Department of Archaeology, University of Turku.

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Pernilla Rasmussen

# Shirts for life and eternity in the grave of Bishop Peder Winstrup (1605–1676)

## Abstract

This article presents the investigation of two linen shirts which form part of the funerary dress of Bishop Peder Pedersen Winstrup (1605–1679), buried 1680 in Lund Cathedral, southern Sweden. When the grave was opened in 2013, it was discovered that the body had been naturally mummified, and that the funerary dress, including the linen, was well-preserved. Extant Early Modern linen garments are rare and the Winstrup shirts are an important contribution to a small corpus. The two shirts are compared to other, similar, examples. The study focuses on the materiality of the shirts and the manufacturing techniques in the context of northern European fashionable clothing culture, as well as their function and meaning as funerary garments.

**Keywords** Shirts, linen, sewing, funerary dress, Bishop Peder Winstrup, 17th century fashion

## Introduction and background

During the 16th and 17th centuries, the use of linen garments and fashionable linen accessories grew in importance and became prominent in fashionable dress and in funerary attire. However, extant linen garments from this period are rare. This article presents the investigation of two shirts, part of the funerary dress of bishop Peder Pedersen Winstrup (1605–1679) buried 1680 in Lund Cathedral, southern Sweden. The aim is to analyse the construction and sewing techniques of the two shirts in comparison with other extant examples, so as to enhance the knowledge of Early Modern manufacturing and use of shirts. The aim is, however, not only to identify and describe, but also to trace the function and meaning of the Winstrup shirts as funerary garments, and to exemplify how the shirts can be understood and interpreted in a wider context regarding textile and clothing culture, funeral practices, politics, health, and belief in late 17th century Scania. The study brings earlier research on men's shirts in the Nordic countries and burial customs to

the fore and deepens the textile and dress historical context from a fashion studies perspective.

## *The life of Peder Winstrup*

Peder Pederson Winstrup was born on 30 April 1605 into the elite of the Danish Evangelical Lutheran clergy as the eldest son of the Bishop of Zealand. After an international education, his career took off as a professor of physics at the University of Copenhagen and doctor in theology, the highest academic degree. In 1635, he was appointed Royal Chaplain in the household of King Christian IV of Denmark, and in 1638, he was installed as Bishop of Lund, one of the most attractive positions in the Danish church (fig. 1) (Rørdam 1905, 53–56; Skansjö 2012, 34–37; Karsten and Manhag 2017, 29–30).

The diocese of Lund encompassed Scania, Blekinge, Halland and Bornholm, with 500 parishes in total. After the Danish-Swedish peace treaty was signed in Roskilde in 1658, Winstrup's diocese became newly subject to the Swedish crown. Winstrup stayed in Lund and became

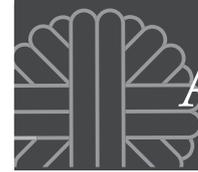


Fig. 1: Bishop Peder Pedersen Winstrup after an engraving published in his work *Pandectæ sacorum*, 1666. Unknown artist, oil on canvas, Lund University art collection (Image: Gunnar Menander)

the last Danish bishop of the diocese, but also its first Swedish bishop (Skansjö 2012, 33, 114–115, 133–134; Sanders 2012, 149). Winstrup is renowned for being a skilled political navigator and one of the strongest and most influential people during a time marked by turmoil, dedicated to defending the special position of his diocese. Years abroad made him a true renaissance man: scholar, theologian, author and collector of books and art with a lifelong commitment to science and education. He was ennobled by the Swedish king and took the initiative to found Lund University, which was inaugurated in 1668 (Hansson 1950, 396; Engelhardt 2007, 84, 195, 201; Sanders 2012, 150). Winstrup became a wealthy landowner with a lifestyle appropriate to his position. Like the Scanian nobility, the bishop and his wife held on to the Danish language and customs, and had close contacts across Öresund, even after 1658. After a turbulent life in the service of four kings and a prolonged illness, Peder Winstrup died in Lund, aged 74, on 7 December 1679. The funeral took place on 27 January 1680 and his coffin was placed in Lund Cathedral (Engelhardt 2007, 232; Skansjö 2012, 138, 142;

Karsten and Manhag 2017, 67–70).

In 2012, the cathedral parish obtained official permission to bury the bishop in the ground. A scientific team supervised by the Historical Museum at Lund University (LUHM) discovered that Winstrup's body had been naturally mummified, and that the funerary textiles were in exceptionally good condition. From September 2014 to December 2015, the body and grave were examined in an interdisciplinary research project (Lagerås 2016; Karsten and Manhag 2017; Karsten and Manhag 2018; Fägerström et al. 2020; Krzewińska et al. 2021). In December 2015, Peder Winstrup was reburied in Lund Cathedral.

### The Winstrup dress

Winstrup's funerary dress was dominated by white linen, black silk velvet, and black silk ribbon bows. The textiles in the grave comprised all the original parts of the funerary attire: undershirt and overshirt, sewn hose, arm wrappings and a winding sheet of waxed coarse linen held in place by knotted linen ribbons and a collar of fine linen, parts of a robe, and headgear of silk velvet and leather gloves. The coffin contained a mattress, two pillows, and a coffin lining of white silk taffeta. A large linen cloth with borders of silver passementerie that originally covered the face, documented in 1833, was missing in 2013 (Karsten and Manhag 2017, 81). The texture and the contrast between the materials gave a discrete, exclusive impression of an apparent simplicity, and spoke a clear symbolic language. The properties of the textiles, spoke further about their value (fig. 2).

Linen was represented by ten different qualities of tabby weave, from the coarsest with 10 × 14 threads per cm to the finest – in a separate collar – with 34 × 37 threads per cm. The high number of different qualities was not a result of haphazardly reused fabrics but mirrored the diversity of textiles in daily use in the bishop's household (Lipkin et al. 2021, 52). Two different linens were found in the shirts. The investigation revealed the remains of a foetus carefully wrapped in three pieces of different linen fabrics and placed in the coffin. DNA analysis proved it to be the grandson of Winstrup (Krzewińska et al. 2021). The high position of the parents was reflected in the exceptionally fine linen fabric used for the inner layer. The funerary textiles give a unique insight into the use of textiles and clothing for life and death in late 17th century Scania.

### Investigation of the burial garments

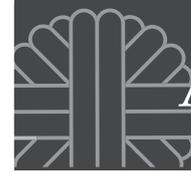
Natural mummification is a frequent characteristic of Scandinavian graves. However, well preserved textiles



Fig. 2: a – Winstrup as he was found in the coffin; b – Winstrup dressed in the undershirt and arm wrapping. View from the left side (Images: Gunnar Menander)

can be found on mummified as well as skeletonised remains. Burial during the winter under cold, dry, and well-ventilated conditions is an explanation for both mummification and good textile preservation (Gravjord 2005, 58; Nuñez et al. 2008; Nyberg 2010, 25;

Lipkin et al. 2021, 52, 62; Väre et al. 2021, 14–15). The herbs placed in the coffin and the fact that Winstrup was weakened and dehydrated after a period of illness could also be contributing factors (Löwengren 1962, 86–88, 92–93, 112; Lagerås 2016).



	Warp threads/cm	Weft threads/cm
Undershirt	27	25
Overshirt	13	11
Swathe	17	14
Arm wrapping, right arm	18	20
Hose	26	19
Collar	34	37
Collar, neckband	22	22
Swathe 1 foetus	41	36
Swathe 2 foetus	10	14
Swathe 3 foetus	18	19

Table 1: Qualities of the linen fabrics found in the grave

Plant fibres normally perish in acidic environments. Only under special circumstances have larger quantities of linen been preserved in graves (Aneer 2013, 315; Lipkin et al. 2014, 42; Lipkin et al. 2021). Winstrup's grave offered a rare opportunity to study a complete funerary dress, and how the garments interacted with each other and the body. In comparison to the drawing made in 1833, no significant disturbances of the dress were noted.

The reburial of Winstrup's remains in 2015 concerned only the body. LUHM undertook an in-depth study of the coffin – first as an entity, and then of the textiles separately from the body, for preservation in the LUHM. The grave was thus dismantled during the process (Karsten and Manhag 2017, 106–109). Winstrup was reburied in the undershirt, the arm wrappings and the winding sheet. After reburial, only parts of the material are still accessible for further research. This decision can be criticised from an ethical perspective, but should be seen in the light of the original plans to bury the whole coffin in the ground (Peacock 2007; Aneer 2008, 100; Tarlow 2011, 9; Aneer 2013, 315).

The coffin, with contents, was scanned with computer-tomography (CT). The scans added few clues as to the garments and the arrangements of the dress (Lipkin et al. 2015, 217). The documentation reported here was made continuously during the undressing process. Due to preservation conditions, the undershirt could only be studied on the body. Despite direct bodily contact, the undershirt was partly intact. Additional clues about the decayed parts of the undershirt were provided by deductions made from the overshirt.

The overshirt, also fragmentary, was preserved as a front part and a back part, partly decomposed in the shoulder area and along the sides and sleeves (inventory



Fig. 3: The back of the overshirt as found when the body was raised (Image: Gunnar Menander)

number DM 352:11, the reburied undershirt was not given a number). When the body was raised, the back of the shirt was found to be preserved, although the body had rested on it. Bodily fluids may have had a beneficial effect on the preservation (fig. 3) (Lipkin et al. 2021, 56). Following historical dress research methods for studies of surviving garments from the Renaissance and Baroque periods, this investigation was undertaken as an object-based case study (Aneer 2008, 99). First, the funerary dress was thoroughly documented and, secondly, it was compared with other material, both visual and written sources and earlier interpretations of primary evidence.

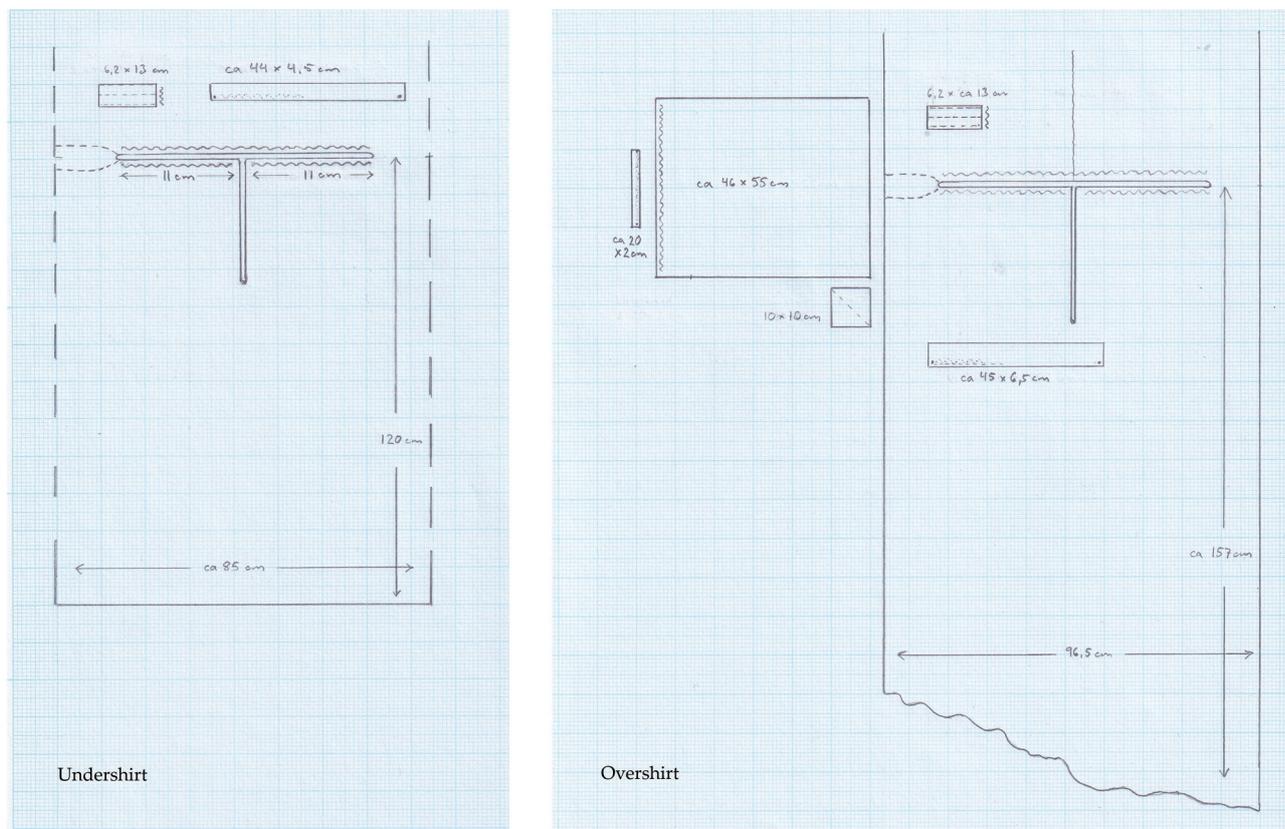


Fig. 4: Patterns of the shirts (Image: Pernilla Rasmussen)

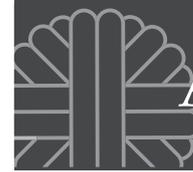
### Other extant shirts from the period

Men's shirts from the 16th and 17th centuries have been preserved in the Nordic countries as memories of prominent persons and dramatic events, or found in graves, often with precise provenance and dating. The shirt worn by King Christian IV, when he was wounded at the sea battle of Kolberger Heide on 1 July 1644, now in the royal collections at Rosenborg Castle in Copenhagen, is the only man's shirt preserved in Denmark from this period (Johansen 1984; Johansen 2020, 59). In Sweden, shirts worn by kings and noblemen are more numerous. The oldest are four shirts worn by Count Svante Stensson Sture and his sons Nils and Erik when they were murdered at Uppsala Castle on 24 May 1567, now in the Cathedral Museum in Uppsala; and two shirts worn by King Gustav II Adolph when he was wounded at Kleinwerder on 24 May 1624 and at Dirschau on 8 August 1627, both in the Royal Armoury in Stockholm (Nylén 1948; Arnold 2008; Royal Armoury database). As these latter two shirts were almost identical, Arnold assumes this to have been a style favoured by the king (Arnold 2008, 73). The possibility of studying two shirts worn on the

same occasion is unique, as those are restricted to the two shirts of Svante Sture, and the three shirts worn by Gustav II Adolph when he was killed in the battle of Lützen on 6 November 1632. In Swedish collections, the shirt of Admiral Claes Hansson Bielkenstierna worn at the sea battle of Fehmarn Bält in 1659, and the shirt of King Karl XII worn on 30 November 1718, when he was killed at Fredrikshald, are rare examples of plain, everyday shirts. Another useful comparison is provided by a smock associated with the future Queen Christina at two years of age in 1628, all in the Royal Armoury in Stockholm (Royal Armoury database). No shirts from the priestly or burgher estates from this period have been preserved above ground. Given this restricted corpus, the Winstrup shirts are highly valuable historical dress evidence.

### The shirts in the grave

Next to the body, Winstrup wore a calf-length, long-sleeved shirt with a neckband and wristbands. The shirt was made of tabby woven linen (*L. usitatissimum*) of medium weight. No major irregularities in the weave were observed. The linen was originally white



but had turned cream or brownish in colour.

Over the undershirt, winding sheet, and arm wrappings, Winstrup wore a full-length overshirt. The back piece revealed that the shirt was a real garment, and not a fake shirt arranged in the coffin. All the parts of the overshirt were made of the same quality linen, coarser than the undershirt. The visible parts appeared rather white after vacuum-cleaning, although partly brittle. The other parts, mainly the back piece, were dry, decayed, and of a brownish colour (fig. 3).

#### *Overall construction and sewing*

The external dimensions and the fabric width of the undershirt were not possible to determine. The length was estimated at 120 cm, with a 2 mm wide slip-stitched hem, 6 stitches per cm. This was a common length. Nils Sture's shirt was 125 cm and Bielkenstierna's shirt 118 cm (Nylén 1948, 218; Arnold 2008, 74; Royal Armory database). The whole width of the fabric was probably used for the body. In comparison, the undershirt seemed narrower than the overshirt with relatively narrow sleeves. For the overshirt the whole width of the linen, approximately 96.5 cm, was used, giving the garment a total width of 193 cm. The overshirt measured 157 cm from the shoulder to the lowest part, revealing that it originally reached the bishop's feet. However, no extant hem was found, and the exact length could not be determined.

The construction and sewing were in many respects similar in the two shirts, although minor differences were observed (fig. 4). The fullness of the front was gathered at the neckline. The shoulders were reinforced by a separate piece. The sleeves were smoothly joined to the body. The neckband and wristbands were fastened with black silk ribbon bows. The tabby-woven ribbons of the undershirt were 2 cm wide and somewhat coarse. The overshirt had 3 cm wide taffeta ribbons. The black bows with long loops on the white linen were a prominent decorative feature in the grave. The bow at the overshirt neckline had 12.5 cm long loops and 13 cm long ends. The entire ribbon was approximately 80 cm in length. The bow on the right sleeve had 9 cm long loops, with 11.5 cm and 13.5 cm long ends and was approximately 63 cm in its entirety. All seams were neat with close stitches in narrow, smooth seams suitable for hardwearing linen. The typical linen sewing techniques were worked with fine, white linen single thread in running stitch, backstitch in a continuous line, whipstitch, slip-stitch, and blanket stitch. Linen thread seems a natural choice. However, Arnold's investigations show silk to be common in finer linen from higher social strata, both in embroidery and functional sewing.

For example, the Kleinwerder shirt was worked with both linen and silk, while the shirt of Bielkenstierna and the Sture shirts were worked with linen thread only, except for the embroidery on Nils Sture's shirt which was worked with silk (Nylén 1948; Arnold 2008, 69, 74). The seams, approximately 6 stitches per cm, were placed 2 mm or four threads from the edges as a standard, but the stitches did not always follow the thread count with regularity. Neckbands and wristbands were embroidered with white, s-spun single linen thread with backstitching and raised knots in a symmetrical pattern.

#### *Neckline*

On both shirts, the front and back were cut in one continuous piece without a shoulder seam. The neckline and front slit were cut in a T-shape. The threads of the fabric indicate that nothing was removed to form the neckline, as in the shirt of Bielkenstierna, but was cut like the Kleinwerder shirt (Arnold 2008, 72–74). The neckline was closely gathered, 10 gathers per cm, to 11 cm from the front opening to the backstitching on the shoulder, with an estimated width of 44 cm in total. The neckline had no gussets, but the shoulders were reinforced with shoulder pieces. This precaution seems to have worked as no tear was observed in this area. An alternative explanation could be that the shirt was relatively new. The shoulder piece was slightly gathered at the neckline, making the piece look narrower (fig. 5).

#### *Front opening*

The front opening, 34 cm deep on the undershirt, and 35 cm on the overshirt, was cut along the threads. The slits were hemmed with a 1 mm hem worked with tiny slip stitches, about 11 stitches per cm. The bottom of the slit was reinforced by a spider and a bar. The bar was



Fig. 5: Left shoulder of the undershirt (Image: Pernilla Rasmussen)



Fig. 6: The front slit of the undershirt reinforced by a spider and bar (Image: Gunnar Menander)

covered with nine blanket stitches. The spiders, 7 mm wide, 5 mm high, had five legs of twisted threads on the undershirt, and eight legs on the overshirt. Around the hub, the stitches formed a small lump. Without this reinforcement, the front opening could easily be torn (Arnold 2008, 71). The slit in Queen Christina's smock was torn and mended. The front openings of the Sture shirts were reinforced by close stitches, while the technique with a spider and bar was found in the shirts of Christian IV and Bielkenstierna. This solution seems common in the 17th century but has not been observed in the 18th century (fig. 6) (Garsault 1771; Nylén 1948, 248; Johansen 1984; Arnold 2008, 26, 74, 75; Johansen 2020, 59; Royal Armory database). On the overshirt a slit at the back, 70 cm deep, was left unhemmed. The slit probably originated when the body was dressed: somebody took scissors, cut the neckband, and then tore a slit on the straight grain down the back of the shirt.

### Neckband

The neckband, 4.5 cm high on the undershirt, and 6.5 cm on the overshirt, was laid straight up the neck and reached to under the chin (fig. 7). It was cut from a straight, rectangular piece, folded lengthwise with an edge-to-edge fold. The edges were turned back and whipstitched to the gathers from each side, 6 stitches per cm. All the neckline gathers were encased in the neckband. As with other shirts from the 17th century, the neckband had no lining. However, the shirts of Nils and Erik Sture had linings of linen in the high neckbands and wristbands (Nylén 1948, 231, 238). Silk ribbons were drawn through eyelet-holes on each side of the neckband, about 7 mm from the bottom and in the middle of the embroidery, revealing that the eyelets were made after the embroidery. The

bow of the undershirt, 5 cm long, was small, flat, and tightly knotted. The eyelet-holes were left unfinished. The awl parted the fabric threads without breaking them, making it possible to economise on the sewing labour. In contrast, the eyelets in the neckband of the overshirt were whipstitched. This resembles the whipstitched neckband eyelets in the outer Lützen shirt (Royal Armory database). However, Sten Sture's shirt had eyelets reinforced with blanket stitches lying outwards (Nylén 1948, 242).

### Sleeve

The overshirt sleeves were constructed from half the width of the linen, with an underarm gusset, 10 x 10 cm. The undershirt sleeves were probably similar. The raw edge of the sleeve-head met the selvedge of the body smoothly in a felled seam worked in two steps. On the undershirt, the right sides were first worked together with running stitches or separated backstitches. On the overshirt, the pieces were instead whipstitched from the right side with 3 stitches per cm. Secondly, on both shirts, the seam allowances were felled to the sleeve from the wrong side and slip-stitched with the selvedge protecting the raw edge. The first run and fell technique resulted in two visible seams on the wrong side: one row of straight stitches parallel to the seamline; and one row with the stitches at an angle. The technique was common in shirts: for example, in the side seam of Nils Sture's shirt (Arnold 2008, 5, 69, 71). The second technique resulted in two parallel



Fig. 7: Inside of the undershirt when lifted from the body, showing the front slit and the gathers to the neckband. On the right side, the eyelet had loosened and remained stuck to the ribbon (Image: Gunnar Menander)



Fig. 8: The sleeve insert and the shoulder piece of the overshirt (Image: Gunnar Menander)

stitch rows visible on the right side. It was also used for the sleeve seams and underarm gusset of the overshirt. This type of fell seam had a long tradition and was also found in the Sture shirts (Nylén 1948, 230–231, 238, 242; Arnold 2008, 5, 69; North and Tiramani 2011, 17). The choice of working the first step with running stitches from the wrong side or with whipstitch from the right side could differ between seamstresses. The sleeve inserts of Bielkenstierna's shirt showed a third technique, a false French seam, made by oversewing the selvedge to the hemmed edge of the sleeves and gusset (Arnold 2008, 74).

#### *Side seam*

The side seams, which were only studied on the overshirt, had their selvedges whipped together from the wrong side, over only one or two threads of the fabric at 9 stitches per cm. In contrast, the side seams of Nils Sture's shirt were run and fell seams which joined two selvedges (Arnold 2008, 69). The side seams left no indication that the shirt or gores had slits in the sides, as in Bielkenstierna's shirt or gores for extra fullness (Arnold 2008, 26).

#### *Shoulder piece*

On both shirts, the shoulder areas were reinforced with rectangular shoulder pieces cut according to the threads, on the undershirt 6.2 cm wide and 13 cm long. On the overshirt, the exact shoulder measurement from neckline to sleeve-head was impossible to establish. The shoulder piece was attached to the right side of the shirt. The edges were turned back, and backstitched from the right side, 2 mm, that is 4 threads, from the edge, at 7 stitches per cm. A backstitched row along the shoulder line kept the fabric layers together. The remaining fragments at the shoulders of the

undershirt revealed the construction which applied to both shirts. The end of the shoulder piece was turned in and whipstitched from the right side to the seamline of the sleeve insert. The sewing was less accurate towards the back of the undershirt, where the short side was finished a millimetre short of the body. On the overshirt, the short side reached a millimetre into the sleeve. These details allowed the workflow to be established: 1) joining the sleeve to the body; 2) attaching the shoulder piece; and 3) attaching the neckband. This order differed from the recommendations given by Garsault (1771, 45) in which the finished sleeve was attached at the end of the process (fig. 8).

#### *Sleeve end and wristband*

Both sleeve seams of the overshirt had a 9 cm long wrist opening with the selvedge left unfinished, and the raw edge neatly hemmed with slipstitches at 6 stitches per cm. This supports the assumption that the sleeves consisted of half the width of the linen at approximately 48 cm. Bielkenstierna's shirt had a worked bar at the bottom sleeve slit (Arnold 2008, 74). This was not observed in the Winstrup shirts. It was not possible to study the sleeve seam of the undershirt but we can assume this to have included an underarm gusset and a slit, as on the overshirt.

The sleeve-ends were gathered at 5 gathers per cm on the undershirt and about 3 to 4 pleats per cm on the overshirt – not as close as the neckline. This difference was also noted for Nils Sture's shirt (Nylén 1948, 232–233). A loose fragment revealed the technique. The gathers were drawn with one linen thread 10 threads from the raw edge with uneven stitches – over 8 threads and under 4 threads. The shallow gathers turned to the right side of the garment and the deeper gathers were turned to the wrong side. It is plausible that the gathering of the neckline was worked in a similar way. This technique was not observed by Arnold (2008, 76, 79, 83, 123) but is described by Catharina Helena Dörrien in 1755 (Krünitz 1781, 5).

The sleeve-end was completed with a wristband made from a straight, rectangular piece, folded lengthwise with an edge-to-edge fold. The cuffs of the overshirt, 2 cm wide, were narrower than those of the undershirt, 3.7 cm wide, although the neckband was higher. The exact length measurement could not be determined. The right wristband of the undershirt was pieced about 1.5 cm from the short edge. This could be due to the cutting method, resulting from a shortage of fabric. The fourth Sture shirt showed the same kind of piecing (Nylén 1948, 267, fig. 43). The outer edge of the wristband was turned in by 2 mm, the inner edge turned by 4 mm. Both sides were slip stitched to the

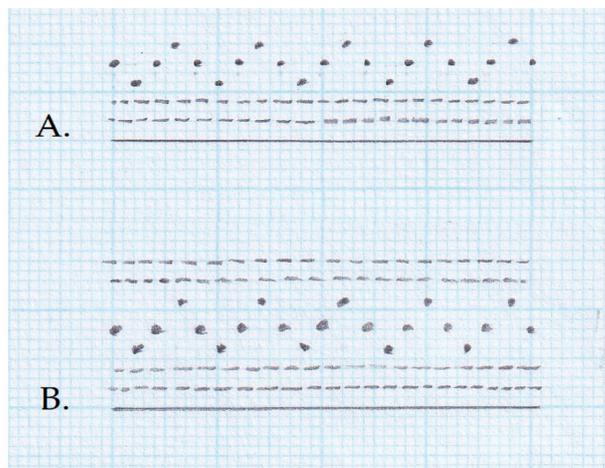


Fig. 9: The embroidered wristband on the left arm of the undershirt. Mark after pin in the middle of the cuff; A – Pattern neckband. B – Pattern wristband (Image: Gunnar Menander and Pernilla Rasmussen)

gathers, approximately one stitch for each gather. The short ends were turned in and oversewn from the right side with 8 stitches per cm – even finer than on the neckband. Whipstitch was also used for the neckband and wristbands on Nils and Erik Sture's high-necked shirts. However, the wristbands on Nils Sture's shirt were whipstitched on the right side and backstitched on the wrong side. During the 17th century, there seems to have been a choice of techniques. The neckbands and wristbands of the Kleinwerder shirt and Bielkensierna's shirts were worked only with backstitch (Nylén 1948, 231–232, 238; Arnold 2008, 21, fig. 8F, 74–75).

The wristbands were closed by ribbons through eyelet holes. The small eyelet-holes, placed on each side of the wristband were made with an awl at the end of the sewing process. Unlike the neckline eyelets, they were whipped on both shirts. In contrast, the wristbands of Sten Sture's shirt had double eyelet holes worked with blanket stitches lying outwards (Nylén 1948, 267, fig. 43; Arnold 2008, 7, 20, fig. 7/8B). The Kleinwerder shirt lacked fastenings, and Arnold assumes that the neckband and wristbands were closed with pins. The shirts of Christian IV and Bielkensierna had simple linen ribbons stitched to the neckline, while the wristbands of the latter were provided with oval, whipped eyelet holes, intended for separate ribbons, as with the Winstrup shirt (Flamand Christensen 1940, 31; Arnold 2008, 26, 74–75).

#### *Embroidery*

Whitework and silk embroidery were common embellishments on men's shirts. An embroidered geometric pattern, 1.3 cm wide, worked with white

linen thread decorated both Winstrup shirts on the outside at the base of the neckband (fig. 9). Two backstitched rows, 1 mm from the bottom edge and 2 mm, at 7 stitches per cm, were followed by three rows of raised knots in a zig-zag pattern. The embroidery followed the threads of the fabric, but the neckband was not sewn evenly to the neckline, and the embroidery was placed closer to the neckline on the left side than on the right. This revealed that the neckband was embroidered before it was joined to the neckline.

The embroidery of the undershirt had a finer finish, in keeping with the finer linen quality. The backstitching was worked over different numbers of threads, giving an even, and more vivid seam. Keeping to the threads and accurate thread counting were emphasised as an important feature for linen sewing, and for instance said to be characteristic of a well-sewn neckband by Catharina Helena Dörrien (Krüinitz 1781, 7). However, the Winstrup shirt proves that this was not always the case.

The pattern on the wristbands was placed close to the gathers. Two rows of backstitch at 7 stitches per cm were worked 2 mm from the edge of the wristband, four threads apart, followed by a zig-zag pattern of knots, and finished by two more backstitched rows. The wristbands of the undershirt were also embroidered, although they were turned up in the grave, which concealed the embroidery.

Part of the undershirt's left wristband was undone, revealing that the stitched rows were worked with backstitch and not double-running stitch, also known as Holbein stitch. The knots resembled French knots, sewn with the thread three times around the



needle and the down-stitch placed 4 threads from the up-stitch, giving each knot a prominent rise. The knots were worked in a zig-zag with the thread lying between them on the wrong side.

With the first backstitched row placed only 2 threads from the edge, it might be assumed that this row was used for sewing the wristband to the sleeve and to keep the gathers in place, as described on Erik Sture's shirt, or as Arnold has repeatedly concluded (Nylén 1948, 238; Arnold 2008, 21, 30). However, the entire embroidery was carried out before the wristband was attached to the sleeve, and the backstitched row lacked practical function. This method resembles the description given by Garsault (1771, 45).

Similar combinations of backstitching and knots in whitework are occasionally found on items of dress in different geographical areas and contexts in Europe during the second half of 16th and the 17th centuries (Nylén 1948, 238, 251; Arnold 2008, 20, 31, 52, 68, 82–83, 107–108). Zig-zag patterns and triangular groupings of knots are also found much later in folk linen from Schleswig, Germany (Andresen 1975, 54). No monogram or traces of any personal marks were found on the shirts.

#### *A special construction technique*

A comparison of the cut of Early Modern men's shirts shows the shoulder area to be particularly variable, although variations in the construction without shoulder seams, with or without shoulder reinforcement, and with a T-shaped neck opening with the fullness gathered into a neckband, were common (Arnold 2008). The shirt of Christian IV had gussets to relieve the strain on the neckline, giving an oval shape to gather. On Karl XII's shirt, the shoulders were reinforced by a narrow strip on the wrong side (Nylén 1948, 271; Johansen 1984). Bielkenstierna's shirt was cut without a shoulder seam but with an oval-shaped neckline – maybe a measure taken to avoid strain without the use of gussets. The shoulders were reinforced with a strip sewn on the wrong side (Arnold 2008, 74). The two shirts of Svante Sture had slightly sloped shoulder seams also reinforced by a wider shoulder piece on the wrong side (Nylén 1948). The shirts from Kleinwerder and Dirschau had straight-cut shoulder seams which did not add to the construction. Despite a special sewing technique for reinforcement, this was a weak point (Arnold 2008, 74). The shoulder seams on the three Lützen shirts were also specially worked with a felled seam (Royal Armory database).

Not one of the shirts available for comparison had the same construction or sewing technique for the

shoulder reinforcement as the Winstруп shirts, with the shoulder piece sewn on the right side late in the process.

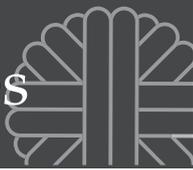
#### **Dressed in shirts for life and eternity**

The Winstруп shirts belong to a history of linen garments with continuity through the centuries over large parts of northern and western Europe, while at the same time adjusting to local conditions, personal skills, and wishes, as well as national legislation. Compared to shirts of royal and noble origin, the Winstруп shirts can be identified as everyday shirts of fashionable dress and not as special clerical or liturgical vestments. The similarities between the Winstруп shirts and the example of linen sewing from the Danish court could be explained by the fact that the Winstруп family had been part of the royal household and later kept to Danish traditions.

Pylkkänen and Arnold argue that changes in fashion did not affect garments that were worn less visibly and that explains why shirts remained almost unchanged for centuries. The basic construction without a shoulder seam has been found in Early Medieval shirts, such as the shirt of Thomas Beckett, and was still present in publications such as Garsault (1771), Krünitz (1781) and *The Workwoman's Guide* (1838) (Burnham 1979, 44; Kania 2010, 68–69). However, fashionable outer garments did influence the visibility and construction of all garments, and placed linens in an area of tension between continuity and change. The interplay between lavish dark coloured silks and velvets and white linen shirts gave 17th century fashionable dress much of its character, as seen in the ruffs of the Sture



Fig. 10: Image taken from the fingers towards the right wrist showing how the shirts were arranged. The sleeve-ends were originally concealed by the high leather gloves. They were later removed (Image: Pernilla Rasmussen)



shirts or in Bielkenstierna's voluminous shirt sleeves, worn visible under the open sleeves of the doublet. Richly decorated linen garments became a target of sumptuary legislation in Sweden. The general dress regulation of 30 August 1664, for all estates, enforced the prohibition against "the excess of linnen", such as embroidery and bobbin lace (Pylkkänen 1998, 36). Winstrup's plain shirts corresponded to the law and statutory dress code of the time. In contrast to the Baroque dandies, Winstrup kept to narrower sleeves and his shirts probably gave an impression of restraint and a fashionable moderation suitable for his position and age (Pylkkänen 1998, 395; Ullgren 2004, 217, 245).

### *17th century funerary splendour*

The Winstrup shirts bring Early Modern practices and attitudes in relation to clothing for both life and death to the fore. In Denmark and Sweden, the Lutheran reformation brought new beliefs about death, which were expressed in altered funerary practices. Funerals became the most splendid feasts arranged by the 17th century elite. The funerary magnificence, *pompa funebris*, peaked in the middle of the century, when the nobility was at the height of its power (Troels-Lund 1984, 77–80; Ullgren 2004, 245, 247, 268; Candreus 2008, 169; Nyberg 2013, 260–261, 268; Engström 2019, 56, 79–87). During the post-Reformation period, preaching about Purgatory was banned. With the correct faith and by the grace of God, the soul was already blessed. The body was not perceived as an impure, empty vessel left behind by the soul, in fact, Luther declared death to be an eternal sleep pending resurrection (Troels-Lund 1984, 77–80, 118–119; Tarlow 1999, 80–81; Jonsson 2009, 141, 149; Gonzalez 2015, 112, 120). For the farewell on earth and the future festive entry into heaven, an elaborate and fashionable dress was regarded as suitable. Metaphors of sleep were materialised by arranging the coffin as a bed, with a mattress and pillows of silk, and displaying and portraying the deceased on a *lit de parade*. As the deceased was considered a still present, public person, the body had to be properly dressed (Jonsson 2009, 143, 148; Engström 2019, 53, 56; Nyberg 2010, 20; Vedeler 2010, 255). Funeral splendour was the target of sumptuary legislation in 1664 and 1668, aiming at the ostentatious consumption and manifestations of power that were important to the nobility (Nyberg 2013, 257; Ullgren 2004, 24, 217, 245). In 1663, Winstrup himself exhorted restraint among the priests in his diocese including abstinence from candles, decorated coffins, and grand funeral feasts. These new rules seemed later to have influenced his own funerary dress (Wallin 1951, 83–84).

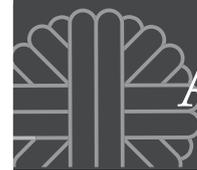
### *Funerary dress*

Gravjord (2005) presents a chronology of the burial dress in the post-Reformation period with three alternatives; a) undress for sleep, b) full formal fashionable attire, in both cases using garments worn in life, or later c) fake funerary clothes worn over a shirt or shift of one's own – funeral gowns, *gravkåpor*, or textiles draped in the coffin to resemble real clothes. These possibilities existed in parallel and with regional variations during the 17th century, although the last grew most common in the 18th century and personal, everyday outer garments became scarce. (Pylkkänen 1955; Aagard 2002; Gravjord 2005, 64, 94–95; Jonsson 2009, 140; Lipkin 2015). In this period of transition, Winstrup's funerary dress belonged to the older tradition.

The conception of death as sleep allowed old and new traditions to blend. During the 16th century, the linen nightshirt became a more common garment to wear in bed and as undress. Count Svante Sture was, for instance, still in his nightclothes when the Swedish King Erik XIV visited him in prison one morning in 1567 (Nylén 1948, 253). Nightclothes were regarded as distinguished in contrast to the medieval habit of sleeping naked and this had an impact on burial clothing. Dressing the body in the fashionable and festive nightshirt and nightgown, made it possible to combine the notions of both feast and sleep (Troels-Lund 1984, 120–121; Johannsen 1988, 42; Gonzalez 2015, 119).

At the Danish and Swedish post-Reformation courts, it was customary to bury the monarch not in his official dress as king or in everyday attire, but in his informal undress for home and sleep (Johannsen 1988; Rangström 2015). For example, the funerary dress of the Swedish King Karl X Gustav included a fine linen shirt and a long shirt (*likskjorta*) under a silver brocade nightrobe – garments from the king's wardrobe (Löwengren 1962, 87–88, 91, 94; Rangström 2015, 55, 84). The Danish kings Christian IV and Frederik III were also dressed in rich silk nightgowns, but with a linen garment of extra length tied below the feet (Johannsen 1988, 44–47; Johansen 2020, 108–109). Unlike, for example, the Polish catholic bishop Jan Trach Gniński buried 1736 in the monastery church in Lubin in full liturgical attire (Grupa 1998), protestant priests were, like royalty, noblemen and burghers primarily clothed in forms of undress (Johannsen 1988; Gravjord 2005, 50; Aagaard 2002; Nyberg 2010, 20). The Winstrup funerary dress did not deviate from this custom.

Commonly, one's wedding shirt was kept for the last rest or a fine shirt was singled out. Alternatively,



the shirt or shift in which they died was kept for the purpose. Sometimes a new shirt was made (Troels-Lund 1904, 107, 109; Pylkkänen 1998, 398; Gravjord 2005, 94–95; Nyberg 2010, 20; Hagberg 2015, 18, 188–189, 192).

The Winstrup shirts presumably came from his everyday wardrobe. The shirts were probably not specially made or decorated nor saved from a special occasion in his life. The undershirt provided a unique insight into the bishop's everyday attire or possibly his Sunday best, probably not only as an old man, but also in his days of power. This was the kind of shirt he had worn next to his skin throughout his life. The overshirt was most likely one of the bishop's nightshirts, like those he wore at night and during times of illness. There would not have been any major reason to provide the bedridden elderly bishop with new sets of shirts. On the other hand, the shirts showed little trace of long-time wear or tear, reflecting a household of means even during the harsh period after the Scanian war in the 1670s.

The dead were believed to enter heaven in their funerary attire and were unable to find peace if not properly clothed. To scrimp and neglect to dress the dead according to rank and legislation was considered shameful (Hagberg 2015, 187; Engström 2019, 94). However, other factors were also considered. Elderly people, like Winstrup, were often dressed more simply than children or younger persons who died in their middle years (Nyberg 2013, 265). The relatively short time between death and the funeral for a man in Winstrup's position indicates less elaborate arrangements. The domestically produced linen and plain garments without lace followed Danish and Swedish sumptuary law for funerals (Ullgren 2004, 245; Gravjord 2005, 67–68). Candreus has noticed a trend during the 17th century for some individuals to express a desire for a simple funeral. As Winstrup had preached against costly funerals, this could have been his own wish (Candreus 2008, 178, 199–200).

#### *Manufacture and use of fashionable linen*

Another factor was the enhanced status of linen garments in general, as shirts became more visible and prestigious in fashionable dress. At the French court, it became a special honour to pass the royal shirt to the king at the ceremonial *levée*, and a new style of portrait, showing men dressed only in their shirts, became more frequent in the last decades of the century (Pylkkänen 1998, 395; Andersson 2008, 40). The prestige of a clean linen shirt could be added to the cultural significance of the role of the nightshirt as a funerary garment, besides the notion of death as

sleep.

Fashion continued into the grave. As seen in portraits, puffed linen sleeves and neckbands with lavish black ribbons were the height of fashion in the 1660s and 1670s. The bishop's black bows should not be interpreted as reflecting his high ecclesiastical position or a sign of grief, but as a sign of fashion in life and death (Pylkkänen 1970; Pylkkänen 1998, 396, 398, 439). As the ribbons were a little frayed at the shirt's ends, they had probably been worn during his lifetime.

Vincent stresses the importance of linen for health and bodily hygiene. Clothing and linen worked in two ways as they protected the body from a dangerous outer world, but also cleaned the body from unhealthy excretions from the inside (Vincent 2003, 8, 52–53). This created a close bond between well-being and proper clothing. The material considerations in graves show how the relatives created an impression of how the dead had been cared for when in a vulnerable and life-threatening situation (Hagberg 1937, 181; Tarlow 2011, 173; Engström 2019, 77). Linen was, however, also used for the benefit of the living as a method of purifying the air from the pathogenic miasma deriving from the corpse (Drakman 2018, 77, 79).

White, laundered, bleached, and starched linen was a sign of purity, civility, good manners, and a refined, disciplined body, which could be translated into the moral and social superiority of the higher classes or the humility of a priest (Vincent 2003, 8, 52–53). Dressed in fashionable linen, Winstrup was still present in a respectable way reflecting his elevated position as both bishop and nobleman.

The two Winstrup shirts are in many respects similar in their construction and making. It is likely that they were both made in the Winstrup household. The linen quality of the undershirt was much finer than the quality of the overshirt. To a modern eye, both give a fine impression, but in comparison, they were only of medium quality. For the Sture shirts, different linens were used in the same shirt and these are similar in quality to the Winstrup undershirt. Royal shirts were considerably finer, for example, in the Lützen shirts where the linen has 43 x 44 threads per cm, and in Christian IV's shirt where the linen of the shirt's body is 45 x 35 threads per cm, and the sleeves 33 x 26 threads per cm. The smock of Queen Christina as a child was still finer, with 66 x 49 threads per cm (Nylén 1948; Royal Armory database). The width of the Winstrup overshirt, 96.5 cm, was a common choice, compared with other extant shirts ranging from 80–100 cm wide. Different widths and qualities could be woven for the body, sleeves, and neckband (Nylén 1948; Arnold 2008, 74; Johansen 2020, 59). However, this was not the case for the Winstrup



shirts. The finest shirts were made of Dutch or north German linen (Pylkkänen 1998, 396). Linens woven in rural Scanian homes were normally 60–70 cm wide (Burnham 1979, 7). Larger estates with broader looms produced wider fabrics for shirts (Kania 2010, 58). For many Scanian estates, linen production and trade were important sources of income (Fischer 1959, 9, 51–53, 315). As the Winstrup shirts were not among the finest, it is likely that the fabrics were woven within the household. Linen of different qualities was manufactured at several of the bishop's estates. The probate mentioned a weaving house at Werpinge estate and spinning wheels and yarn winders were listed from Sankt Peders Kloster (Fridh and Fridh 1977, 38, 41–42).

As the probate of Winstrup written in July 1680 is incomplete, the content of the bishop's wardrobe remains unknown (Fridh and Fridh 1977). According to other probate accounts, rich burghers in Finland could own a dozen shirts. Jacob Forbus' inventory noted six fine outer shirts of Dutch linen, six undershirts of Warendorf linen, and five old undershirts (Pylkkänen 1998, 397). Danish inventories testify to far richer wardrobes in the higher echelons: King Frederik II had more than 20 shirts in 1560, and the nobleman Peder Oxe left 60 shirts in 1579 (Fischer 1959, 24). Presumably Winstrup's personal linen contained several shirts in sets of at least six of different qualities and for different functions.

Wearing more than one linen shirt at the same time was part of 17th century clothing practice. An undershirt was commonly worn under a finer shirt. In comparison to shorter undershirts of cheaper fabric, mentioned in written sources, the shirt Winstrup wore closest to his body could hardly be described as a specially made undershirt, but was likely a finer shirt previously worn when formally dressed (Junker and Stille 1988, 22; Pylkkänen 1998, 398). This layering of shirts was thus more similar to the clothing practice of Gustav II Adolph, wearing three similar shirts for the battle of Lützen in 1632, or reflects a habit of wearing a shirt under the long nightshirt for undress (Royal Armory database).

Unlike tailored garments, shirts were normally cut with the same construction a dozen or half dozen at a time, to optimise the use of fabric (Garsault 1771, 44). The different linen qualities reveal that the Winstrup shirts did not belong to the same set and were probably not made during the same time span. The shirts showed many similarities, but also differences. The shirts were made for different functions and could not have been switched. The reinforcements on the shoulders were, for example, a special technical solution, not observed

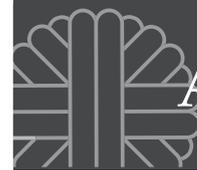
in other extant shirts, but similarly preformed in these two. This was probably the preferred style in the Winstrup household. The slight variations in the sewing technique were of limited importance for the visual impression, but perhaps demonstrates a personal touch, even in standardised linen sewing. The fact that the same type of embroidery was chosen for both shirts further points to the taste and preferences of the household. The similarities in these durable shirts, which were perfect on the inside as well as the outside, suggest the technical skills of people in the bishop's household.

#### *The shirt on the body*

A shirt of closely woven linen was a loose-fitting garment but had a close relationship with its wearer. The fabric had a soft, but crisp and heavy hand. It had some weight and authority, but the linen also adjusted to the body beneath. Clues to the relationship between body and dress are especially valuable when a garment without inherent shape like the shirt, is studied. When not on the body, the shirt looks shapeless. When observed on the body, it becomes evident that the construction was intended to enhance a certain shape of the wearer. The width and gathered folds were concentrated at the centre-back and chest, giving a soft volume and a rich impression. The collar and wristband emphasised neck, head and hands. The sleeve-head rested high on the shoulder. However, other shirts from the period and later on, commonly had a dropped seam, as is visible on the shirts of Svante Sture, Christian IV, Bielkenstierna, and the shirt worn by the Sewdish King Gustav III when he was shot in 1792 (Nylén 1948; Johansen 1984; Arnold 2008, 74; Royal Armory database). The reinforced shoulders on the Winstrup shirts marked a defined, broad, and strong, masculine stature.

#### *The shirts in the coffin*

The Winstrup shirts also allowed the original funerary dress arrangements to be studied. The high visibility and attractiveness of the shirts meant they played a key role in the funerary dress. At the same time, the shirts were used to conceal practical funerary arrangements, such as the arm wrappings and the winding sheet with pins and numerous knots. When the overshirt was removed, it became clear that the arm wrappings, covering the sleeves of the undershirt, began at the wrists and continued in a spiral around the arms. The wristband was turned back over the lower edge of the wrapping, so that neither the bands nor the embroidery were visible. The loops of the black bows were tucked in between the undershirt and wrappings. These were



not intended to be seen under the sleeve and wristband of the overshirt which was wider and reached further down the wrist. The wristband of the overshirt was kept in place by a large, black silk ribbon bow. On the right side, a pin, stuck through the wristband of the overshirt and the turned wristband of the undershirt, kept the shirt layers together in the desired position. On the left side, a missing pin had left marks of metal oxide on the overshirt and holes on the undershirt, showing an original position like that on the right. The use of pins for the beautifying arrangements of funerary dress was common in graves from the period (Lipkin et al. 2014, 42). However, pins were extensively used in Early Modern clothing for the living and not only reserved for the dead (fig. 9–10).

### Conclusion

The two shirts of bishop Peder Winstrup were crucial parts of his funerary dress. As the investigation proved them to be real garments, an everyday shirt and a night shirt from his everyday wardrobe, they add to the knowledge of manufacturing and use of linen garments for both everyday life and eternal rest. The comparison with other extant shirts showed far-reaching similarities with shirts of royal and noble origin from the Nordic countries. The Winstrup shirts were thus part of a fashion culture, rather than special priestly, liturgical, or funerary garments. This shows that the fashion and dress practices of life continued unbroken in death.

The Protestant beliefs of death and afterlife, which entailed a new focus on funerary attire materialising the notion of death as sleep, were clearly present in the Winstrup dress, as were views on health, textiles and fashion. Simplicity in funerals, prescribed by sumptuary law during the second half of the 17th century, in reaction to the *Pompa funebris* of the nobility was reflected in the plain execution and locally produced fabrics of the Winstrup shirts. The comparison with other shirts highlights the long line of continuity that characterises the construction and linen sewing techniques, but also shows elements of change and variation. All the shirts showed similar as well as different construction and sewing techniques. In comparison to the standardisation indicated by 18th century sources, this was an expression of a personal touch, rather than general changes in construction and sewing techniques or fashion. The two Winstrup shirts were made for different functions but with some similar and some unique technical solutions, showing the preferences in linen sewing of the Winstrup household. However, as with Protestant Danish and Swedish kings, Winstrup's official ecclesiastical

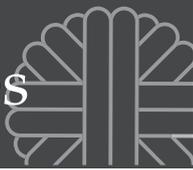
position was not emphasised by his shirts or in his funerary attire. His future entrance into heaven would not be primarily as a bishop, but as a fashionable scholar and nobleman.

### Acknowledgements

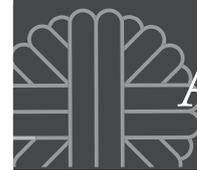
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### Bibliography

- Aagard, K. (2002) *Det havde de på. Restaureringen af Helsingørs Domkirke 2000-2001 og undersøgelserne af de borgerlige begravelser*. Helsingør: Helsingør Kommunes Museer.
- Andersson, E. I. (2008) Hur modemedveten var Bockstensmannen? In P. Wiking-Faria (ed), *Bockstensmannen och hans tid*. Varberg: Länsmuseet i Varberg.
- Andresen, G. (1975) *Særke. Danske bondekvindens særke og oplod fra ca 1770 til ca 1870*. Copenhagen: Borgen.
- Aneer, C. (2008) Tailored Criticism. The Use of Renaissance and Baroque Garments as Sources of Information. In M. Gleba, C. Munkholt and M-L. Nosch (eds), *Dressing the past*. Ancient Textiles Series 3. Oxford: Oxbow Books, 98–114.
- Aneer, C. (2013) Elsa Beata Brahes begravningsdräkt. In R. Gullbrandsson (ed), *Grevars och bönders tempel. En bok om Brahekyrkan på Visingsö*. Jönköping: Jönköpings läns museum, 310–326.
- Arnold, J. (2008) *Patterns of Fashion 4. The cut and construction of linen shirts, smocks, neckwear, headwear and accessories for men and women c. 1540–1660*. London: Macmillan.
- Burnham, D. (1979) *Skjortor, särkar och blusar*. Stockholm: Wahlström and Widstrand. With Swedish preface by Eva Nordlinder.
- Candreus, C. (2008) *De hädangångnas heraldik: en studie av broderade begravningsfanor ca 1670–1720*. Hedemora: Gidlund.
- Drakman, A. (2018) *När kroppen slöt sig och blev fast. Varför åderlätning, miasmatorin och klimatmedicin övergavs vid 1800-talets mitt*. Uppsala: Uppsala University.
- Engelhardt, P. E. (2007) *Skåne mellom dansk og svensk: en undersøgelse af de nationale brydninger i Skåne stift i årene 1658 til 1679: holdningen hos biskoppen og i præsterskabet*. Copenhagen: Museum Tusulanum Forlag.



- Engström, A. (2019) *Olikhetens praktiker. Adlig begravningskultur i Sverige ca 1630–1680*. Uppsala: Studia Historica Upsaliensia.
- Fischer, E. (1959) *Linnevävarämbetet i Malmö och det skånska linneväveriet*. Malmö: Nordiska Museet.
- Flamand Christenssen, S. (1940) *De danske kongers kronologiske samling paa Rosenborg. Kongedragterne fra 17. og 18. Aarhundede*. Copenhagen: Munksgaard.
- Fridh, B. and Fridh, H. (1977) *Möllesving och andra ting i Skåne 1650–1750*. Malmö: Staffanstorps tryckeri.
- Fägerström, C., Buckland, P. I., Lemdahl, G., Karsten, P., Lagerås, P. and Manhag, A. (2020) Insects and other invertebrate remains from the coffin of a 17<sup>th</sup> century bishop in Lund Minster, S Sweden. *Journal of Archaeological Science: Reports* 31, 102299, 1–10.
- Garsault, F. A. de. (1771) *L'art de la lingère*. Paris: De l'imprimerie de L. F. Delatour.
- Gonzalez, J. M. (2015) Fashioning Death: Clothing, Memory and Identity in 16th Century Swedish Funerary Practice. In S. Tarlow (ed), *The Archaeology of Death in Post-medieval Europe*. Warsaw/Berlin: De Gruyter.
- Gravjord, I. (2005) "de sal: folches kistekläder" i bö gamle kyrke. *Graver frå 1600- og 1700-åra*. Skien: Telemark museum.
- Grupa, M. (1998) Textiles from the 16th–18th Century from the Benedictine Monastery in Lubiń, Leszno Voivodeship. In L. Bender Jørgensen and C. Rinaldo (eds), *NESAT Textiles in European Archaeology*. Report from the 6<sup>th</sup> NESAT Symposium, Borås, 7–11 May 1996. GOTARC Series A, vol 1. Gothenburg: Gothenburg University, 287–291.
- Hagberg, L. (2015 [1937]) *När döden gästar. Svenska folkseder och svensk folktrö i samband med död och begravning*. Stockholm: Wahlström and Widstrand.
- Hansson, K. F. (1950) *Lundabiskopen Peder Winstrup före 1658. Tillägg: Peder Winstrup som svensk biskop 1658–1679. En utblick*. Lund: Gleerup.
- Johannsen, B. (1988) Om kongelige begravelseskikke på Christian IV's tid. In A. Kruse (ed), *Fru Kirstens Børn. To kongebørns begravelser i Roskilde Domkirke*. Copenhagen: Nationalmuseet, 35–64.
- Johansen, K. (1984) *Pattern drawing, C4s skjorte 2.36, opubl. 6.2.1984*. De danske kongers kronologiske samling, Rosenborg.
- Johansen, K. (2020) *Ti kongers tøj. Tre århundreders kongsdragter på Rosenborg Slott, 1596–1863*. Aarhus: Aarhus Universitetsforlag.
- Jonsson, K. (2009) *Practices for the Living and the Dead. Medieval and Post-Reformation Burials in Scandinavia*. Stockholm: Department of Archaeology and Classical Studies.
- Junker, A. and Stille, E. (1988) *Zur Geschichte der Unterwäsche 1700–1960*. Frankfurt am Main: Historisches Museum Frankfurt.
- Kania, K. (2010) *Kleidung im Mittelalter. Materialien, Konstruktion, Nähtechnik. Ein Handbuch*. Köln: Böhlau Verlag.
- Karsten, P. and Manhag, A. (2017) *Peder Winstrup – historier kring en 1600-talsmumie*. Lund: Historiska Museet vid Lunds Universitet.
- Karsten, P. and Manhag, A. (2018) *Antikvarisk rapport gällande undersökningen av biskop Peder Winstrups kista och mumifierade kvarlevor*. Lund: Historiska Museet vid Lunds Universitet.
- Krünitz, J. G. (1781) *Oeconomische Encyclopädie, oder, Allgemeines System der Staats-Stadt- Haus- u. Landwirthschaft, in alphabetischer Ordnung, Teil 23*. Berlin: J. Pauli.
- Krzewińska, M., Rodriguez-Valela, R., Ahlström Arcini, C., Ahlström, T., Hertzman, N., Storå, J. and Götherström, A. (2021) Related in death? A curious case of a Foetus hidden in bishop Peder Winstrup's coffin in Lund, Sweden. *Journal of Archaeological Science: Reports* 37, 102939, 1–8.
- Lagerås, P. (2016) Från trädgård till grav. Växterna i biskop Peder Winstrups kista. *Ale* 4, 15–28.
- Lipkin, S. and Kuokkanen, T. (2014) Man buried in his everyday clothes – attire and social status in early modern Oulo. *MASF* 3, 40–53.
- Lipkin, S., Vajanto, K., Kallio-Seppä, T., Kuokkanen, T., Niinimäki, S., Väre, T. and van Bommel, M. (2015) Funeral dress and textiles in 17th and 19th century burials in Ostrobotnia, Finland. In K. Grömer and F. Pritchard (eds), *NESAT XII. Aspects of the Design, Production and Use of Textiles and Clothing from the Bronze Age to the Early Modern Era*. Budapest: Archaeolingua, 209–221.
- Lipkin, S., Ruhl, E., Vajanto, K., Tranberg, A. and Suomela, J. (2021) Textiles: Decay and Preservation in Seventeenth- to Nineteenth-Century Burials in Finland. *Hist Arch* 55, 49–64.
- Löwengren, Y. (1962) *Balsameringsbruket genom tiderna*. Stockholm: Nordstedt.
- North, S. and Tiramani, J. (2011) *Seventeenth-century Women's Dress Patterns. Book One*. London: V&A Publishing.
- Nuñez, M., Paavola, K. and García-Guixé, E. (2008) Mummies in Northern Finland. In P. Atoche Peña, C. Rodríguez Martín, Á. Ramírez Rodríguez and A. C. Aufderheide (eds), *Mummies and Science, World Mummies Research, Proceedings of the VI World Congress in Mummy Studies*. Tegui, Lanzarote, February 20th to 24th, 2007. Santa Cruz de Tenerife: Academia Canaria de la Historia.
- Nyberg, J. (2010) A peaceful sleep and heavenly celebration for the pure and innocent. The sensory experience of death during the long eighteenth century. In F.

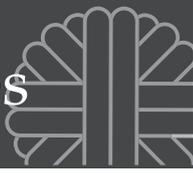


- Fahlander and A. Kjellström (eds), *Making Sense of Things: Archaeologies of Sensory Perception*. Stockholm: Stockholm University.
- Nyberg, J. (2013) 'O himmels gyllne pracht'. Familjen Brahe och stormaktstidens adliga begravningar. In R. Gullbrandsson (ed), *Grevars och bönders tempel. En bok om Brahekyrkan på Visingsö*. Jönköping: Jönköpings Läns Museum, 257–274.
- Nylén, A.-M. (1948) Stureskjortorna. *Livrustkammaren IV* (8–9), 217–276.
- Peacock, E. E. (2007) Study of Archaeological Textiles Intimately Associated with Human Remains – Where Is the Ethical Dilemma? In A. Rast-Eicher and R. Windler (eds), *Nesat IX Archäologische Textilfunde – Archaeological Textiles*. Ennenda: Ragotti and Arioli Print, 12–16.
- Pylkkänen, R. (1955) *Gravdräkter från 1600-talet I Åbo domkyrkomuseum*. Åbo stads historiska museums årsskrift, 17–18.
- Pylkkänen, R. (1998 [1970]) *Barockmodet i Finland 1620–1720*, Stockholm. Unpublished translation of *Barokin pukumuoti Soumessa 1620–1720*. Helsinki: Suomen muinaismuistoyhdistys.
- Rangström, L. (2015) *Dödens teater. Kungliga svenska begravningar genom fem århundraden*. Stockholm: Atlantis och Livrustkammaren.
- Rørdam, H. F. (1905) *Dansk biografisk lexikon XIX*. Copenhagen: Gyldendalske Boghandels forlag.
- Sanders, H. (2012) Peder Winstrup och Knut Hahn: två kyrkomän och deras tid. In S. Skansjö (ed), *Lunds historia – staden och omlandet. 2. Tidig modern tid. I en bördig bygd (1536–1862)*. Lund: Lunds kommun.
- Skansjö, S. (2012) *Lunds historia – staden och omlandet. 2. Tidig modern tid. I en bördig bygd (1536–1862)*. Lund: Lunds kommun.
- Tarlow S. (1999) *Bereavement and Commemoration. An Archaeology of Mortality*. Oxford: Blackwell Publishers.
- Tarlow S. (2011) *Ritual, belief and the dead in Early Modern Britain and Ireland*. Cambridge: Cambridge University Press.
- The Workwoman's Guide* (1838) by A Lady, London: Simpkin, Marshall and Co.
- Troels-Lund, T. F. (1984) *Att dö i Norden. Föreställningar om livet slut på 1500-talet*. Stockholm: Författarförlaget.
- Ullgren, P. (2004) *Lantadel: adliga godsägare i Östergötland och Skåne vid 1600-talets slut*. Lund: Sisyfos.
- Wallin, C. (1951) *Gravskick och gravtraditioner i sydöstra Skåne*. Stockholm: Svenska kyrkans Diakonistyrelses Bokförlag.
- Vedeler, M. (2010) Dressing the Dead: Traditions of Burial Costume in Rural Norway. In E. Andersson Strand, M. Gelba, U. Mannering, C. Munkholt and M. Ringgaard (eds), *North European Symposium for Archaeological Textiles X. Ancient Textiles Series 5*. Oxford: Oxbow Books, 254–258.
- Vincent, S. (2003) *Dressing the elite. Clothes in Early Modern England*. Oxford: Berg.
- Väre, T., Lipkin, S., Suomela, J. A. and Vajanto, K. (2021) Nikolaus Rungius: Lifestyle and Status of an Early Seventeenth-Century Northern Finnish Vicar. *Hist Arch* 55, 11–29.

#### Internet sources

- The Royal Armoury, Statens Historiska Museer database, available at <https://emuseumplus.lsh.se> (accessed 17 May 2022)
- Shirt probably worn by Queen Christina as child, 1628, inv. 9379 (4323)
- Shirt worn by Karl XII, 1718, inv. 20875 (3466)
- Shirt worn by Gustav II Adolph at Kleinwerder, 1624, inv. 31196 (3380)
- Shirt worn by Gustav II Adolph at Dirschau, 1627, inv. 31197 (3382)
- Three shirts worn by Gustav II Adolph at Lützen, 1632 inv. 31120 (3383:a), 31121 (3383), 31122 (3383)
- Shirt worn by Amiral Claes Hansson Bielkenstierna, 1659, inv. 21454 (5793:1)
- Shirt worn by Gustav III, 1792, inv. 31187

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Katherine L. Larson and Marta Kløve Juuhl

# Norwegian double-cloth: warp-weighted loom experiments in a complicated technique

## Abstract

The Norwegian reversible double-cloth tradition, known in areas of Scandinavia from the Viking Age to the Early Modern Era (eighth to 18th centuries), disappeared before it could be documented. Evidence indicates that surviving double-cloth coverlets were woven on the warp-weighted loom, raising the question of how the loom was utilised to produce these relatively complicated textiles. Building upon a prior study, experimentation in the width of a coverlet was conducted to determine the interaction between weight-row disposition and adequate shed formation, utilising four weight-rows placed in four separate configurations. Best results for shed formation were achieved with all rows behind the shed rod, but with the forward two rows attached to the shed rod at regular intervals. Heddle length was shown to impact both shed formation and pattern transfer, and heddle length together with weight-row placement revealed potential problems in accessing shed openings past the loom uprights.

**Key words** Warp-weighted loom, double-cloth, experimental, weights, heddles, coverlets, Norway

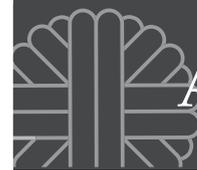
## Introduction

The warp-weighted loom, an ancient weaving implement known in Europe from as early as the 6th to 7th millennia BCE (Barber 1991, 93), was thought to be extinct by scholars of the early 20th century (Crowfoot 1936/37, 38). However, it actually survived into the 20th century in Norway, where two weaving traditions were thoroughly documented (Hoffmann 1964). In both cases the loom was used for weaving weft-faced plain-weave coverlets. A less recognised source of information about the warp-weighted loom can be found in a third group of coverlets woven in a more complicated technique, the reversible double-cloth coverlets of northern Gudbrandsdal. The double-cloth tradition, described in numerous studies, has medieval antecedents in both Norway and Sweden (Sylwan 1928; Franzén and Nockert 1992), and survived into the 17th and possibly 18th centuries in central Norway (Engelstad 1952; 1958; Hoffmann 1958; 1964). Because the most recent reversible coverlet tradition disappeared before the technique could be

documented, the exact method by which these textiles were woven is not known. Yet the relatively recent date of the tradition means that a sizeable group of textiles exists, many of which are in excellent condition.

Reversible double-cloth is a technique that allows free-form patterning. In the Norwegian tradition, it was created with two plain-weave warps that were placed on the loom at the same time and woven concurrently, each with its own weft. Light and dark contrasting colours were typically chosen for the two webs, wefts were woven alternately into the front and back layers, and patterns were created when corresponding warp threads in the two warp layers were exchanged. This produced light patterns on a dark background on one side of the developing web, and identical dark patterns on a light ground on the reverse (fig. 1).

A recent study of the 17th to 18th century Norwegian double-cloth tradition (from which approximately 80 coverlets survive, most held in the collections of the National Museum of Art, Architecture and Design, Oslo; Maihaugen Museum, Lillehammer; and the

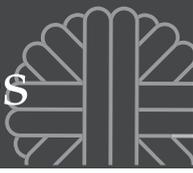


National Museum of Decorative Arts and Design, Trondheim) established that these textiles were woven on the warp-weighted loom (Larson 2015, 201–206). Details within the weave structure were investigated to determine what they might reveal about loom function

and/or weaver practice. These observations were combined with, and lent support to, experimentation on the warp-weighted loom to determine an effective method for weaving reversible double-cloth. A number of loom parameters were deduced from details in the



Fig. 1: Norwegian double-cloth coverlets are characterised by repeating patterns. Light and dark webs, with weft-stripping in varying colours in the dark web, created light patterns on a dark background on one side and the reverse on the other. Accession number SS-02039, Maihaugen Museum; width 151 cm, length 160 cm (Image: Tone I. Egge Tømte, Maihaugen)



coverlets and from trial-and-error experiments, the latter of which clarified the challenge of warp-thread passage between two plain-weave layers (clear shed formation was impacted by the continual need to pass one layer through the other when bringing each to the front of the loom; the Norwegian double-cloth structure, a dense, balanced plain-weave in both webs, with slightly more warps than wefts per centimetre, contributed to the challenge). Despite these inherent problems, a successful method for weaving double-cloth was proposed in a recent study (Larson 2015, 207–219). However, one element of this result has been called into question.

The method at issue indicated that a slight fanning of the warp threads improved warp-thread passage between forward and back-layer warp threads. This method was inspired by findings from a study that experimented with weight-rows wider than the warp being woven, with the intent of determining possible impacts on the developing textile: despite some unevenness in the resulting textile's warp-thread spacing, edges of the weaving remained straight and shed changes were easy due to the slight fanning effect from the wider weight-rows (Mårtensson et al. 2009, 385). Although the warp fanning described in that study was an effect and not intended as a methodology, it suggested a method of expanding the weight-rows to improve warp passage that was found to be effective for weaving double cloth (Larson 2015, 179). No irregularities were noted in the double-cloth textile that was produced (30 cm in width), possibly because weight-rows were not crowded but held separate by their spacing chains, and the method was proposed as a possible element in weaving double-cloth.

Four of the six surviving medieval double-cloth textiles have a width of 30.5 cm or less (Franzén and Nockert 1992, 64–66; Engelstad 1958, 111), and thus it seems possible that the relatively simple warp-fanning method may have been used for weaving these narrower decorative textiles. However, in a subsequent study of double-cloth weaving at a wider width (80 cm) it became evident that the warp-fanning method would not have been effective in a coverlet-width textile. Warp fanning did not extend to the innermost warp threads, and attempts to increase the expansion of the weight-rows caused selvedge distortion (Larson 2019). The widths of surviving double-cloth coverlets range from 123 cm to 175 cm, with an average of 145 cm (Engelstad 1958, 111–113; Larson 2011, 150). The current study was therefore undertaken to determine how shed formation might be improved for weaving reversible double-cloth at coverlet width. With many loom-setup factors already supported by observations

from surviving coverlets and by experimentation in the earlier study, the element that seemed most promising for achieving better loom function was the disposition of the weight-rows. Accordingly, the current study was designed to test four possible weight-row configurations.

### Methodology

In designing this loom-function study, guidelines presented by the *Tools, Textiles, Texts and Context* (TTTC) research programme were followed where possible (Olofsson et al. 2015, 77). The exceptions were: tools were not precise copies of archaeological (or in this case ethnographic) originals, since physical evidence of the warp-weighted loom in northern Gudbrandsdal, aside from the textiles themselves, is lacking (Hoffmann 1958, 154); materials for the study were commercially available yarns, as discussed below; experimentation by two skilled craftspeople, while part of the original design, was prevented by the pandemic; and products were not evaluated by independent experts since testing loom function, not the products produced, was the goal of the study.

With the exception of the warp-fanning method described above, the basic configuration for weaving a coverlet-width warp drew on conclusions from the earlier study.

### Loom setup

The following elements were used in the test loom:

- Four heddle rods, two for each warp layer
- Two pairs of heddle-rod-supports, each holding the heddle rods for one layer
- Forward-layer heddle rods positioned on the upper pair of supports, back-layer heddle rods on the lower supports
- Four weight-rows, two for each layer
- Weights of 1 kg each, with 15 warps per bundle and a weight per thread of 66 g

### Weaving double-cloth: two processes

The method for weaving double-cloth followed that proposed in the prior study as well. In brief, two nearly identical processes separated pattern and background warps in one layer so that the opposing layer could be woven. When the process in one layer was completed, it was then repeated in the other with roles reversed.

Three steps were required in each of these processes:

1. Separation of pattern vs. background warps in one layer with a pattern stick, which then held the selection temporarily at the top of the weaving area; this separation was accomplished by either making a selection with a pattern stick (first use)



or transferring a stored selection from the lower warp threads into the weaving area (subsequent uses, described below)

2. Opening a weaving shed in the opposing layer
3. Bringing the pattern stick down near the heddle rods, with pattern warps held in front and background warps falling behind, thus transforming the weaving shed into the pattern shed for insertion of the weft

Steps in each process were the same but with warp designations reversed: pattern warps in one layer were considered background warps in the other.

Sheds were opened at the front of the loom for pattern weaving (fig. 2). Opening the two front-layer



Fig. 2: Pattern sheds are formed at the front of the loom when weaving double-cloth: a forward-layer pattern shed is open immediately behind the pattern stick; back-layer pattern warps (gold) are held on the pattern stick in front of the open shed (brown warps); back-layer background warps (gold) remain behind (Image: Katherine Larson)

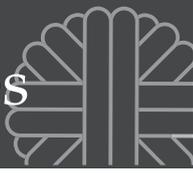
plain-weave sheds was relatively straightforward; in contrast, warps for each back-layer plain-weave shed had to travel through front-layer warps to present a shed for weaving (Larson 2015, fig. 2). In addition, the entire back-layer warp was regularly brought to the front of the loom to allow pattern selection.

#### *Pattern storing*

After a new row of pattern was selected in the weaving area, it was stored in the lower warp threads of each layer above the spacing chains. Transfer of the pattern up and down through the heddles was accomplished by using pattern boards measuring 152 cm long by 6 cm wide. Used in pairs, one board opened the shed sufficiently to allow the second to be inserted above (or below) the heddles.

Transferring pattern in the forward-layer warps was a straightforward process given its location at the front of the loom; transferring pattern that was stored in the lower back-layer warps to the weaving area at the front of the loom required several additional steps (Larson 2015, fig. 7). Two methods for the latter were tested, each of which required the back-layer heddle rods to be brought forward but at different times. The first involved transferring the pattern up the back warp through the heddles, then bringing it forward into the weaving area by pulling forward the back-layer heddle rods (“up/forward”): when the back-layer warp was pulled forward, back-layer warps held in front of the pattern board travelled through the front-layer and were saved on the pattern stick; warps held behind remained behind. The second method required first transferring the pattern from the back-layer warp threads forward below the heddles and then bringing it up to the weaving area (“forward/up”): the back-layer heddle rods were pulled forward at the start for this method, at which point the pattern board that held the stored pattern at the back of the loom was turned on its side, causing the pattern shed to appear in front of the front-layer warps in the constrained area immediately below the heddles. From there it was saved on a pattern board and, after releasing the back-layer heddle rods to remove tension on the warp threads, the pattern was transferred up through the heddles (in this case, both forward- and back-layer heddles) to the weaving area, where it was saved on the pattern stick.

Pattern storing, normally problematic on the warp-weighted loom due to its divided warp, was shown to be an effective method for weaving double-cloth in the prior and current studies, where all tested weight-row configurations relied on heddle rods rather than the shed rod to create a shed. This use of pattern storing

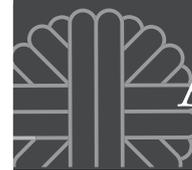


was based on strong indications of the practice that were observed in both the medieval and more recent double-cloth traditions (errors repeated for an entire row of pattern; Larson 2015, 186). Evidence of the logical next step was more elusive: storing multiple

rows of pattern for use in reverse order to create a symmetrical pattern. However, because storing multiple rows greatly simplified pattern selection, which was the most time-consuming part of the weaving process, and because approximately three



Fig. 3: Establishing the coverlet-width warp at Osterøy Museum: a – sewing the warp to the beam; b – separating warp threads to apply the first row of weights and spacing chain; and c – beginning pattern weaving (Images: Katherine Larson)



quarters of the coverlets recorded in the prior study contained symmetrical patterns (Larson 2011, 302–307), this practice was tested in the current study. Thin sticks for storing multiple rows of pattern (in addition to the active pattern, stored on the pattern boards) had been successfully used for storing several rows of double-cloth pattern at narrower widths (Larson 2018), but this practice rapidly began to interfere with shed formation at the wider width of the current study. Replacing these sticks with loosely inserted cords, which removed possible interference the sticks caused with adequate warp tension, proved successful for storing up to 13 rows of pattern. Access to both the front and back of the loom in the current study allowed storage of multiple rows in both layers, a significant saving in effort when weaving the second half of a symmetrical pattern. In a loom situated against a wall, storing multiple rows in just the forward layer would still simplify the pattern-selection process: in the current study, selection in one layer was regularly used as a template for selection in the other (a reduction in effort and in the rate of errors); thus, storing multiple rows in the forward layer alone would be beneficial.

### Materials

The same materials as those used in the prior study were selected for the coverlet-width warp: *Hillesvåg Frid tynt vevgarn*, a blend of spælsau wool and hair (Larson 2015, 207–215). Use of the blended yarn was an approximation of what was considered typical of Scandinavian double-cloth, that is, a colourful wool layer vs. a layer of smoother warp. Surviving double-cloth textiles indicate that the choice of a smoother material evolved over time in Scandinavia. All surviving medieval textiles were woven with a wool layer vs. a (smooth) layer of linen (Sylwan 1928, 38), but based on observations in the later tradition, the Norwegian coverlets appeared to have a wool layer vs. a (smooth) layer of predominantly hair, tightly spun. Among other evidence observed in the earlier study, warp ends exposed as a fringe in one coverlet (the fringe likely reflecting a later usage) exhibited a sharp contrast: one layer retained its twist, while the twist in the other was markedly diminished (Larson 2015, 180).

In addition to a smooth-fibre layer, it is possible that warp passage in the double-cloth coverlets was aided by the use of a sizing material. Without any evidence of such use, however, and given the apparent importance of a smooth-fibre layer in surviving textiles, sizing was not tested in the current study.

Obtaining an all-hair yarn as a smooth-layer material was not possible for either the prior or current study,

and therefore two semi-smooth layers of wool/hair blend were substituted. However, recognising the importance of warp passage in a test of double-cloth methods, this choice of materials was revisited in the current study. A smaller fibre-test warp was designed as part of the larger study to compare three fibre options: a wool/hair blend in both layers (semi-smooth vs. semi-smooth); linen (smooth) in one layer vs. pure wool (fuzzy) in the other, using *Klippan Yllefabrik Tuna 7/2*; and linen (smooth) in one layer vs. a wool/hair blend (semi-smooth) in the other.

### Setting up the test warps

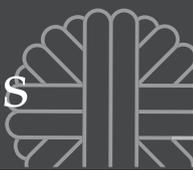
Weaving of the coverlet-width warp was conducted on two looms of approximately the same size and slant. The warp was set up and weaving begun at Osterøy Museum in Norway (fig. 3), and then the warp was transferred to a weaving studio in the Seattle area in the United States. The smaller fibre-test warp was woven on a slightly narrower loom in the Seattle studio. Initial plans for two weavers to work together in both locations were prevented by the pandemic. Experimentation by one author continued, as did discussion of results between authors.

### Coverlet-width warp

The coverlet-width warp was 125 cm in width and held on a heading cord with 6 warp threads per cm in each layer and both layers arranged alternately on the heading cord. Space between the warp and the loom uprights was approximately 15 cm on each side. Spacing chains were knitted around pairs of warp threads (based on paired warps from the warping process) and an empty loop was knitted between each pair, except between neighbouring weight bundles (thereby reducing the tendency for bundles to separate). Chains were knitted in each half of each plain-weave layer, a total of four chains. Although the warp was initially weighted with sandbags (Osterøy), these were soon replaced with coin-bag weights (Seattle) that were 4 cm to 6 cm in thickness. The resulting weight-rows were 124 cm before spacing chains were attached to the uprights, 127 cm after chains were slightly stretched to do so.

### Fibre-test warp

The smaller fibre-test warp was 68 cm in total width, with space between the warp and the uprights of approximately 14 cm on each side. The warp was actually comprised of three separate 22 cm wide sections with a 1 cm gap between the sections. In all other respects (aside from 3 individual weft treatments corresponding to the warp fibre in each section), these



three sections were treated as one warp, following the same parameters of the coverlet-width warp regarding spacing of warp threads, size and arrangement of weights and weight-rows, knitting of spacing chains, number and placement of heddle rods, and knitting of heddles.

### Heddle length

The importance of heddle length when weaving double-cloth was not fully recognised at the beginning of the current study. In the earlier study, results had been effective with uniformly sized heddles measuring 11 cm from heddle “nose” to heddle rod, but heddle tangling had been noted as a problem with the forward-layer warp threads (Larson 2011, 230). Double-notched heddle-rod supports, known from medieval finds in Trondheim (Nordeide 1994, 230), have been described as a possible implement used for weaving twill on the warp-weighted loom (Batzer and Dokkedal 1992), and these varying cleft distances (or rather the use of blocks on the heddle-rod supports to mimic the same) were considered as a possible solution for slack heddles. However, this idea receded in importance when the warp-fanning method was applied in the earlier study and heddle tangling was no longer an issue.

In the current study, the coverlet-width warp was initially set up with heddles of the same length as in the earlier study, and a return to the idea of double-notched heddle rod supports (as before, using blocks to remove slack in the heddles) was envisioned as a first step. Significant heddle tangling ensued, however, and it was noted that heddles that were merely held forward (that is, without visible slack) but not held taut by their warp threads still had a tendency to tangle. Shortening the forward-layer heddles seemed like a reasonable next step.

In a small interim study conducted during the hiatus when the coverlet-width warp was moved from Osterøy to Seattle, it was noted that heddles (in either layer) that were too short risked impeding the passage of the stored pattern up and down through the heddles (Larson 2020). Therefore, when the coverlet-width warp was put back on the loom in Seattle, forward layer heddles were shortened to 8.5 cm, a length that held the heddles taut but still allowed sufficient leeway for passage of the pattern shed, and back-layer heddles were lengthened to approximately twice that size, 16 cm, a distance that similarly held those warps taut and slightly forward of plumb, but still allowed pattern transfer in that layer as well (it should be noted that these lengths were based on the slant of the Seattle loom, approximately 75°).

The revised heddles in the coverlet-width warp remained constant throughout the remainder of the study, with all tests of weight-row configurations utilising these sizes. Heddle lengths for the fibre-test warp conformed to the revised sizes. The approximation of optimal heddle lengths occasionally called for additional measures in both the coverlet-width warp and the fibre-test warp: inserting blocks to hold the heddle rods away from the uprights or adjusting cleft distances from the uprights. These slight adjustments corrected for the varying location of the forward-layer warps.

### Weight-row configurations

Four weight-row configurations were tested on both the coverlet-width warp and the fibre-test warp, each involving a different placement of the two forward-layer weight-rows (fig. 4): configuration 1, in front of the shed rod; configuration 2, straddling the shed

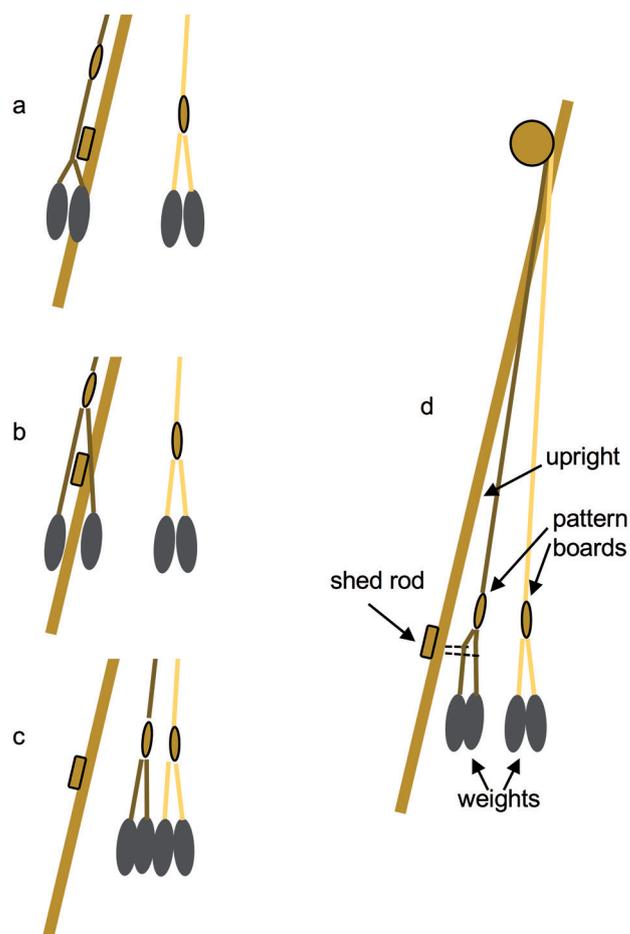


Fig. 4: Simplified view of forward-layer weight-row configurations (spacing chains, located beneath the pattern boards, are not shown): a – configuration 1; b – configuration 2; c – configuration 3; and d – configuration 4 (Image: Katherine Larson)

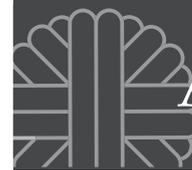


Fig. 5: Weight-rows in the coverlet-width warp, configuration 4: the two forward-layer rows are attached by their spacing chains to the shed rod; a pattern board is stored in the warp threads above (Image: Katherine Larson)

rod (one row in front, one behind); configuration 3, behind the shed rod (hanging straight from the beam); and configuration 4, behind the shed rod (held forward by attachment to the shed rod). Note that in configuration 2, the pattern board stored in the lower warp threads of the forward layer effectively kept the two weight-rows of the forward layer close to one another and to the shed rod. Note also that in configuration 4, the spacing chains above each of the two forward weight-rows were attached to the shed rod with approximately 3 cm separating the shed rod from the attachment points of the foremost row and 3 cm separating the foremost row from the second row (fig. 5). These attachments separated the forward and back-layer weight groups by approximately 10 cm. In the coverlet-width warp, the attachments created five gentle arcs of approximately 25 cm in width, measured in a straight line between attachment points; three arcs of similar size were formed in the smaller fibre-test warp. In all four configurations, the back-layer weight-rows remained hanging straight from the beam.

### Findings

Tests of the four weight-row configurations in the coverlet-width warp were assessed based on how well the loom functioned for the three basic steps in each of the two double-cloth processes (table 1). In the fibre-test warp, tests of the same four weight-row configurations were evaluated according to the occurrence of errant warp threads in the sheds, which clarified the effect of fibre content in double-cloth layers while comparing its importance relative to weight-row configuration. Other factors emerged as a

result of the two test warps, notably the importance of warp layer position relative to the uprights and the related relevance of heddle length in arriving at a workable loom configuration.

### *The coverlet-width warp*

Several general comments regarding the steps in each process and the basis on which they were evaluated will clarify the analysis:

Step 1: Transferring the pattern in the two processes encountered different problems. For the forward layer, pattern sheds during transfer were not impacted by errant warps; instead, interference from heddle size or from the uprights was noted. For the back layer, varying degrees of success in transferring the back-layer pattern warps through the front layer were noted, in other words in forming a shed large enough or clear enough to receive a pattern stick (or pattern board in the forward/up method) at the front of the loom.

Step 2: Weaving sheds were assessed as very small (1 cm or less), small but adequate (1 cm to 3 cm) and comfortable (3 cm or more).

Step 3: Pattern sheds were assessed using the same size characterisations as those for weaving sheds, and any difficulties in bringing the pattern stick down towards the heddle rods were noted. In both processes, once the pattern shed was opened, enlarging the shed with a pattern board turned on its side was found to be an effective practice. This both provided a platform for sliding the weft bobbin through the shed with the help of a long stick, and regulated the size of the shed, allowing the weft to be more evenly arranged. A common occurrence in step 3 of the second process in all configurations was the need to clear errant warps from the pattern shed. This was easily and quickly accomplished by flexing the pattern stick at the front of the open shed, a simple practice reminiscent of the shed-clearing process described in weaving Icelandic twill, where a stick was left in the warp for that purpose (Gudjónsson 1990, 171).

Each of the four weight-row configurations exhibited some difficulties, although configuration 4 clearly was the most effective. Nonetheless, findings can be grouped into two categories according to similarities in results: configurations 1 and 2, with weight-rows in front of (or straddling) the shed rod, and configurations 3 and 4, with weight-rows behind (or attached in arcs to) the shed rod.

### *Configurations 1 and 2*

These two configurations, with their close proximity to the shed rod, had very small pattern sheds in both



the forward and back-layer processes. Additionally, there were problems with the back-layer sheds, both in opening a weaving shed at the front of the loom (pulling forward one heddle rod) and in clearing the entire back warp to the front of the loom during pattern transfer (pulling forward two heddle rods). In these steps in both processes, it was noted that forward-layer heddles jammed or tangled, impeding the opening of the back-layer shed at the front of

the loom. A contributing factor may have been the inability to fully correct for slightly slack heddles in these configurations (with blocks and/or cleft distance changes), but it is worth noting that correcting this issue by further shortening the heddles would risk impeding pattern transfer upwards through the heddles.

In configuration 1, the position of the warp relative to the uprights hindered forward-layer pattern transfer,

Configuration	Process	Steps	Notes on loom function
1. In front of shed rod	Select FL/ weave BL	Transfer pattern	Hindered by uprights
		Open weaving shed	Difficult to open, forward-layer heddles tangled
		Open pattern shed	Very small shed
	Select BL/ weave FL	Transfer pattern	Forward/up and up/forward both problematic due to difficulty clearing back-layer shed forward
		Open weaving shed	(impossible to continue)
		Open pattern shed	“ “
2. Straddling shed rod	Select FL/ weave BL	Transfer pattern	No problem
		Open weaving shed	Difficult to open, forward-layer heddles tangled, comfortable shed once cleared
		Open pattern shed	Very small shed, clear
	Select BL/ weave FL	Transfer pattern	Up/forward very difficult; forward/up possible with added effort (plucking pattern threads for transfer forward)
		Open weaving shed	Comfortable shed, clear
		Open pattern shed	Very small shed, clear after flexing pattern stick
3. Behind shed rod	Select FL/ weave BL	Transfer pattern	Hindered by forward-layer heddles
		Open weaving shed	Comfortable shed, heavy to open
		Open pattern shed	Easy to bring pattern stick down, minimal clearing
	Select BL/ weave FL	Transfer pattern	Forward/up: forward no problems, transfer up hindered by forward-layer heddles
		Open weaving shed	Adequate shed, heavy to open; improved by reducing cleft distance to uprights
		Open pattern shed	Difficult to bring pattern stick down; improved by reducing cleft distance to uprights, shed clear after flexing pattern stick
4. Behind shed rod, attached in arcs	Select FL/ weave BL	Transfer pattern	No problem
		Open weaving shed	Comfortable shed
		Open pattern shed	Comfortable shed after minimal clearing
	Select BL/ weave FL	Transfer pattern	Forward/up, no problems
		Open weaving shed	Comfortable shed
		Open pattern shed	Adequate shed, somewhat difficult to open, clear after flexing pattern stick

Table 1: Observations from varying configurations of two forward weight-rows relative to the shed rod. Notes: FL = forward layer; BL = back layer



while severe difficulties in back-layer pattern transfer using either the forward/up or up/forward method made the second process impossible to complete. Without the ability to bring pattern from the back-layer warps forward to the weaving area, testing in configuration 1 was discontinued.

In comparison, configuration 2 functioned better overall despite its similarly small (but clear) pattern sheds: where forward-layer pattern transfer had been hindered by the uprights in configuration 1, it was unobstructed in configuration 2, and while transferring the back-layer pattern up/forward was not possible in configuration 2, the alternate method of forward/up did work, albeit with extra effort (the back-layer pattern shed only partially appeared through the forward-layer warp below the heddles, requiring pattern warps to be plucked forward to receive the pattern board). However, the combination of very small sheds and difficulties in clearing the back-layer warp threads forward made configuration 2 problematic as well.

#### *Configurations 3 and 4*

These two configurations, both behind the shed rod but to varying degrees, had adequate to comfortable shed sizes. However, several significant problems that were noted in configuration 3 were largely removed in configuration 4.

In configuration 3, adequate to comfortable weaving and pattern shed sizes were impacted by other problems. Heddle rods for both layers were heavier to move, with the feeling of excessive weight especially noticeable when pattern boards (holding open a shed during pattern transfer or for weft insertion) regularly snapped shut. In addition, pattern transfer was hindered by short forward-layer heddles that restricted the size of the transfer shed for both processes.

The issue of heddle size identified two other problems in the second process of configuration 3 that highlight the interplay of warp position, heddle length and the uprights. First, forward-layer heddle rods were excessively heavy to pull forward due to both heddle length and the position of the forward-layer warp (further back than in any of the other configurations): one heddle rod engaged the other halfway to the clefts, ultimately pulling the weight of two rows forward when opening a shed (possibly identifying an additional concern with shorter heddles). Secondly, the pattern stick, holding back-layer warps, was difficult to bring down from the top of the weaving area due to the forward angle of the open shed resisting the weight on the pattern stick. Both problems were resolved by a revision in which the cleft distance on

forward-layer supports was halved (from 23 cm to 12 cm). This eliminated the second heddle rod with its added weight from riding forward, and it reduced the angle of the open shed for bringing down the pattern stick. The resulting pattern shed was comfortably sized, but a new problem arose: access to the shed was completely blocked by the uprights. Increasing the cleft distance brought a return of the aforementioned problems, while reducing it further diminished the size of the pattern shed without an appreciable improvement to shed access past the uprights. In addition, the feeling of excessive weight when manipulating the back-layer heddle rods remained. Thus, the initial and revised versions of configurations 3 both experienced significant problems.

Better overall loom function was found in configuration 4, where pattern transfer for both layers was problem free. Furthermore, attaching the forward-layer weight-rows to the shed rod had two effects. First, it provided a separation between the forward and back-layer weight-rows, thus relieving the feeling of excess weight when manipulating the back-layer heddle rods. Second, the arcs formed by the attachment points actually lengthened the overall spread of the warp in the two forward weight-rows, from approximately 127 cm to 145 cm (measured along the curve of the arcs). This was an effect reminiscent of the warp-fanning method described in the prior study. It seems likely that this added length resulted from the latent stretch present in the spacing chains, enhanced to some extent by the empty loops between warp pairs (without such stretching into arcs, the spacing chains remained a neutral presence above the weights).

Weaving sheds in both the back and forward layers were adequate to comfortable in configuration 4, with the forward-layer pattern shed being somewhat smaller than that of the back-layer. This was the result of some resistance to bringing the pattern stick down fully into the weaving area when forming the forward-layer pattern shed in the second process (the pattern shed becomes wider the further down the stick is drawn). This problem was similar to that noted in the second process of configuration 3 but much less severe. It was clear that the angle of the open shed still presented a challenge, being held forward at the same cleft distance as initially used in configuration 3 (23 cm), but resistance to the pattern stick in configuration 4 was lessened due to the separation between forward and back weight-groups in this configuration: the pattern stick was now only working against the resistance of the back two weight-rows rather than the weight of all four rows. Thus, while involving many steps, weaving

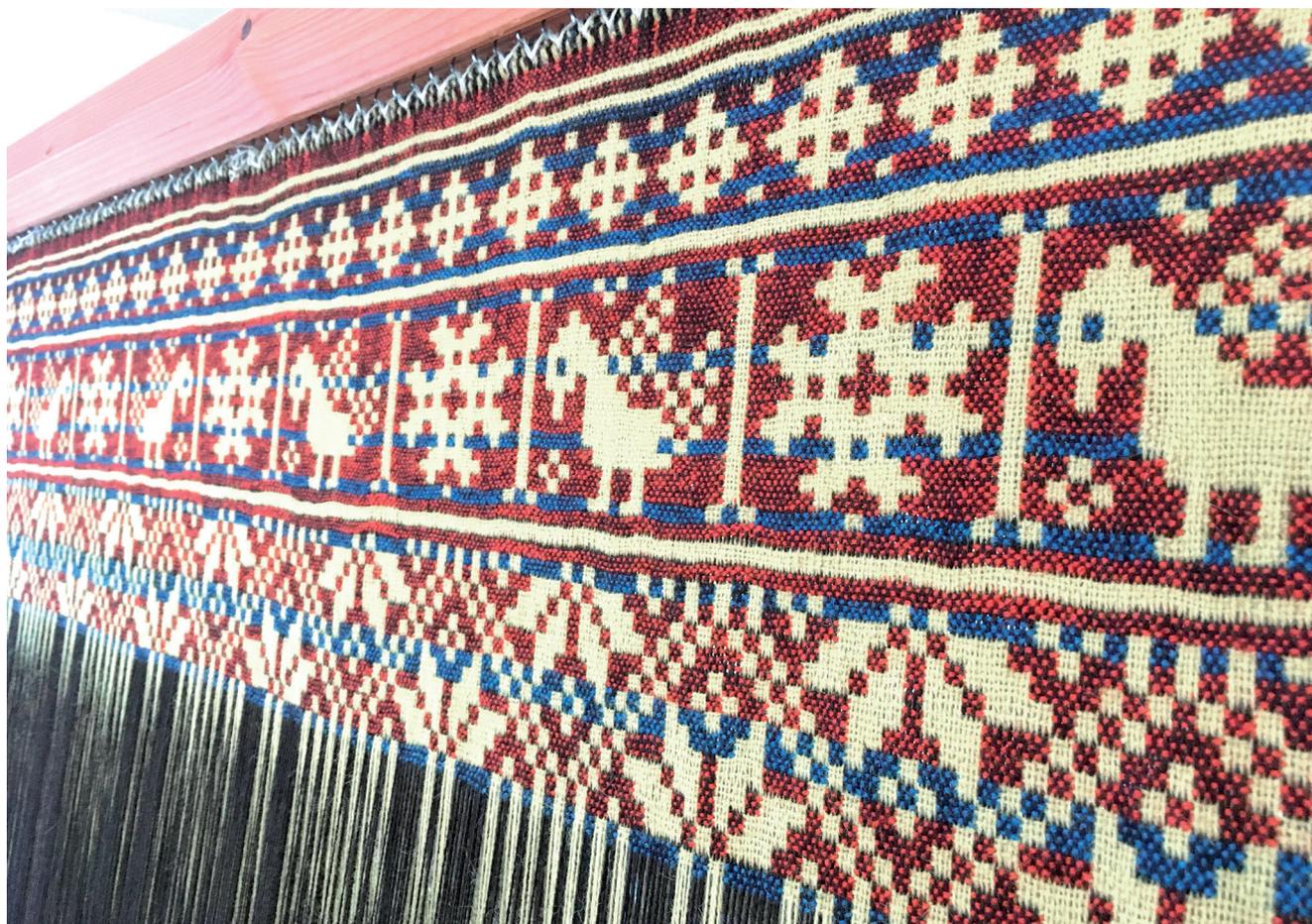


Fig 6: Coverlet-width warp in progress (Image: Katherine Larson)

with configuration 4 fell into a rhythm that was easy to maintain (fig. 6).

*Interaction between the shed openings and the uprights*

The position of the uprights relative to weaving and pattern sheds became an issue in some configurations. From a side view, sheds could occur in front of the uprights, in back of the uprights, or be blocked by the uprights. In most cases the sheds opened in front of the uprights, although in configuration 3 they opened both in front and in back, and were completely blocked when cleft distance was reduced. Pattern transfers upwards from the lower warp threads were more variable, with the uprights blocking transfers for both layers in configurations 1 and 2, transfers occurring in back of the uprights in configuration 3, and both in front and in back of the uprights in configuration 4. Problems arose when the uprights were either very close to the shed opening or when they blocked the opening entirely. In both cases inserting the pattern boards or pattern sticks became difficult but not

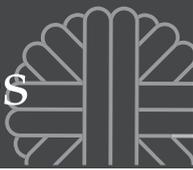
impossible: the implements could be introduced into the shed at an angle and the leading edge of the board or stick depressed from the front of the loom to insure that it followed the shed opening as it was pushed through the shed. However, partial blockage by the uprights did render visual inspection of the sheds for errant warp threads difficult, and complete blockage made visual inspection impossible.

*The fibre-test warp*

Weaving in the smaller fibre-test warp utilised the same four configurations, each with two processes consisting of three steps. Results were primarily judged on how well the warps passed through the opposing layer, with the frequency of errant warp threads characterised as none, several and many. The two side sections, each of which had one layer of linen warp, regularly had a lower number of errant warp threads (generally found to be none or several) compared to errant warps in the centre section, where both layers were a wool/hair blend (generally found to be several or many). This meant that additional shed clearing was required more often in the centre



Fig. 7: Fibre-test warp with a forward-layer weaving shed open (third heddle). Note layer separation close to the pattern stick below the fell: sections with linen-layer warp threads (left and right) cleared opposing-layer warps slightly better than in the blended wool/hair section (centre); observation of errant warps in both left and right sections of this shed: none; in centre section: several (Image: Katherine Larson)



section. In spite of this finding, as weaving progressed it became clear that weight-row configuration had a greater impact on loom function than the fibres being compared: when a loom configuration worked well, the additional clearing required in the centre section was relatively minor compared to those on the sides; when a loom configuration did not work well, results in shed formation were the same across all three combinations of fibres (fig. 7).

Results from the four weight-row configurations in the fibre-test warp supported those found in the coverlet-width warp, and mostly divided into the same two categories. In configurations 1 and 2, the back layer was difficult to pull through the forward layer to form a shed at the front of the loom, both for the steps of opening a weaving shed and for transferring pattern. In configurations 3 and 4, weaving-step results were similar to those in the coverlet-width warp, with comfortable sheds but a feeling of greater weight on the back-layer heddle rods, and with the same exception noted in configuration 3: opening a pattern shed in the second process was difficult, due primarily to the open-shed angle in the forward layer. In contrast, configuration 4 had comfortable sheds and no problems in forming the forward-layer pattern shed by drawing down the pattern stick. The difference in this latter finding to the slight resistance experienced in configuration 4 of the coverlet-width warp no doubt reflects the narrower overall width (and therefore lesser amount of weight resistance) of the fibre-test warp.

### Discussion

The results of this study primarily concern the relative merits of different weight-row configurations for weaving double-cloth on the warp-weighted loom, with ancillary observations on the effects of heddle length. However, two overall impressions from weaving at coverlet width are worth highlighting. First, minor deficiencies in loom function, some of which were barely noticeable at a narrower width, became major and sometimes insurmountable problems at a wider width. Secondly, in the relatively complicated steps required to create this weave structure, adjustments to one element of the configuration affected other elements, making isolation of specific effects a challenge.

#### *Errant warp threads and yarn fibre*

The choice of fibre is a logical place to start discussion of the current study's findings, given the historic importance of a smooth-fibre layer in counteracting the inherent problem of double-cloth, namely two

plain-weave layers attempting to interact in a space best suited to one. A few stray warps were not unusual in most sheds of the coverlet-width warp, and not an unexpected occurrence given the many slight errant-warp weaving errors observed in the coverlets of northern Gudbrandsdal (Larson 2015, 215). Based on results from the fibre-test warp, it seems likely that the number of errant warps experienced while weaving the coverlet-width warp would be reduced if a layer of predominantly hair (tightly spun) were used in one layer, rather than two layers of a wool/hair blend. However, this was considered to be a difference of degree rather than of kind, with the impact on overall loom function unlikely to change.

#### *Weight-rows close to the shed rod*

Weight-row configurations 1 and 2 that placed the forward layer weights in front of or straddling the shed rod had a common problem: the forward-layer warp impeded the basic requirement of pulling the back-layer warp threads to the front of the loom. This step was necessary for opening the back-layer weaving shed in one process, and for bringing the back-layer pattern warps to the front of the loom for weaving the forward-layer weft in the second process. While this ultimately made weaving in configuration 1 impossible, in configuration 2 the problematic sheds could usually be cleared with extra effort, at which point the weaving sheds produced were comfortably sized and the pattern sheds very small but clear. This agreed with results from the prior study, where weight-rows had straddled the shed rod: the method of fanning the warp threads significantly improved warp passage to the point that comfortable weaving sheds were regularly formed (Larson 2011, 225). Although pattern-shed size was not recorded in the earlier study, no problems were noted. It is worth mentioning, however, that a small but clear pattern shed on a narrow textile can be less problematic than on a wider textile.

The similarity between results in the prior study and those noted in configurations 1 and 2 draws attention to the problem of warp-thread passage (resistance of forward-layer warps to the passage of back-layer warps) when the forward layer partially or fully passes over shed rod. It seems possible that a contributing factor to this difficulty may have been a slightly reduced tension on the forward-layer warps, caused by a slightly reduced pull from the weights located below the bearing surface of the shed rod (all front-layer warps passed over the shed rod in configuration 1, half did so in configuration 2).

While other factors not considered in this study could

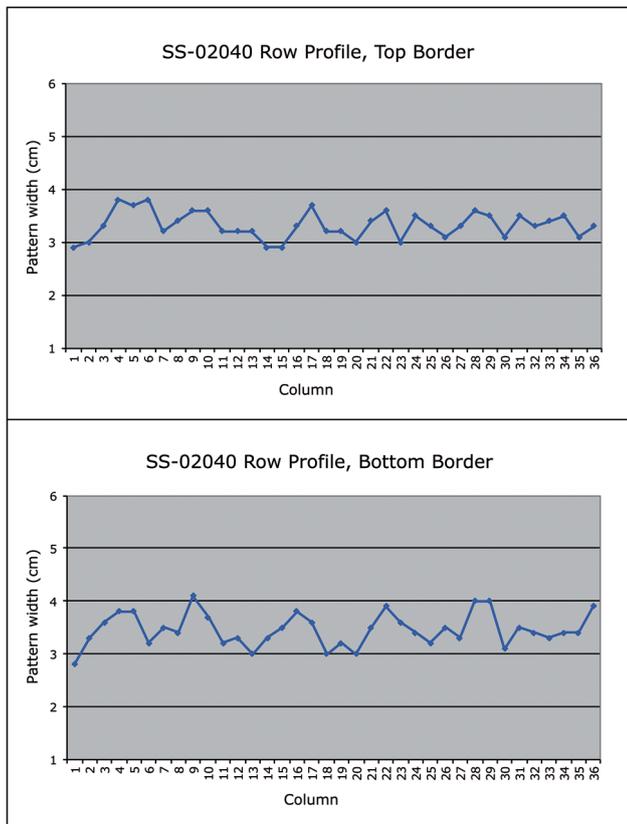


Fig. 8: Graph of warp-thread spacing variability in repeating pattern elements from the top and bottom borders of a double-cloth coverlet. Regularly occurring areas of greater warp-thread spacing grew more pronounced at the bottom of this coverlet (Accession number SS-02040, Maihaugen Museum, Norway; adapted from Larson 2011)

produce different results, it was concluded that the impaired ability to bring back-layer weaving and pattern sheds to the front of the loom made both configurations 1 and 2 unlikely candidates for use by the double-cloth coverlet weavers.

#### *Weight-rows behind the shed rod*

Both warp layers were positioned somewhat closer to one another behind the shed rod in weight-row configurations 3 and 4. A possible negative effect (reduced warp tension) from the warp threads passing over the shed rod was removed, possibly contributing to improved warp-thread passage in both configurations. Adequate to comfortable sheds were possible for each layer, and back-layer pattern transfer was also effective using the forward/up method, a procedure likely to cause less wear on the warp threads than the up/forward method due to the pattern transfer occurring beneath the heddles where the warps were somewhat less constrained (excess wear

on the warp, producing fuzzier threads, appeared to increase resistance to warp-thread passage over time). The main difference between the two configurations was the feeling of excessive weight experienced in configuration 3, which created an impediment to smooth loom function. The excess weight was caused by all four weight-rows hanging together, with back-most rows bearing the weight of their forward neighbours as they were pulled towards the front of the loom. This problem was resolved by separating the two weight-row groups in configuration 4. The extent to which the further slight fanning of the warp threads (held in crescents attached to the shed rods) may have contributed to the ease of shed formation is not clear. While the relatively smooth loom function experienced in configuration 4 might benefit from further testing, this unusual use of the shed rod offered a reasonably effective method for weaving double-cloth at coverlet width on the warp-weighted loom.

#### *The case for a novel use of the shed rod*

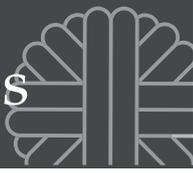
Use of the shed rod as an attachment point for the forward-layer weight groups was the logical final choice in the weight-row configuration sequence of the current study. Other evidence indicates possible reasons for, or results of, such separation.

#### *Wear*

Observations from the coverlets in the prior study indicated that wear on heddles and warp threads may have been a problem, especially in the back layer: weaving irregularities were noted towards the bottom of several coverlets, where back-layer warp threads appeared together out of plain-weave sequence, likely the result of a broken heddle or warp thread (Larson 2015, 184). It is reasonable to assume that the back-layer warps and heddles, regularly pulled further forward to open a shed, and moreover pulled through the opposing layer, experienced greater wear than those in the front layer. Such wear would become more pronounced if all the weight-rows were hanging together, with back layer warps and heddles pulling the added weight of all rows ahead of them. It therefore seems likely that weavers sought to minimise the possibility of wear by separating the two weight groups.

#### *Warp-thread spacing irregularities*

The idea of attaching the forward weight-rows to the shed rod came from contemplation of the possible causes of warp-thread spacing irregularities noted in several coverlets. In a study of overall warp-spacing variability, measurements were taken of small



repeating pattern elements across the width of selected coverlets (Larson 2015, 202). Line graphs of the results showed the general irregularity expected from a textile woven without a reed, but in some coverlets an unusual pattern emerged: among the peaks and valleys of warp-spacing irregularity (representing widely and densely spaced warp threads), some textiles exhibited areas of wider spacing that occurred rather regularly across the textile (fig. 8). After considering possible causes for this phenomenon (among them uneven attachment to the beam and irregular weight-rows), a theory was developed that back layer spacing chains might have been attached to the shed rod in an attempt to reduce wear on back layer warps and heddles; the pull from these attachment points could have increased warp spacing at the spacing chain attachment points, which would then be reflected as warp-spacing irregularities in the textile (Larson 2015, 185). With the realisation in the current study that all weight-rows may have been placed behind the shed rod, the possible cause for these areas of wider spacing was revisited. The shed rod was now envisioned as providing a crosspiece to which the forward weight-rows could be attached at regular intervals, thereby holding them separate from the back rows, but having the same effect on the warp threads as theorised in the prior study: regular areas of wider spacing in the spacing chains and in the textile.

It should be noted that after the spacing chains were attached to the shed rod in the coverlet-width warp, corresponding areas of more widely spaced warp threads did not appear in the textile. This could reflect the various weight-row configurations undertaken while weaving the study textile, but there may be other explanations. It is possible that the coverlet irregularity could have resulted from some unknown factor, weaver practice being one likely possibility. For example, habits of weft insertion and weft packing with a sword beater can produce uneven results that, repeated over time in the same areas of a developing textile, could conceivably produce areas of wider and narrower warp spacing. However, it should be noted that the coverlet weavers seemed relatively adept at maintaining a proper weaving width (Larson 2011, 152–153), a testament to their skill at handling the imprecisions of the warp-weighted loom, and they were thus likely aware of practices that might create further problems.

The lack of warp-thread irregularity in the coverlet-width warp could also reflect the method utilised for knitting the warps in the spacing chains: in pairs separated by empty loops. While this provided even warp spacing, the empty loops between pairs may not

reflect the practice of the coverlet weavers. Moreover, evidence of possible warping methods observed in the coverlets can be interpreted as either two or four strands taken together in each layer (Larson 2011, 142–43). The number of strands can impact the number of warps selected for spacing-chain loops. Four strands, and thus four warps in each loop, would require individual loops to be larger, with less even warp spacing a likely result, and the pull from attachment points on a less-even chain might then have a greater effect on the textile. Further experimentation with this point might demonstrate such an effect, but despite the lack of irregular spacing in the study textile, the effectiveness of separating the weight-rows by attaching the forward group to the shed rod would seem to argue in favour of this being a likely method for achieving weight-row separation.

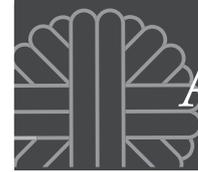
#### *The importance of heddle length*

The adjustment in heddle size undertaken early in the current study resulted in a significant reduction in the problem of heddle tangling. This improved the ability to test the effect of weight-row configurations in creating adequate sheds for weaving double-cloth, which was the goal of the study. However, by clarifying one issue, the adjustment in heddle size revealed the interrelated nature of other aspects of loom setup involved in achieving a workable method for weaving double-cloth. It is possible that a careful calibration of heddle size, cleft distance and loom angle could accommodate the conflicting priorities affecting warp placement relative to the uprights, all of which underscores the preliminary nature of the results presented in the current study.

#### *Heddles and loom angle*

Although variations in loom angle were not tested in the current study, it is possible that adjusting the angle of the loom might improve loom function, but not necessarily shed formation. With the corresponding adjustments to heddle length that a different loom angle would entail, especially keeping in mind the twin constraints of overly long heddles (increased heddle tangling) and overly short heddles (hindered pattern passage through the heddles; both plain-weave weight-rows engaged when pulling forward one heddle rod), it seems more likely that instead of improved shed formation, a different loom angle might allow better access to the sheds past the uprights.

While the loom angle was not changed during the study, the angle of the warp relative to the uprights did change slightly when the beam was advanced for the first time. The textile was wound away from the



weaver, as documented in surviving warp-weighted loom traditions (Hoffmann 1964), but the slightly more slanted angle of the warp relative to the uprights had little effect on performance of the heddles or on shed formation. Its most noticeable effect was a slight improvement in the relationship of shed openings to the uprights.

#### *Heddle length, the uprights and shed visibility*

Within a given weight-row configuration it was noted that the position of the warp layers relative to the uprights was affected by the related factors of heddle length and cleft distance. This was recognised as a problem in the current study due to a loom setup where the weaving width maximised the available loom space. Even when sheds were judged to be accessible in the various configurations tested, they were often quite close to the uprights. This meant that when the sheds were partially or fully blocked, the uprights impeded smooth loom function by complicating insertion of the pattern boards and pattern stick. Although this was not an insurmountable problem, the ability to visually check for errant warp threads was of greater concern, as it impacted the quality of the weaving. This was a simple matter to correct if the sheds were visible, and it prompted further consideration of the conditions under which the coverlets were woven.

This study was carried out in a well-lit environment, which made it easy to detect errant warp threads. In an earlier study (Larson 2016), weaving double-cloth under lower light levels was tested, specifically the conditions found in an open-hearth house, the older



Fig. 9: Weaving double-cloth under the low-light conditions found in an open-hearth house, Osterøy Museum (Image: Katherine Larson)

type of home common in Norway prior to the 17th and 18th centuries (Anker 1998, 81–86). This type of home had a smoke hole in the roof to let smoke escape and daylight enter. The transition to an interior with a chimney and windows occurred unevenly in Norway, but at approximately the same time period that the double-cloth coverlets were woven, leaving open the possibility that the coverlets were woven under the low-light conditions found in such a dwelling. An experiment was conducted in a 16th century hearth-house at Osterøy Museum in Norway to test weaving under those conditions. In the approximately 5 m sq interior of the hearth-house, the loom was placed near a corner to take maximum advantage of daylight from the smoke hole above. Such placement would not be unusual in a small interior, especially considering that pattern boards for weaving a double-cloth coverlet were quite long, and space would be needed to insert them; in other words, significant room was needed on one side of the loom, making placement in or close to a corner likely. Of particular concern in that study was the need to select warp threads for pattern weaving, a necessity made more difficult by the nearly uniform use of dark brown in one layer of the double-cloth coverlets. However, it was found that daylight coming through the smoke hole was entirely adequate for pattern selection, and in fact that the difficulties inherent in close work with dark threads were even aided by light coming from above (fig. 9). Not considered was the weaver's ability to visually check the open sheds in a coverlet that maximised loom space, a necessity recognised in the current study. The hearth-house test warp was relatively narrow (26 cm), which allowed ample space between the uprights and the side of the warp to both insert the pattern boards and to check for errant warp threads. This would not be the case when weaving at coverlet width. Furthermore, the shadow cast by the forward warp threads on the long tunnel of a coverlet pattern shed, plus the likelihood that a brown wood wall was at the far end of that shed, could have made visibility an issue. It thus seems likely that a loom configuration giving the best possible shed visibility may have been an important factor in setting up a loom for weaving double-cloth.

#### *Weight conformation*

Beyond meeting the TTTC-recommended parameters of providing adequate tension on the warp threads and conforming to a weight-row size neither too narrow nor too wide (Olofsson et al. 2015, 88, 92), the shape of the weights themselves was not considered further in this study. However, it was noted that



the two rows within each weight-row group, held together as they were by pattern boards that bridged both halves of each plain-weave warp, tended to mingle with one another. In configuration 4, the most successful weight-row disposition, it would be interesting to consider what effect the loom weights described as typical or “classic” in a medieval context in both Bergen and Trondheim might have on such close weight-rows (Øye 1988, 60–61; Hagen 1994, 214, 335). These generally flat-sided, slope-shouldered weights, usually of soapstone, could be relatively thin, with an average thickness of 3 to 4 cm (fig. 10). Given the close proximity of the two weight-rows inherent in each of double-cloth’s two layers, perhaps thinner weights would perform less like two individual rows and more like a blended single row, with an unknown effect on how the weight-row groups functioned.

### Conclusion

The Norwegian reversible double-cloth coverlets provide an excellent opportunity to consider how the warp-weighted loom may have been used to weave complicated textiles. While the exact method with which double-cloth was woven on the warp-weighted loom cannot be known, this study has described positive and negative aspects of various weight-row configurations and determined a configuration that worked well for weaving at coverlet width.

Despite the apparent simplicity of the loom, the study draws attention to the many variables to be considered when weaving double-cloth. It demonstrates how the interplay of these variables can affect the critical element of warp-thread passage in the formation of useable sheds, and identifies the importance of warp position relative to the uprights for both physical and visual access to the sheds. A number of areas for further study are suggested, among them adjustments to loom angle, the possible effect of sizing to improve warp-thread passage, and the use of thinner weights in such close weight-rows. Additional testing of various heddle lengths might also yield better shed access for double-cloth, and determining the exact fibre content of warp threads in surviving coverlets could provide the basis for further experimentation with more exact materials.

Perhaps the most intriguing finding from this study is the proposed use of the shed rod, not serving in its normal role as a crosspiece to separate the warp into weaving sheds, but instead serving as a crosspiece to provide an attachment point for separating the two double-cloth weight groups. Such a novel approach to using this key element of the loom may represent a flexibility in the way weavers of the past viewed



Fig. 10: Soapstone loom weights from medieval Trondheim, most under 4 cm in thickness. Medieval exhibition, NTNU Vitenskapsmuseet, Trondheim, Norway (Image: Katherine Larson)

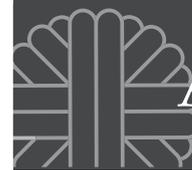
this most basic of utensils. Over the course of the warp-weighted loom’s long history, it is likely that other complicated structures were woven. It would seem that the Norwegian double-cloth weavers, by continuing their use of the warp-weighted loom into the modern era, provide us with an opportunity to consider those past practices, and invite consideration of weaving methods that have long since disappeared.

### Acknowledgements

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### Bibliography

- Anker, P. (1998) *Folkekunst i Norge: Kunsthåndverk og byggeskikk i det gamle bondesamfunnet*. Oslo: J. W. Cappelens Forlag.
- Barber, E. J. W. (1991) *Prehistoric Textiles*. Princeton: Princeton University Press.
- Batzer, A. and Dokkedal, L. (1992) The warp-weighted loom: some new experimental notes. In L. Bender Jørgensen and E. Munksgaard (eds), *Tidens Tand. Archaeological Textiles in Northern Europe, NESAT IV*. Copenhagen: Konservatorskolen, Det Kongelige Danske Kunstakademi, 231–234.
- Crowfoot, G. M. (1936/37) Of the Warp-Weighted Loom. *The Annual of the British School at Athens* 37, 36–47.
- Engelstad, H. (1952) *Refil, bunad, tjeld, middelalderens*



- billedtepper i Norge*. Oslo: Gyldendals Norsk Forlag.
- Engelstad, H. (1958) *Dobbeltvev i Norge*. Fortids kunst i Norges bygder 2. Oslo: Gyldendals Norsk Forlag and Kunstindustrimuseet i Oslo.
- Franzén, A. M. and Nockert, M. (1992) *Bonaderna från Skog och Överhogdal och andra medeltida väggbeklädnader*. Stockholm: Almqvist & Wiksell International.
- Gudjónsson, E. E. (1990) Some Aspects of the Icelandic Warp-Weighted Loom, Vefstaður. *Textile History* 21(2), 165–179.
- Hagen, K. G. (1994) *Profesjonalisme og urbanisering, Profesjonalismeproblemet i håndverket belyst ved et tekstil- og vevloddsmateriale fra middelalderens Trondheim fra 1000-tallet frem til slutten av 1300-tallet*. Oslo: Universitetet i Oslo.
- Hoffmann, M. (1958) *En gruppe vevstoler på vestlandet*. Oslo: Norsk Folkemuseum.
- Hoffmann, M. (1964) *The Warp-Weighted Loom: Studies in the History and Technology of an Ancient Implement*. Studia Norvegica 14. Oslo: The Norwegian Research Council for Science and the Humanities. Reprinted in 1974. Oslo: Robin and Russ Handweavers.
- Larson, K. L. (2011) *Norwegian Double-weave and the Warp-weighted Loom: The Northern Gudbrandsdal Tradition*. Doctoral dissertation. University of Washington.
- Larson, K. (2015) Double-cloth coverlets and the warp-weighted loom: observations and experimental findings. In A. Kjus, K. Skåden and K. Telste (eds), *Kulturgjenstander og gjenstandskultur*. Norsk Folkemuseum Årbok By og Bygd 46. Trondheim: Museumsforlaget, 159–230.
- Larson, K. (2016) Weaving in the dark? Hearth-house weaving on a warp-weighted loom. In R. Andersen and A. O. Martinussen (eds), *The Warp-weighted Loom, Kljåsteinavefstadurinn, oppstadveven* (with contributions from H. Hákonardóttir, E. Johnston, M. K. Juuhl, R. Andersen and A. O. Martinussen). Leikanger: Skald Forlag and Museumsenteret i Hordaland, 242–249.
- Larson, K. (2018) *Pattern storing in double-cloth on the warp-weighted loom*. Unpublished research. University of Washington.
- Larson, K. (2019) *Weaving double-cloth at wider widths on the warp-weighted loom*. Unpublished research. University of Washington.
- Larson, K. (2020) *Testing heddle length for double-cloth on the warp-weighted loom*. Unpublished research. University of Washington.
- Mårtensson, L., Nosch, M-L. and Andersson-Strand, E. (2009) Shape of things: understanding a loom weight. *Oxford Journal of Archaeology* 28(4), 373–398.
- Nordeide, S. W. (1994) Håndverket. In A. Christophersen and S. W. Nordeide (eds), *Kaupangen ved Nidelva*. Trondheim: Riksantikvarens Skrifter (7), 213–241.
- Olofsson, L., Andersson-Strand, E. and Nosch, M-L. (2015) Experimental testing of Bronze Age textile tools. In E. Andersson-Strand and M-L. Nosch (eds), *Tools, Textiles and Contexts: Investigating Textile Production in the Aegean and Eastern Mediterranean Bronze Age*. Ancient textiles series 21. Oxford: Oxbow Books, 75–100.
- Øye, I. (1988) *Textile Equipment and Its Working Environment, Bryggen in Bergen, c 1150–1500*. The Bryggen Papers, Main Series 2. Bergen: Norwegian University Press.
- Sylwan, V. (1928) Svenska dubbelvävnader samt dubbelsidiga vävnader av utländskt ursprung. In A. Branting and A. Lindblom (eds), *Medeltida vävnader och broderier i Sverige*. Stockholm: Almqvist & Wikselis Förlag, 29–52.

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Elsa Yvanez

# Fashioning Sudan.

## Archaeology of Dress along the Middle Nile

September 2022 marked the beginning of a new 5-year project on the archaeology of clothing practices in ancient Sudan and Nubia – *Fashioning Sudan*. Financed by the European Research Council (Starting Grant), *Fashioning Sudan* is housed at the Centre for Textile Research, Saxo Institute, at the University of Copenhagen. The team is composed of archaeologists specialised in archaeological textiles, animal skin/leather, and biochemical methods, together with experts in ancient weaving techniques, illustrations, and digital humanities.

The project uses garments as a privileged medium to reveal past identities, with the aim of bringing new and more representative knowledge about the populations of ancient Sudan and highlighting the entanglement of dress practices in the fabric of society. Our starting point is the acknowledgement that dress practices form a tangible and intimate gateway to past populations and their identities, following an individual from birth to death as a second skin. In ancient Sudan, “dress” includes all manner of body protection and ornamentation, such as clothing made of woven fabric and animal skin, hairstyles, jewellery, tattoos, and scarification (fig. 1). When combined according to specific cultural codes, these elements form “dress practices” functioning as powerful means of non-verbal communication and “dressing” the body into an individual and social persona. These fragile organic materials are exceptionally

well preserved in the dry sands of Sudan and Nubia, especially in funerary contexts where garments were reused to wrap the deceased. Uniting archaeology and the study of cloth cultures, *Fashioning Sudan* will explore how the diverse populations of ancient Sudan purposely selected resources, techniques, forms, and ornaments, weaving their own identities and embedding in their garments their relations to nature and the society.

### The project’s settings and material sources

The project is ambitious in scope, covering c. 4,000 years of Sudanese history, from the Bronze Age to the Late Medieval period (c. 2500 BCE to 1500 CE). This long period is marked by the development of the Kushite culture, which emerged from different basins along the Nile and reached, at its peak, from the southern plains of the Gezira (south of modern Khartoum along the Blue and White Nile) all the way north to Lower Nubia. Over these 4,000 years, the Kushite realm integrated new populations (such as Egyptian settlers, Noba and Blemmyes tribes), changed its centre of power (such as Kerma, Meroe, Dongola) and adopted new religions (such as Pharaonic polytheism, Christianity). Despite these major changes, the Kushite culture seems to have retained its own identity, deeply ingrained in its particular environment and location as the “corridor to Africa”. However, since the beginnings of its archaeological exploration, our understanding of the



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Sudanese past has remained limited to an inadequately rigid and linear historical framework revolving around the homogenous culture of sedentary elites and often limited to binary oppositions (sedentary/farming vs. nomad/pastoral, Pharaonic vs. “African” influences, external imperialism vs. local tribal societies). Stepping aside the monumental remains favoured in traditional archaeology, *Fashioning Sudan* will propose a new paradigm focussing directly on the people and the way they chose to portray themselves to the world.

To sustain the project’s all-encompassing approach, it is essential to base our work on a very high number of objects, covering an extensive time and geographical scale. Previous research and a preliminary survey have revealed material from more than 70 sites, representing 2000+ artefacts. Ongoing discussions with colleagues continue to bring more specimens to light, left unattended and unpublished in excavation storage magazines. So far, material corpora from 15 key sites have been chosen, and agreements have been obtained to study archaeological textile and skin garments in nine international museums and excavation teams, in Sudan, Egypt, Europe, and North America. Particular attention has been paid to ensuring a chronological and geographical coverage as exhaustive as conservation permits. We have endeavoured to select sites (fig. 2) and material according to the following criteria: (i) sites located in both Central Sudan, the fourth cataract region, and Nubia; (ii) sites dated to understudied periods which represents an unfortunate “gap” in the material chronology; (iii) long-lasting sites bridging many centuries; (iv) assemblages suggesting interesting cultural dynamics, such as those occurring during transitional periods or in border regions.

### Objectives and Work Packages

The objectives of the project are 1) to build the archaeology of dress practices in Sudan as a valuable method to study the human past, 2) to provide new and original knowledge about the natural resources and socio-economic dynamics of Sudan, and 3) to create a dynamic model articulating diverse narratives of identity in ancient Sudan.

The project embraces three different ways in which humans experience identity: we *craft* and *perform* our own identities, while *recognising* the identities of others. These three dimensions led to the creation of three Work Packages centred around these concepts:

WP1. Recognising Identities, in which the team will work on the elaboration of a new paradigm to study garments as identity markers in Sudan,

WP2. Crafting Identities, in which we will reveal the animal and plant species as well as the skills and craft dynamics necessary to produce garments, and

WP3. Performing Identities, in which we will strive to understand the phenomenon of dress practices as a whole: how it developed, and how it structured the construction of self and group identities.

### Approach and methodology

Throughout the manufacture and selection of garments, each individual expresses key aspects of his or her identity and capacity: access to raw material, level of skills, personal aesthetics, cultural background, place in society, and conformism or opposition to the generally accepted practice. Operated by larger groups of people, the deliberate choice of garments in daily life, in special events such as funerals, and in iconography, is highly significant. Following the pioneering work of Marie Louise Stig Sørensen in her



Fig. 1: Examples of dress practices as represented on a copper alloy bowl from Karanog showing distinctive garments, hairdos, jewellery, and either tattoos or scarification on the stomach of the seated female individual (reproduced from *Soudan, Royaumes sur le Nil*, 1997, 382), with material illustrations from the same site (strings of beads E7794 – Image: PennMuseum, and cotton textile E7511E2 – Image: Elsa Yvanez, with courtesy of the PennMuseum)

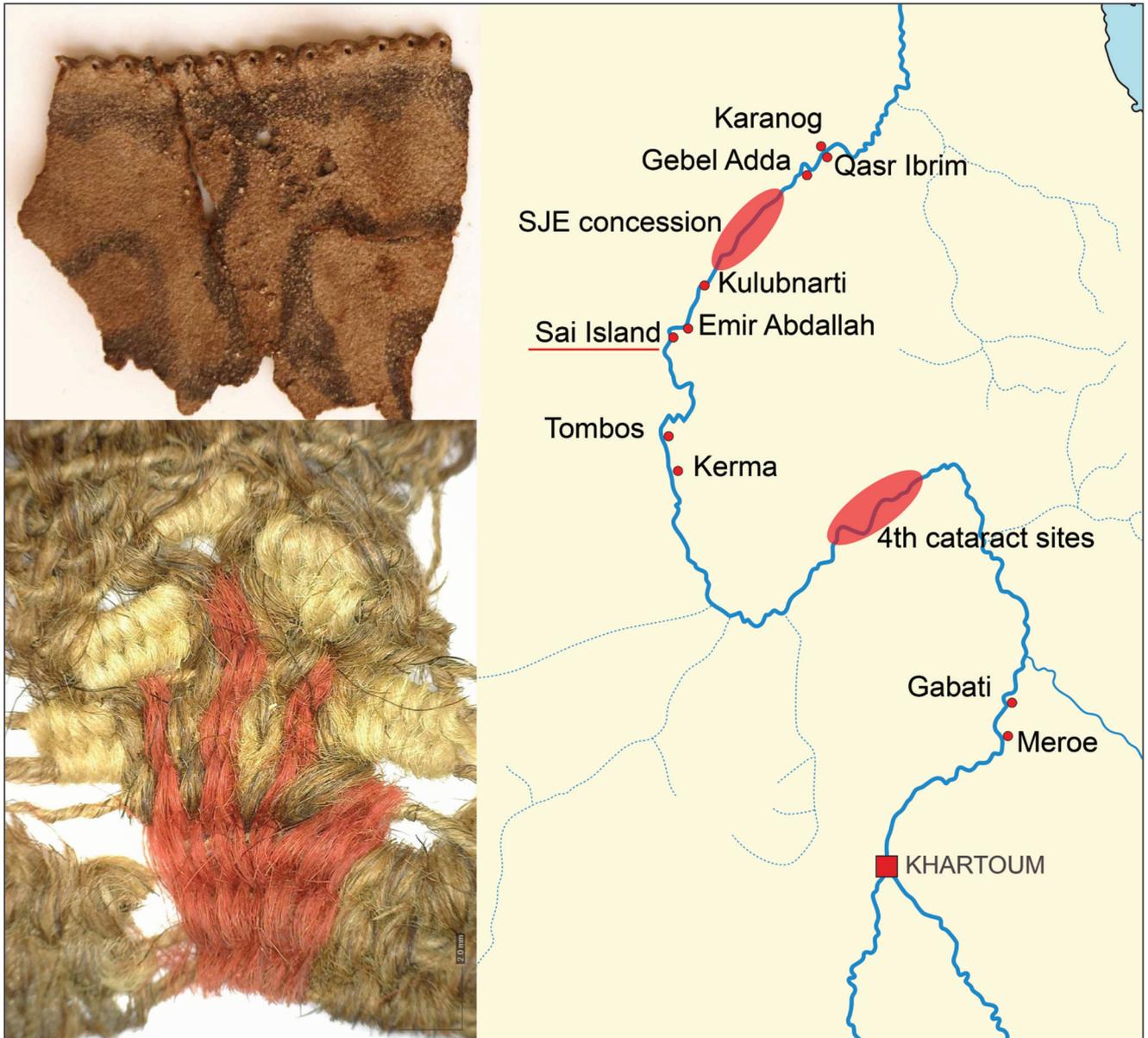
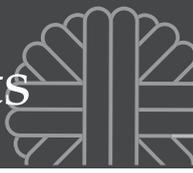


Fig. 2: Map of some key corpora, with examples of leather and wool textile fragments from garments found at Sai Island (Images and map: Elsa Yvanez/Sai Island Archaeological Mission).

foundational paper “Reading dress: the construction of social categories and identities in Bronze Age Europe” (*Journal of European Archaeology* 5.1, 1997, 93–114), *Fashioning Sudan* will conduct an archaeology of dress practices by tracking and mapping these dynamic processes through time and space, in order to unveil diverse narratives of identity in ancient Sudan. Our approach will merge different academic fields, such as archaeology, textile and animal skin research, fibre and species identification by microscopy and palaeoproteomics, and socio-cultural theory, to

develop an interdisciplinary study of garments. The project will encompass the high-resolution analysis of textile and animal skin garments, in close connection with their archaeological context.

From artefacts to interpretations, *Fashioning Sudan* will follow the material from fibre to cloth, from clothing to clothing practices in six steps: [1] Building infrastructure (databases, textile-skin-clothing terminologies, categories & concepts), integrating new theoretical debates on multiple ontologies and the decolonisation of cultural heritage; [2] Extensive



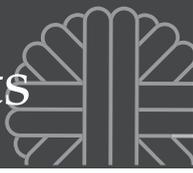
data collection to gather all information pertaining to textile and skin artefacts (such as material, craft techniques, date, shape, context); [3] Statistical data analyses to reveal the localisation, concentration, evolution of diagnostic traits; [4] Results interpretation using frameworks from economic theories and communities of practice, discussing site-catchment analyses, production, and exchange geared toward non-subsistence and comfort items; [5] Wardrobe study: garment database merging archaeological, iconographic, and textual sources; individual items and their combinations in outfits; investigation of different body concepts and sensory assemblages; GIS map of dress practices with timeline; [6] Series of case studies: stemming from semiology and mediation theory, garments will be examined as a multi-vectoral mode of communication and help reframe the notion

of past identities. Depending on each case study, we will explore diverse narratives of identity, focussing on either one aspect or on the multi-layering of identities: gender and age, social status, body and personhood in life and death, regionality, and individual vs group identities. These individual cases will finally be compared to the diachronic overview to determine if patterns emerge in specific regions and periods, drawing a dynamic understanding of diverse identities through time and space.

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Nina Ferrante

# Textile production in the Western Mediterranean: Phoenician and Punic contexts between the 9th and 2nd centuries BCE

## Introduction

The PhD project “Textile production in the Western Mediterranean in the Phoenician and Punic contexts. Analysis of contexts and materials” is hosted at Sapienza University of Rome (IT) and started at the end of 2019. It investigates textile tools, textile installations, and fabrics in handicraft, residential, and cultic settings in Phoenician-Punic settlements in the Western Mediterranean (Italy, Tunisia, Ibiza, and the Iberian Peninsula) between the 9th and the 2nd centuries BCE.

The Phoenician and Punic world was very complex and regionally differentiated due to the interrelationships that first the Phoenicians and later the Carthaginians had with local production centres. Some of the main Phoenician and Punic sites in the Mediterranean, which preserve traces of textile activity, have been taken into consideration in the project (fig. 1). So far, the study has focused mainly on the analysis of textile activity of Phoenician and Punic sites in the Sicilian region (Motya, Palermo, Lilybaeum), making comparisons with neighbouring indigenous and Greek sites. This region has proven to have been important in the exchange of technological traditions between Phoenician, Punic (Balco and Kolb 2009; Nigro 2015), Greek, indigenous (Landenius Enegren 2015; Longhitano 2021b), and Tyrrhenian Italian cultures (Michetti 2007).

## State of Art

Textile production is an industry of great social, cultural, and economic importance, dealing with the sourcing and processing of raw materials to obtain the finished product. The *chaîne opératoire* is as follows: the sourcing and selection of raw materials,

the preparation of the fibre first, and the yarns after, the methods of execution for the various weaving techniques, the treatment of the fabrics, and all the operations relating to the production and use of dyes (Gleba et al. 2013; Gleba 2017).

Textile production in the Phoenician and Punic areas has been researched, but not systematically, both along the Levantine coast (Pritchard 1978; 1988; Mazar 2001; Sauvage 2014) and the Western Mediterranean (Alfaro Giner 1984; Fantar 1993; García Vargas 2010; Oliveri 2021; Pla Orquín et al. 2021). The most investigated sector of textile production in the Phoenician-Punic area is the process of making shellfish purple (Acquaro 1998; Mederos Martín and Escribano Cobo 2006; Peyronel 2006; Marín Aguilera et al. 2018), and its social, economic, and cultural value is well documented by the sources (Mazza et al. 1998; Xella 2010; Soriga 2021; De Simone 2021).

On the other hand, studies of the textile tools and their uses (loom weights, spindle whorls, spatulas, needles, etc.) are still lacking. Indeed, findings from archaeological contexts have not yet been given the attention they deserve, except for a few cases (Carriazo Arroquia 1973; Rossoni and Vecchio 2000; Nigro 2007; García Vargas 2020; Pla Orquín et al. 2021). Recently, the first foundations have been laid for an interdisciplinary investigation of textile production in the Phoenician and Punic fields (Manfredi et al. 2021; Ferrante PhD thesis).

## Research aims

This PhD project investigates the traditions and innovations of textile activity in Phoenician and Punic settlements in the Western Mediterranean between the ninth and second centuries BCE.



Fig. 1: Map of the Western Mediterranean showing the sites relevant to the study (Image: Nina Ferrante)

The aim of this research is primarily to identify the contribution of technological innovations over the centuries within Phoenician and Punic societies. Secondly, a Phoenician-Punic production model will be recognised, considering on one hand the technological and cultural contribution of the motherland, and on the other hand possible interactions with protohistoric societies in the Western Mediterranean. The third aim concerns the definition of the main workers in the textile industry in the various production phases, with particular attention to the role of women in textile production.

In contrast to the studies carried out so far, which have privileged large analyses and quantitative collections over vast geographical areas and an extensive chronological period (Alberti 2008; Marín Aguilera et al. 2018), the research aims to analyse the materials in a qualitative way and their relation to specific contexts and areas. Therefore, the research started from small regions and specific case-studies to reconstruct the production process in the Phoenician and Punic areas in the Western Mediterranean. The regions examined are Sicily, Sardinia, the southern sector of the Iberian Peninsula, Ibiza and Tunisia.

### Methodology

The work began with an examination of Phoenician and Punic archaeological sites in the Western Mediterranean. The research proceeded with the preliminary study of handicraft, residential and cultic

areas with evidence of textile activity. In addition to literary, epigraphic, and iconographic sources, the following archaeological indicators were used: textile tools, textiles, traces of the presence of looms, shell middens in relation to other installations essential for the production of shellfish purple, installations for the preparation of dyes of animal or vegetable origin in craft contexts. From this preliminary survey, I selected 20 sites to be used as case-studies.

Subsequently, I conducted research stays in the museums of Motya, Palermo, Marsala, Ibiza, and Carthage, leading a joint study of the contexts, installations, and objects to understand the production process at the selected sites.

Textiles preserved in the main Punic necropolises of the Western Mediterranean (Motya, Birgi, Lilybaeum, Monte Sirai, Palermo, Carthage, Gadir, Puig des Molins, etc.) were also analysed. Analyses were also conducted on some fabric from the necropolis of Motya (Ferrante et al. 2023), and analyses are planned for the other necropolises mentioned above.

Regarding the analysis of specific materials, such as spindle whorls and loom weights, the method adopted by the Centre for Textile Research (CTR) in Copenhagen (Nosch 2009; Andersson Strand 2012), as part of the scientific project "Tools and Textiles – Texts and Contexts" (TTTC), will be applied. For spindle whorls, a lot of importance is given to the weight, which can indicate the diameter and the twist angle of the yarn. For loom weights, the decisive factors



Fig. 2: Triangular clay tablets from tomb 2 of the Archaic necropolis of Motya (Image: MAM archive)

are the weight and the thickness, as the loom weight must provide the correct tension for each thread in the warp, and even a small difference affects the produced fabric. In the following paragraph, I will present the case study of Motya.

### The case study of Motya

The island of Motya was of particular interest in the PhD research due to the large amount of textile-related material (approximately 1500 textile tools) found in various areas of the island (craft, residential, cultic, and funerary areas) – a rare and precious situation since such tools are preserved in only a few cases. Located on the western cusp of Sicily, the island



Fig. 3: A loom weight from Motya bearing a rosette impression on the top probably using *Papaver somniferum* L. (Image: MAM archive)

has long been renowned for its involvement in textile production. Textile tools are attested from the 15th century BCE until at least the 4th century BCE, when it became a prevalent centre for the production of rich garments and was mentioned by Diodorus (Brugnone 2003, 55). The island can be considered an important Phoenician and Punic centre from the 8th to the 4th centuries BCE. During these four centuries, there is a large amount of evidence that reveals the importance of textile activity on the island: loom weights, spindle whorls, fragments of textiles, and – an exceptional case – remains of a carbonised warp-weighted loom as well as crafting areas where dyeing activities (Tusa 1996) were most likely carried out.

The best-documented type of textile manufacture in Motya is weaving. As in the rest of Sicily (Longhitano 2021a), the most quantitatively interesting textile implements are loom weights that evidence the use of the warp-weighted loom. It does not, however, appear to be the only weaving technique used, as it was most probably complemented by tablet weaving used to decorate clothing (Ferrante 2022). In this regard, two triangular clay tablets were found in the Archaic necropolis as part of the furnishings of an incineration tomb dated to the 7th century BCE (Cintas and Jolly 1980) (fig. 2), and bone spacers associated with this technique were found in the “Zone B” of the settlement (Ferrante 2022).

The technique of the warp-weighted loom on the island of Motya is corroborated not only by the consistent presence of clusters of loom weights, but also by the extraordinary finding in the “Zone D” of remains of a carbonised warp-weighted loom (Nigro 2007, 45). Loom weights were found in almost all excavated areas, especially in the “Zone A” of the settlement. G. Rossoni defined the following typology for the “Zone A” loom weights: truncated pyramid, parallelepiped, and discoidal loom weights (Rossoni 2002).

Another particularly interesting aspect is the decorations and signs on the body of the loom weights: engraved and painted crosses, small dots and circles arranged in the shape of a cross, oval gem and lozenge-shaped impressions, rosettes, stars, simple grooves, or engraved dots (Rossoni 2002; Oliveri and Lo Porto 2018) (fig. 3). The value and function of these marks on loom weights are still unclear, but it has already been noted as a common activity in Sicily (Longhitano 2021b).

The presence of markers that could attest to operations related to dyeing yarns, textiles, and mats is noteworthy. In the Phoenician-Punic settlements in the Mediterranean, some areas attest to the presence of spaces used for such practices, but they are not homogeneously documented. In Motya’s “Zone T”,



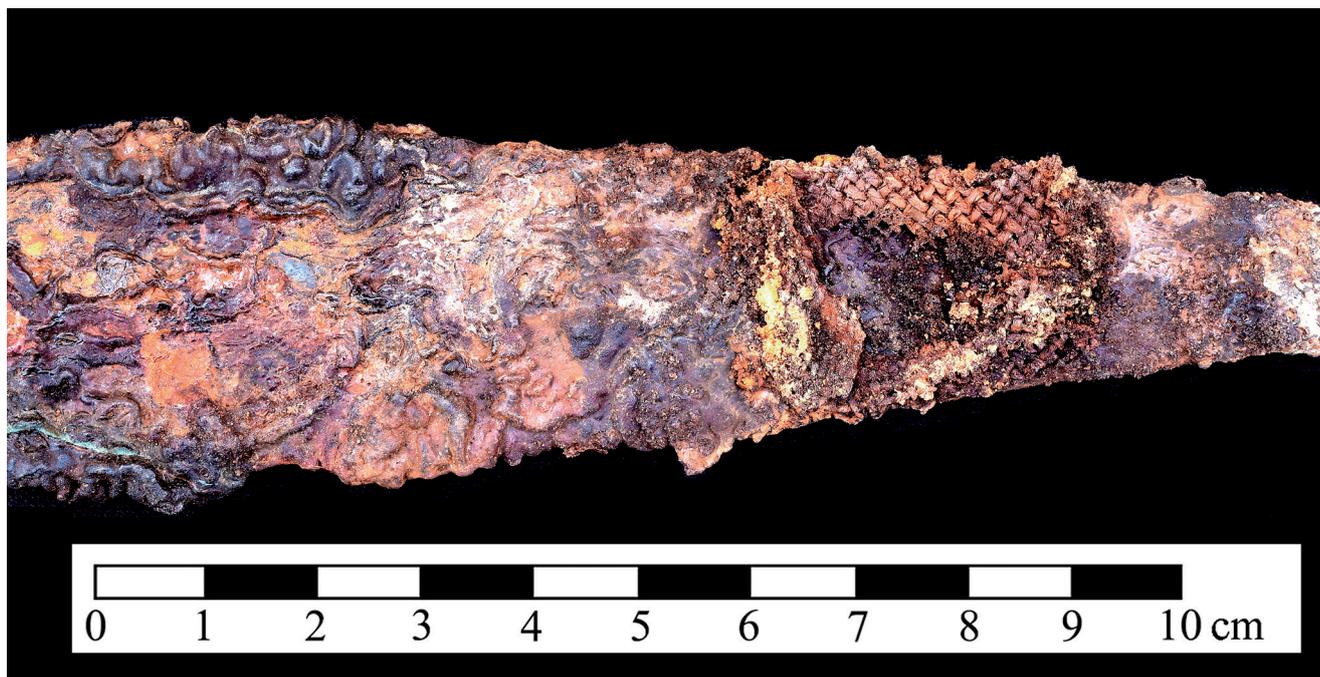


Fig. 5: Iron knife broken in half with fragment of a textile from tomb 172 of Motya (Image: MAM archive)

tanks and installations were interpreted as being used for the various phases of shellfish purple production (Tusa 1996; Reese 2005; Orsingher 2013) (fig. 4).

Finally, remains of textiles – the final products of textile production – are very scarce on the island, as they are in the other Phoenician-Punic settlements in the rest of the Mediterranean due to their perishability. During the excavation of an incineration tomb (T.172) along the Motya city wall, an iron knife was found among the grave goods, which had a rare fragment of mineralised fabric on the blade (Ciasca 1979, 215; Nigro and Spagnoli 2017, 69) (fig. 5). The fragment is a balanced tabby and probably belonged to a fabric that wrapped the object at the time of its deposition (Ferrante et al. 2023).

In the Phoenician and Punic world since the 6th century BCE, it was a common activity to wrap valuable objects in textiles. Comparisons were made in this regard with the Punic necropolis in Palermo and Birgi, where there are some weapons with textiles (Tisseyre 1998; Griffo 2018).

The analysis of textile production in Motya, showing all phases of the *chaîne opératoire*, has acted as a driving force for the identification of comparisons with other sites across the Mediterranean.

### Conclusion

The PhD project currently underway at Sapienza University of Rome (IT), studying materials related to

textile production in the Phoenician and Punic areas, will provide countless opportunities to understand the textile traditions of the areas investigated and how the Phoenician and Punic contribution influenced the Western Mediterranean settlements.

The future research questions are the definition of weaving in the Phoenician and Punic society as well as understanding its patrons and workers. This can only be achieved through the combination of archaeozoological data, iconographic sources, epigraphic sources, and archaeological remains, combined with ethnographic studies.

Much still needs to be researched and studied in order to better understand the possible relationships between Phoenician centres and local production centres in the Western Mediterranean. For the time being, it can only be stated that textile production has regional characteristics, even if it features technological innovations brought by foreign peoples. This can be seen in Motya, where the Phoenician and Punic traditions are combined with Tyrrhenian, Greek, as well as local features. However, detailed analyses of individual sites will help broaden the panorama of weaving practices in the Western Mediterranean. In the end, the main research gain for the field of textile archaeology is to observe the different types of textile that may have been produced in the Phoenician and Punic areas. In addition, it is also important to consider the impact of the different types of textile

on the society, economy, and culture of the Western Mediterranean to gain a complete picture of this still little-known area of textile archaeology.

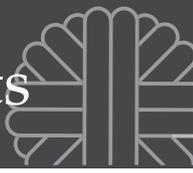
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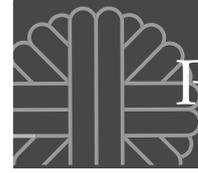
The photos were taken by Nina Ferrante and are part of the archives of the Archaeological Mission to Motya (MAM) of the Sapienza University of Rome. I warmly thank the Director of the archaeological excavations in Motya of Sapienza University of Rome, Lorenzo Nigro, and the Directors of the museums and their staff: Maria Pamela Toti (Museo G. Whitaker of Motya), Caterina Greco, Giuliana Sarà (Museo Archeologico Regionale A. Salinas of Palermo), Anna Maria Parrinello, Maria Grazia Griffo (Parco archeologico di Lilibeo), Benjamín Costa Ribas, María Bofill Martínez (Museo Arqueológico de Ibiza y Formentera). Also, I thank the labs for the textile analyses: Francesco Mura and his staff (CNIS – Research Center on Nanotechnology Applied to the Engineering of La Sapienza) as well as Laura Medeghini (Department of Earth Sciences, Sapienza University of Rome).

### Bibliography

- Acquaro, E. (1998) I Fenici, Cartagine, e l'archeologia della porpora. In O. Longo (ed), *La porpora: realtà e immaginario di un colore simbolico. Atti del convegno di studio Venezia, 24 e 25 ottobre 1996*. Venice: Istituto Veneto di Scienze, Lettere ed Arti, 99–110.
- Alberti, M. E. (2008) Murex shells as raw material: the purple-dye industry and its by-products. Interpreting the archaeological record. *Kaskal* 5, 73–90.
- Alfaro Giner, C. (1984) *Tejido y cestería en la Península Ibérica. Historia de su técnica e industrias desde la Prehistoria hasta la romanización*. Bibliotheca Prehistorica Hispana XXI. Madrid: Instituto Español de Prehistoria del C.S.I.C.
- Andersson Strand, E. (2012) From spindle whorls and loom weights to fabrics in the Bronze Age Aegean and Eastern Mediterranean. In M-L. Nosch and R. Laffineur, *KOSMOS. Jewellery, adornment and textiles in the Aegean Bronze Age*. Liège: Peeters, 207–213.
- Balco, W. and Kolb, M. (2009) Loom weights as material culture indicators: a western Sicilian case study. In H. Oniz (ed), *SOMA 2008. Proceedings of the XII Symposium on Mediterranean Archaeology, Eastern Mediterranean, University Famagusta, North Cyprus, 5–8 March*. Oxford: Archaeopress, 177–182.
- Brugnone, A. (2003) Tessuti costumi e mode nella Sicilia antica. *Kokalos* 49, 51–85.
- Carriazo Arroquia, J. M. (1973) *Tartesos y el Carambolo* (Ministerio de Educación y Ciencia). Madrid: Publ. del Patronato Nacional de Museos.
- Ciasca, A. (1979) Scavi alle mura di Mozia (campagna 1978). *Rivista di Studi Fenici* 7, 207–227.
- De Simone, R. (2021) Per un lessico fenicio e punico della tessitura: le fonti epigrafiche. In L. I. Manfredi, A. Mezzolani Andreose and S. Festuccia (eds), *Tessuti sociali. Del filare e del tessere nel mondo fenicio e punico. Mediterraneo Punico. Supplementi alla Rivista di Studi Fenici*. Rome: Istituto di Scienze del Patrimonio Culturale, 171–190.
- Fantar, M. H. (1993) *Carthage. Approche d'une civilisation 1*. Tunis: Les Editions de la Méditerranée.
- Ferrante, N. (2022) La tessitura a Mozia: nuove evidenze. *Vicino Oriente XXVI* (forthcoming).
- Ferrante, N., Medeghini, L. and Mura, F. (2023) L'utilizzo dei tessuti nel rituale funerario: la tomba 172 di Mozia. *Scienze dell'Antichità* (forthcoming).
- Ferrante, N. (forthcoming) PhD Thesis: *La produzione tessile in ambito fenicio e punico nel Mediterraneo Occidentale (IX-II sec. a.C.). Analisi dei contesti e dei materiali*. Sapienza University of Rome.
- García Vargas, E. (2010) Tejidos y tintes como objeto de lujo y símbolo de estatus en la colonización fenicio-púnica. Una propuesta de contextualización histórica. In B. Costa Ribas and J. H. Fernández Gómez (eds), *Aspectos suntuarios del mundo fenicio-púnico en la Península Ibérica. XXIV Jornadas de Arqueología fenicio-púnica (Eivissa, 2009)*. Treballs del Museu Arqueològic d'Eivissa i Formentera 65. Eivissa: Museu Arqueològic de Ibiza y Formentera, 77–109.
- García Vargas, E. (2020) Shellfish purple production in Iberia and the Balearic Islands in the pre-roman period: archaeological evidence in its Mediterranean context. In B. Marín Aguilera and M. Gleba (eds), *Interweaving traditions: clothing and textiles in Bronze and Iron Age Iberia*. Sagvntvm-extra 20. Valencia: University of Valencia, 29–46.
- Gleba, M. (2017) Textiles in pre-roman Italy: from a qualitative to a quantitative approach. *Origini* XL, 9–28.
- Gleba, M., Harris, S. and Cutler, J. (2013) Production and consumption: Textile economy and Urbanization in Mediterranean Europe 1000–500 BCE (PROCON). *Archaeology International* 16, 54–58.
- Griffo, M. G. (2018) Nuovi dati sulla fase arcaica della necropoli fenicio-punica di Birgi (Marsala). *Mare internum: archeologia e culture del Mediterraneo* 10, 23–43.
- Landenius Enegren, H. (2015) Loom weights in Archaic south Italy and Sicily: five case studies. *Opuscula. Annual of the Swedish Institutes at Athens and Rome* 8, 123–155.
- Longhitano, G. (2021a) *Textile Activity and Cultural Identity*



- in Sicily Between the Late Bronze Age and Archaic Period.* Ancient Textiles Series 37. Oxford: Oxbow books.
- Longhitano, G. (2021b) L'attività tessile tra le comunità indigene della Sicilia occidentale in età arcaica: dinamiche economiche e sociali in un'area di frontiera. In L. I. Manfredi, A. Mezzolani Andreose and S. Festuccia (eds), *Tessuti sociali. Del filare e del tessere nel mondo fenicio e punico. Mediterraneo Punico. Supplementi alla Rivista di Studi Fenici*. Rome: Istituto di Scienze del Patrimonio Culturale, 89–102.
- Manfredi, L. I., Mezzolani Andreose, A. and Festuccia, S. (2021) *Tessuti sociali. Del filare e del tessere nel mondo fenicio e punico. Mediterraneo Punico. Supplementi alla Rivista di Studi Fenici*. Rome: Istituto di Scienze del Patrimonio Culturale.
- Marín Aguilera, B., Iacono, F. and Gleba, M. (2018) Colouring the Mediterranean: Production and Consumption of Purple-dyed Textiles in Pre-Roman Times. *Journal of Mediterranean Archaeology* 31(2), 127–154.
- Mazar, E. (2001) *The Phoenicians in Achziv, the southern cemetery: Jerome L. Joss Expedition. Final report of the excavations, 1988–1990*. Barcelona: Laboratorio de Arqueología, Universidad Pompeu Fabra de Barcelona.
- Mazza, F., Ribichini, S. and Xella, P. (1998) *Fonti classiche per la civiltà fenicia e ponica – I. Fonti letterarie greche dalle origini alla fine dell'età classica*. Collezione di Studi Fenici 27. Rome: Consiglio nazionale delle ricerche.
- Mederos Martín, A. and Escribano Cobo, G. (2006) Mare purpureum. Producción y comercio de la púrpura en el litoral atlántico norteafricano. *Rivista di Studi Fenici* 34(1), 71–96.
- Michetti, L. M. (2007) Scambi e interferenze culturali tra ambiente etrusco-italico e mondo punico: alcuni esempi nell'artigianato artistico di età recente (IV–III sec. a.C.). In G. M. Della Fina (ed), *Etruschi, Greci, Fenici e Cartaginesi nel Mediterraneo centrale. XIV Convegno internazionale di Studi sulla storia e l'archeologia dell'Etruria, Orvieto 2006*. Annali per la Fondazione del Museo "C. Faina" XIV. Rome: Edizioni Quasar, 325–363.
- Nigro, L. (2007) *Mozia XII, Zona D. La "Casa del sacello domestico", il "Basamento meridionale" e il Sondaggio stratigrafico I. Rapporto preliminare delle campagne di scavi XXIII e XXIV (2003–2004) condotte congiuntamente con il Servizio Beni Archeologici della Soprintendenza Regionale per i Beni Culturali e Ambientali di Trapani*. Quaderni di Archeologia Fenicio-Punica III. Rome: Sapienza University of Rome – Department of Archaeology.
- Nigro, L. (2015) *Mozia tra VI e V sec. a.C. Monumentalizzazione e organizzazione socio-politica: un nuovo modello*. In M. P. Baglione and L. M. Michetti (eds), *Le lamine d'oro a cinquant'anni dalla scoperta. Dati archeologici su Pyrgi e rapporti con altre realtà del Mediterraneo*. Scienze dell'Antichità 21(2). Rome: Edizioni Quasar, 225–245.
- Nigro, L. and Spagnoli, F. (2017) *Landing on Mozia. The Earliest Phoenician Settlement of the 8th century BC and the creation of a West Phoenician Cultural Identity in the excavations of Sapienza University of Rome – 2012–2016*. Quaderni di Archeologia Fenicio-Punica/Colour Monograph 04. Rome: Sapienza University of Rome – Department of Archaeology.
- Nosch, M-L. (2009) Shape of things: understanding a loom weight. *Oxford Journal of Archaeology* 28(4), 373–398.
- Oliveri, F. (2021) Tessere a Mozia: i pesi da telaio tra quotidiano e sacro. In L. I. Manfredi, A. Mezzolani Andreose and S. Festuccia (eds), *Tessuti sociali. Del filare e del tessere nel mondo fenicio e punico. Mediterraneo Punico. Supplementi alla Rivista di Studi Fenici*. Rome: Istituto di Scienze del Patrimonio Culturale, 77–88.
- Oliveri, F. and Lo Porto, A. (2018) Piccoli oggetti del lavoro quotidiano: i pesi da telaio, testimoni della tessitura a Mozia. In V. Caminnecki, M. C. Parello and M. S. Rizzo (eds), *La città che produce. Archeologia della produzione negli spazi urbani. Atti delle Giornate Gregoriane X Edizione, 10–11 dicembre 2016*. Bibliotheca Archaeologica 50. Bari: Edipuglia, 161–167.
- Orsingher, A. (2013) La ceramica di impasto a Mozia tra cultura fenicia e tradizione indigena. In L. Girón Angiozar, M. Lazarich González and M. Conceição Lopes (eds), *Actas del I Congreso Internacional sobre Estudios Cerámicos homenaje a la Dra. Mercedes Vegas, Cádiz, del 1–5 de noviembre de 2010*. Cádiz: Universidad de Cádiz, Servicio de Publicaciones, 757–790.
- Peyronel, L. (2006) Il ruolo della porpora nell'industria tessile siro-palestinese del Bronzo Tardo e dell'età del Ferro. Le evidenze storico-archeologiche dei centri costieri. *Rivista di Studi Fenici e Punici* 34, 49–70.
- Pla Orquín, R., Guirguis, M. and Mazzarello, V. (2021) Trame di dialogo e tessuti di relazioni nel mediterraneo del I millennio a.C. La produzione tessile nelle comunità fenicie della Sardegna tra cultura levantina e tradizioni autoctone. In L. I. Manfredi, A. Mezzolani Andreose and S. Festuccia (eds), *Tessuti sociali. Del filare e del tessere nel mondo fenicio e punico. Mediterraneo Punico. Supplementi alla Rivista di Studi Fenici*. Rome: Istituto di Scienze del Patrimonio Culturale, 57–76.
- Pritchard, J. B. (1978) *Recovering Sarepta, A Phoenician City. Excavations at Sarafaand, Lebanon 1969–1974, by the University Museum of the University of Pennsylvania*. Princeton: Princeton University Press.
- Pritchard, J. B. (1988) *Sarepta IV, The Objects from Area II, X*. Beirut: Lebanese University.
- Reese, D. S. (2005) Whale bones and shell purple-dye at Motya (western Sicily, Italy). *Oxford Journal of*



- Archaeology* 24(2), 107–114.
- Rossoni, G. (2002) I pesi da telaio. In M.-L. Famà (ed), *Mozia. Gli scavi nella "Zona A" dell'abitato. Collana di Archeologia del Centro Internazionale di Studi Fenici, Punici e Romani*. Comune di Marsala 1. Bari: Edipuglia, 315–320.
- Rossoni, G. and Vecchio, P. (2000) Elementi per la definizione di attività domestiche nell'abitato di Mozia Zona A. In *Atti delle Terze Giornate di Studi sull'area elima. Gibellina - Erice - Contesa Entellina, 23–26 ottobre 1997*. Pisa/Gibellina: Scuola normale superiore, 879–894.
- Sauvage, C. (2014) Spindles and Distaffs: Late Bronze and Early Iron Age Eastern Mediterranean Use of Solid and Tapered Ivory/Bone Shaft. In: M. Harlow, C. Michel and M.-L. Nosch (eds), *Prehistoric, ancient Near Eastern and Aegean textiles and dress*. Ancient Textile Series 18. Oxford: Oxbow, 184–226.
- Soriga, E. (2021) Flashy shining people: the illustrious Phoenicians and their lustrous textile production. In L. I. Manfredi, A. Mezzolani Andreose and S. Festuccia (eds), *Tessuti sociali. Del filare e del tessere nel mondo fenicio e punico. Mediterraneo Punico. Supplementi alla Rivista di Studi Fenici*. Rome: Istituto di Scienze del Patrimonio Culturale, 149–169.
- Tisseyre, P. (1998) *Palermo Punica. Catalogo della mostra al Museo Archeologico Regionale Antonio Salinas (6 dicembre 1995–30 settembre 1996)*. Palermo: Sellerio, 360–370.
- Tusa, V. (1996) L'area industriale di Mozia. In E. Acquaro (ed), *Alle sorgenti della classicità; il Mediterraneo tra tradizione ed innovazione. Studi in onore di Sabatino Moscati 2*. Archeologia ed Arte. Pisa/Rome: Istituti editoriali e poligrafici internazionali, 1003–1019.
- Xella, P. (2010) Su alcuni termini fenici concernenti la tessitura. In M. G. Biga and M. Liverani (eds), *Ana turri gimilli. Quaderni di Vicino Oriente V*. Rome: Sapienza University of Rome, 417–424.

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Sylvie Odstrčilová

# Deciphering the pattern of the tablet-woven band on the tunic from Thorsberg

## Introduction

The textiles from Thorsberg moor (Germany) have excited archaeologists and textile experts since their discovery more than 150 years ago. Hundreds of pages have been written about the *Prachtmantel*, trousers, tunic and other textile fragments; yet the pattern of the tablet-woven band trimming the sleeves of the tunic has not been successfully described until now.

The previous researchers agreed that the band has warp-twined borders formed by six edge tablets on one side and seven tablets on the other side, and a double-faced twill section in the centre. However, this central part was considered woven with 12 (Stettiner 1911; Hansen 1990) or nine tablets (Schlabow 1976; Ræder Knudsen 2011), with four threads per tablet (Stettiner 1911) or three threads per tablet (Schlabow 1976). Hansen (1990) did not mention the number of threads but categorised the technique as 2/1 twill. None of the authors described the pattern in more detail. In the most recent paper, it was explicitly stated that the colours were too faded for the pattern to be seen (Ræder Knudsen 2011).

Nevertheless, some amateur tablet weavers have tried to reconstruct the pattern based on the available information and images, but none of these reconstructions published on the internet (Nigdziekolwiek 2019; Aislings Welt 2020) look accurate when compared closely with photographs of the original band.

## Methodology

The research presented here was based on the examination of two photographs (fig. 1a and fig. 2a) taken by Matt Bunker in the Schloss Gottorf museum, where the tunic is on display. Only one face of each

sleeve could be observed, as the tunic is mounted next to the wall.

The photographs were digitally adjusted to enhance subtle colour differences in the textile by increasing the colour saturation (fig. 1b and fig. 2b). However, more important for this research than observing the colours was the examination of the texture of the band.

There are many tablet weaving techniques that result in various textures on the surface of the woven band. For the current study, only two of those need be mentioned: warp twining and double-faced broken twill. In warp twining made by continuous turning of the tablets in one direction, threads threaded in one tablet form a cord, which can be diagonally striped, if the threads have different colours. This cord can be S-twisted or Z-twisted, depending on the direction in which tablets are turned, and on the direction of their threading (Collingwood 2002, 78–81). The twill texture is achieved by turning each tablet twice forward and twice backward, but the tablets are not all synchronised; neighbouring tablets are moving one step apart in this sequence (Collingwood 2002, 211, 214). It is important to note that there are two diagonal lines in the tablet-woven twill structure: the one lying at a near 45° angle and corresponding with the diagonal lines in the pattern is less noticeable on the surface than the other line lying at a 60° angle in the opposite direction. For this reason, the twill structure with the prominent lines in the Z-direction is called S-twill and vice versa (Collingwood 2002, 214–215).

## Findings

Most of the central part of the band is covered with

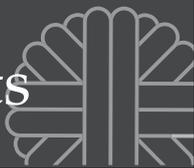
diagonal lines associated with the twill structure. But there are also areas displaying cords parallel to the warp-twined borders of the band, revealing not only that these sections are warp-twined, but also that the tablets used for weaving the pattern were threaded with four threads (the same as the tablets forming the borders) and not three, as suggested by Schlabow (1976).

Even without taking the colours into consideration, it is evident from the recurring sequence of areas with different textures that there are two repeats of identical

(or very similar) motifs in the band on the right sleeve, followed by a different motif near the fold of the sleeve (fig. 1c). Unfortunately, this last motif could not be analysed because of the distortion of the texture lines due to the curvature of the sleeve and a small damaged area where some threads are missing. The photograph of the left sleeve displays a section formed by diagonal twill lines, which is similar to the section on the right sleeve, but the areas of warp twining around it differ (fig. 2c). The details are not very clear because of the partially unfocused photograph due to the uneven



Fig. 1: Tablet-woven band on the right sleeve of the tunic: a – seen by the naked eye; b – with increased colour saturation; c – with lines showing the texture of the weaving (red: warp twining in S-direction; pink: warp twining in Z-direction; green: S-twill; yellow: Z-twill) (Image: Matt Bunker; edited by Sylvie Odstrčilová)



surface of the fabric. For this reason, the following part of the research concentrated on the two clearly visible repeats from the right sleeve only.

In contrast to the almost monochromatic band on the left sleeve, the band on the right sleeve clearly

shows that at least two tablets in the pattern contained two bluish and two reddish threads. The digital enhancement of the image revealed subtle colour differences in other parts of the band too. A reddish colour occurs across the whole width of the pattern,

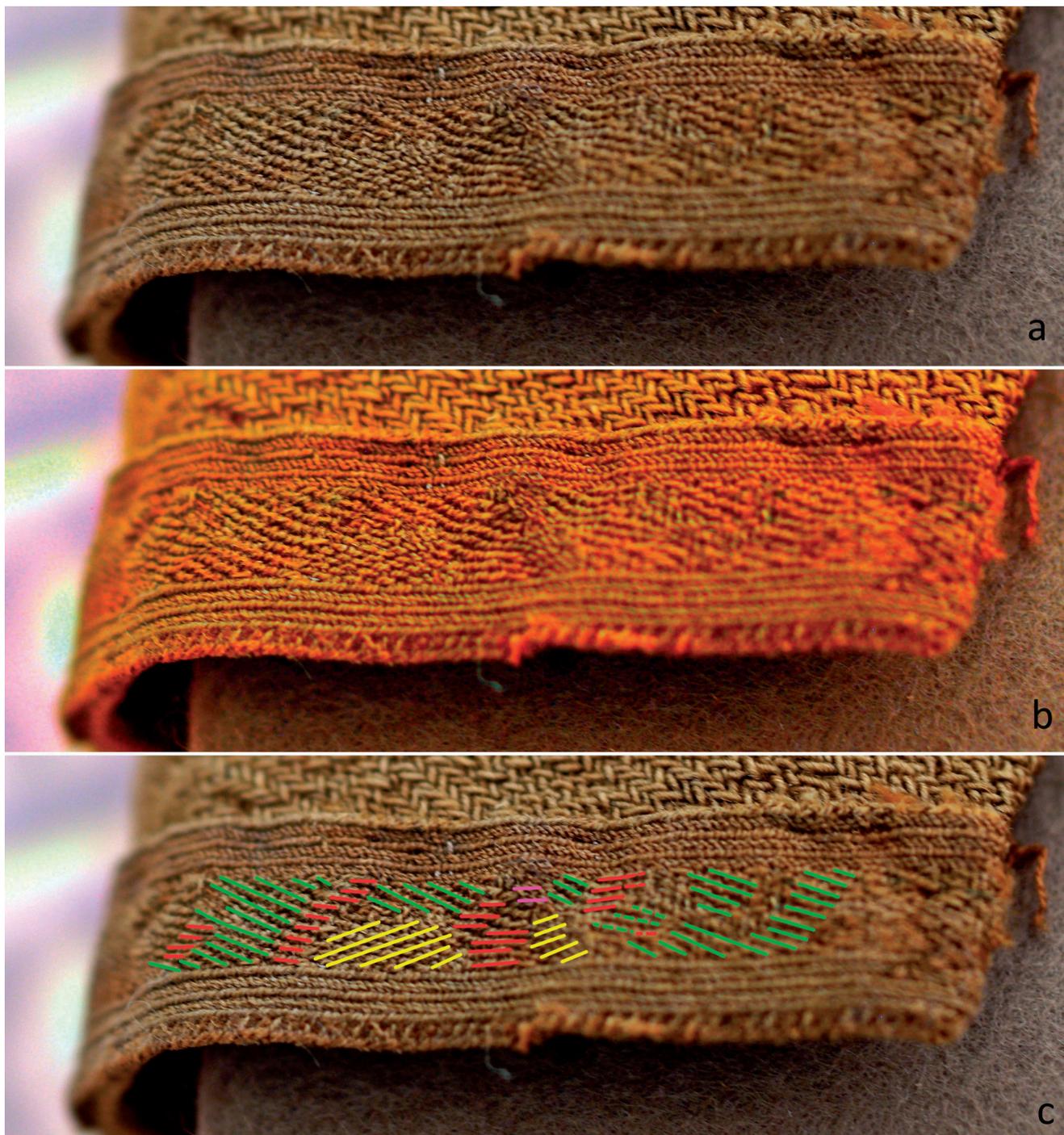


Fig. 2: Band on the left sleeve: a – seen by the naked eye; b – with increased colour saturation; c – with lines showing the texture of the weaving (red: warp twining in S direction; pink: warp twining in Z direction; green: S-twill; yellow: Z-twill) (Original image: Matt Bunker, editing: Sylvie Odstrčilová)



Fig. 3: Part of the pattern from the right sleeve: a – original band (see arrow for the frayed thread indicating a damaged long float and ellipses for irregularities in the pattern); b – reconstruction with regular quarter turns ( $90^\circ$ ); c – reconstruction with half turns ( $180^\circ$ ) at the reversal points (Image a: Matt Bunker; images b and c: Sylvie Odstrčilová)

while the bluish colour was replaced by a yellowish one. The larger warp-twined areas are striped in these two colours (red and blue/yellow). In other parts of the band, the colour changes follow the transitions between different types of weave. The only colour change not foreseen by the observation of the texture is the one in the middle of the S-twill section.

The pattern was charted according to the combined observations of the texture and colours. A sample was woven using this pattern and then compared with the original band. This process was repeated three times until they matched (fig. 3).

This demonstrated that the central part of the band was woven with nine tablets. The reconstructed part of the pattern shows two geometrical warp-twined motifs on the chequered background of 3/1 broken twill. Both repeats are almost identical, but in inverted

colours. The weaving was done from the right side of the photographs to the left, as indicated by the change of the direction of the twill lines.

There are several places in the pattern that a modern weaver would not find pleasing and consider mistakes. However, they were probably not errors because they recur in both warp-twined motifs (fig. 3a).

In contrast to numerous long floats (warp threads passing over four wefts) visible at the transition from the twill background to the warp-twined motif in the original band, there are almost no warp floats longer than two weft picks inside the motif. It indicates that half turns ( $180^\circ$ ) were probably used at the reversal points (fig. 3c), as was the case in bands from the Finnish Iron Age (Karisto and Pasanen 2021). However, a similar appearance might be the result of the long floats having been damaged, as suggested by



Fig. 4: Final reconstruction including borders and in 1:1 scale (Image: Sylvie Odstrčilová)

one frayed yarn end (fig. 3a). Half turns were probably used in the middle cord too. If the middle tablet was regularly turned 90°, the colours at the beginning and at the end of the motif would not match. Idling, or turning this tablet back-and-forth, which would solve this problem, would result in a long float, which is again absent here. Therefore, the most likely solution is two half turns either in the same or in the opposite direction. The details and colour changes are too difficult to see in the centre of both motifs to be sure about this.

#### A question about the colours

An earlier dye analysis detected red and blue dye in the band and therefore its original colour was interpreted as purple (Fischer 1997). However, the current study shows that the band contained threads of at least two colours, so it is possible that the red and blue dyes belonged to different threads, and they were detected in the same sample only because the dyes bled one into another. But were there only two colours or three? There are many tablet-woven bands with the background striped in two colours – from early iron age Hallstatt to medieval Arlon. On the other hand, the dark stripe is visible only on the right sleeve, although originally the trims on both sleeves probably formed one band, which was cut in two (Stettiner 1911, 51; Ræder Knudsen 2011, 181). There are a few small bluish spots in the band on the left sleeve, not only in the same place as the blue threads in the band on the right sleeve, but also in other parts of the pattern and in the border. Therefore, it is possible that the whole band was woven in red and blue (fig. 4). However, only a microscopic examination and new dye analyses can resolve this question.

#### Conclusion

Even though only a short section of the pattern was reconstructed, this study offers significant progress from the earlier research into the Thorsberg textiles.

Based on the texture visible in the black and white photograph of the sleeve end lying flat (Stettiner 1911, Tafel IX), the whole pattern probably comprised various geometrical motifs on the chequered background of 3/1 broken twill. If more high resolution photographs are available in the future, it may be possible to reconstruct the full length of the pattern. More importantly, the method of study based on textural differences may be applied also to other tablet-woven bands, which have lost their colours due to being buried in the earth for a long time.

#### Acknowledgements

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#### Bibliography

- Collingwood, P. (2002) *The Techniques of Tablet Weaving*. McMinnville: Robin & Russ Handweavers Inc.
- Fischer, C.-H. (1997) Historische organische Farbstoffe. *Spectrum der Wissenschaft* 10, 104–108.
- Hansen, E. (1990) *Tablet Weaving – History, Techniques, Colours, Patterns*. Højbjerg: Hovedland Publishers.
- Karisto, M. and Pasanen, M. (2021) *Tablet-woven Treasures: Archaeological bands from the Finnish Iron Age*. Helsinki: Mythologia Fennica.
- Ræder Knudsen, L. (2011) The tablet-woven textiles from 3rd and 4th century AD weapon deposits in Denmark and northern Germany. In S. Möller-Wiering (ed), *War and Worship*. Oxford: Oxbow Books, 163–198.
- Schlabow, K. (1976) *Textilfunde der Eisenzeit in Norddeutschland*. Neumünster: Wachholtz.
- Stettiner, R. (1911): Brettchenwebereien in den Moorfunden von Damendorf, Daetgen und Torsberg. *Mitteilungen der Anthropologischen Vereins in Schleswig-Holstein* 19, 26–56.

#### Internet sources

- Nigdziekolwiek (2019) Krajka z Thorsberg Mose. Między interpretacją a rekonstrukcją <http://nigdziekolwiek.com/2019/12/krajka-z-thorsberg-mose-miedzy-interpretacja-a-rekonstrukcja/> (accessed 24 June 2022)
- Aislings Welt (2020) Die Borte vom Thorsberg-Kittel <https://aislingde.blogspot.com/2020/06/die-borte-vom-thorsberg-kittel.html> (accessed 24 June 2022)

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# Textile Resources in Viking Age Landscapes (TRiVal)

## Introduction

The Centre for Textile Research, University of Copenhagen, has received substantial funding from the Independent Research Fund Denmark for a new three-year project, **Textile Resources in Viking Age Landscapes** (TRiVal) 2022–2025. The overarching aim of the project is to contribute to understanding the impact of the huge need for textile resource on the Danish landscape, and its influence on settlement structure, focusing on case studies around Limfjorden and southwest Zealand. The integrated results will reveal and enable studies of socio-political structures. This will be the first time that the results of a landscape analysis of textile resources, combined with textile tools and context investigation, are included in interpretations of the variation, organisation and impact of textile production in Viking Age society.

The Viking Age is generally defined as the time period between 750 and 1050 CE. The use of the term “Viking” is highly debated (Croix 2015). However, even if criticised, “Viking Age” is still used by both scholars and in dissemination events such as exhibitions. The term “Viking Age” is used to define the core period of investigation.

A team of scholars and research assistants will work together in the project (fig. 1). A series of small workshops and in-depth studies, each with a specific theme relating to the work packages, will be arranged in collaboration with an advisory board and other specialists. In order to grasp themes related to the project, a guest researcher is invited for one month’s study in 2023 to work on the theme of Early Medieval textile economies. The project will generate landmark papers, books, and PhD dissertations as the outcome of the research.

## Background

The Viking Age was a period of transition and change, characterised by overseas trade, warfare, and colonisation, where the socio-political developments supported the formation of centralised kingdoms within the Scandinavian homelands (Hedenstierna-Jonson 2009). The Viking Age is also a period in which textile production made a profound impact on society, clearly indicating a new consumption of the sails that supported long-distance travel as well as a new fascination and use of luxury clothing (Bender Jørgensen 1986; 2012; Andersson 2003; Andersson Strand 2016; 2021; Mannering 2017). The introduction of the sail in the 7th century was without doubt one of the most important and innovative technological developments of the period (Kastholm 2014, in prep.; Ravn et al. 2016) and allowed Scandinavian communities to travel long distances over the open sea, in order to engage more efficiently in trade and raiding, and to explore new lands. The project hypothesis is that the use of sailcloth and changes in textile production demanded physical labour as well as a large supply of raw material, which would result in an increased use of land for sheep grazing, a large-scale cultivation of textile crops, and important changes in settlement structures.

This project will combine landscape analysis of textile resources with analysis of textiles, textile tools, and context investigations to determine the variation, organisation, and impact of textile production on the known Viking Age landscape. The project will demonstrate how textile research can be used to gain a better and more diverse understanding of Viking Age society and its actors. It will answer the following research questions: 1) *How an increasing demand for*



Fig. 1: From the left, student assistant Pernille Gottschalk-Hansen, PhD fellow Jonas Jæger, PI Eva Andersson Strand, Senior researcher Charlotte Rimstad. Missing is research assistant Pernille Foss, professor Matthew Collins, research professor Ulla Mannering and further post-doc 1 who will join the team later (Image: Eva Andersson Strand)

*textile raw materials affected landscapes and settlements; 2) How an increasing consumption of textiles affected the production of textiles as well as the organisation of said production; and 3) Whether only local raw materials were used or whether these were supplemented by importing of raw materials and/or textiles.*

Objective 1 is to create an overarching framework and methodology that directly integrates the importance of textiles and textile resources in current debates on Viking Age economy, power, and politics. Objective 2 is to make the results of textile research on Viking Age materials and contexts accessible for the study of settlements and landscapes, at both local, regional, and inter-regional levels.

### **Project design**

To fulfil the overarching aims and objectives, an investigation of selected regions/landscapes, settlements, tools, and textiles will be undertaken. In order to identify a possible increasing demand for textile resources, the starting point will be the beginning of the Late Iron Age from c. 600 to 1050 CE. Two different types of landscapes have been carefully selected: southwest Zealand and the area around

Limfjorden, Jutland. These landscapes represent central and important regions in Viking Age Denmark. They are well studied with numerous settlement and burial structures, finds of textiles, and textile tools (Bender Jørgensen 1986; Ulriksen 1998, 2018; Kastholm 2013; Sarauw 2019). In order to investigate whether textile production in the settlements represents different organisation modes, various types of settlements have been chosen.

The landscape and settlement studies as well as the registration of tools and textiles will be accomplished in close collaboration with the different local museums and the National Museum of Denmark. The project members will collect and record archaeological, osteological, geological, and geographical data in the field and at the museums, and further process the data at CTR and relevant institutes. At CTR, we have facilities for different types of textile and tool analyses in our new CTR TexLab, supported by the Danish Roadmap for Research Infrastructure project E-RIHS.dk. All materials will be recorded in a database, designed for the project, and mapped in a geographical information system (GIS). Significantly, we will combine theoretical perspectives from both

sciences and humanities. We will use natural science (as objective, quantifying, descriptive, fact aiming at discovery, explanation, and solutions) to gain new perspectives on cultivation, sheep management, types of textiles, and tools. This approach will be combined with the humanities (subjective, interpretive, speculative, politicising, aesthetic approaches) to better comprehend the influence and impact of textiles and textile production on Viking Age society (Sørensen 2017).

All the collected research data will be curated and preserved by the individual participants at UCPH and shared with the museums during the project. At the end of the project, all data will be made open access. The project will attain synergy at different levels resting on three Work Packages (WPs), each structured to be shared and take advantage of the research undertaken in the others.

#### **Landscape of Textile Resources, WP1: Post-doc 1 (TBD), research assistant Pernille Foss**

To what extent was the landscape used to provide the raw materials for clothing, sails, and furnishing textiles in the Viking Age? The production of one large sail would demand wool from 100 sheep, which needed 3 to 5 hectares of well-fertilised land to graze on; or more than 1 hectare of land for the cultivation of plant fibres (Frøier and Zienkiewicz 1991; Bender Jørgensen 2012). In WP1, we will investigate the uses of the Viking Age textile landscapes. Data from the selected landscapes will be compiled by PD1 in close collaboration with Dr. Morten F. Mortensen, National Museum of Denmark. New pollen and macrofossil analyses will be conducted by PD1 and the RA to gain detailed knowledge on the use of those landscapes, including infields and backwoods, as well as grazing land. Landscape analysis, by means of GIS, will further contextualise any zoo-archaeological evidence of sheep management, wool production, and flax and hemp cultivation. An investigation of available dye plants in combination with recent textile dye analyses will indicate use of dyes as well as the trade in dye plants. The results from WP1 will be essential when discussing both the access to and cultivation of textile raw materials as well as their trade.

#### **Tools, textiles and contexts, WP2: PI Eva Andersson Strand, Senior Researcher, Charlotte Rimstad, Research Professor Ulla Mannering, student assistant Pernille Gottschalk-Hansen**

Textile tools are one of the most frequent artefacts from Viking Age settlement excavations and analysis indicates which types of textiles might have been

produced given the use of specific tools. WP2 will investigate what type of textile production was performed in the different settlements by recording and analysing the function of textile tools and their find contexts. This work will be done by Eva Andersson Strand together with the student assistant.

Even if textiles are found in different contexts, textile analyses have until now primarily focused on clothing textiles in grave contexts (for example Bender Jørgensen 1986). This project, however, will combine studies of textiles from different contexts with tools and landscape analyses providing a new holistic view of Viking Age textile consumption. This will enhance the possibility of exploring local production in contrast to the previous focus on imports (Geijer 1938; Hägg 1974; Bender Jørgensen 1986). Analyses of textile finds, including fibre and dye analyses from the selected areas, will be performed by Charlotte Rimstad and Ulla Mannering. They will also collect information on previously analysed textiles and combine these with the new results.

Spatial analysis (GIS) will be used to explore the distribution of textile tools and textile production constructions, in order to identify the space where production took place and identify potential textile workshops. It will be possible to create density maps to associate different classes of textile tools with their original contexts, in order to observe the production trends throughout different chronological phases of a specific site. By combining results from tools, textiles, and context analyses, we can discuss different types of organisation modes and also local production versus imports.

#### **Sheep and sheep management, WP3: PhD fellow Jonas Jæger, supervisor PI Eva Andersson Strand, co-supervisor Professor Matthew Collins**

As the demand for wool increased, was there a corresponding change in animal management? When looking at the preserved fibres, does the wool indicate evidence of a switch from primary hairy female animals, as part of a mixed economy, to the use of castrated males?

Management of sheep in the archaeological record has been confounded by the challenges of discriminating sheep from goats, and previous analysis by Jæger (2020) of Late Iron Age ovicaprine teeth demonstrated that many “goats” were in fact sheep. In WP3, the increasing demand for wool within the Viking textile economy will be explored. Jonas Jæger will conduct a large-scale screening of ovicaprine remains from the Early Iron Age through the Viking Age. Zooarchaeology by Mass Spectrometry (ZooMS) will



be used to complement and cross-validate osteological identification of sheep (Reed 1960; Halstead et al. 2002; Zeder and Lapham 2010; Zeder and Pilaar 2010; Buckley et al. 2010). Selected sheep molars will be subjected to a DNA analysis (collaboration with Prof. Dan Bradley, Dublin) to explore age and sex in order to explore mortality patterns of adult animals and scans will be made for possible genetic signatures of sheep breeding during the Viking Age. An analysis of mortality patterns will be made based on estimates of age (tooth eruption and wear) and sex identification structures of flocks.

### The SYNERGY – Towards a new perception of Viking Age textile landscapes: all project members

The study of animal remains and archaeobotanical studies of plant fibre will provide new insights into landscape use in rural and outland environments. Together with context analyses of textile production sites and settlements, this data will elevate the discussion of the use of the landscape and Viking Age textile craft production, organisation, and specialisation, creating a new dimension of understanding.

Only through meticulous research in the three work packages is it possible to elevate the project to the level of dynamic collaboration that is necessary to fulfil the aim and objectives presented here. The work accomplished within and between WPs 1 to 3 will create the possibility of a fourth part, in which their collective synergy will demonstrate how textiles and textile production can provide a new and fundamental understanding in the development of Viking Age society. Integrating the results of sub-projects' analyses (WPs) will yield significant new perspectives in both the environmental and the social impact of textile production and provide a foundation for further studies on resource exploitation and agricultural practices related to textile production. The synergy will answer the hypothesis of whether textiles or textile resources can be used as markers of large-scale production and land exploitation and give new insights into the development of Viking Age society.

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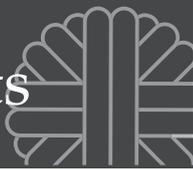
#### Bibliography

- Andersson, E. (2003) *Tools for Textile Production – from Birka and Hedeby*. Birka Studies 8. Stockholm: Riksantikvarieämbetet.
- Andersson Strand, E. (2016) Segelduk och segelduksproduktion i arkeologisk kontext. In M. Ravn, L. Gebauer Thomsen, E. Andersson Strand and H. Lyngstrøm (eds), *Vikingtidens Sejl*. Copenhagen: Afdeling for Arkæologi, 23–53.
- Andersson Strand, E. (2021) Weaving textiles – textile consumption for travels and warfare. In F. Iversen and K. Kejsrud (eds), *Viking War, special issue Viking*. Oslo: Norsk arkeologisk selskap forlag, 139–148.
- Bender Jørgensen, L. (1986) *Forhistoriske tekstiler i Skandinavien*. Nordiske Fortidsminder serie B 9. Copenhagen: Det Kongelige Nordiske Oldskriftselskab.
- Bender Jørgensen, L. (2012) The introduction of sails to Scandinavia: raw materials, labour and land. In R. Berge, M. E. Jasinski and K. Sognnes (eds), *N-TAG Ten: Proceedings of the 10th Nordic TAG Conference at Stiklestad, Norway 2009*. Oxford: Archaeopress, 173–181.
- Buckley, M., Kansa, S. W., Howard, S., Campbell, S., Thomas-Oates, J. and Collins, M. (2010) Distinguishing between archaeological sheep and goat bones using a single collagen peptide. *Journal of Archaeological Science* 37, 13–20.
- Croix, S. (2015) The Viking, victims of their own success? A selective view on Viking research and its dissemination. *Danish Journal of Archaeology* 4 (1–2), 82–96.
- Frøier, K. and Zienkiewicz, H. (1991) *Linboken, Hemodling och Hemberedning*. Borås: Natur och Kultur (reprint of 1979).
- Gebauer Thomsen, L. (2016) Spor efter vikingetidens sejlproduktion på Sjælland. In M. Ravn, E. Andersson Strand and H. Lyngstrøm (eds), *Vikingtidens Sejl*. Copenhagen: Afdeling for Arkæologi, 53–71.
- Geijer, A. (1938) *Birka. Untersuchungen und Studien III. Die Textilfunde aus den Gräbern*. Stockholm: Almqvist & Wiksell.
- Halstead, P., Collins, P. and Isaakidou, V. (2002) Sorting the sheep from the goats: morphological distinctions between the mandibles and mandibular teeth of adult ovis and capra. *Journal of Archaeological Science* 29, 545–553.
- Hedenstierna-Jonson, C. (2009) Social and political formations in the Scandinavian areas, 8th–10th century. The martial perspective. *Territorio, Sociedad y Poder* 2, 89–104.
- Hägg, I. (1974) *Kvinmodräkten i Birka. Livplaggens Rekonstruktion på Grundval av det Arkeologiska Materialet*. Uppsala: Uppsala University, Institute of North European Archaeology.



- Jæger, J. H. (2020) *ZooMS'ing in on Sheep and Goats – Wool Production during the Southern Scandinavian Late Iron Age and the Potential of Biomolecular Methods*. Unpublished master's thesis.
- Kastholm, O. T. (2013) Vestervang at Kirke Hyllinge, Zealand: a late Iron Age settlement with rich stray finds. *Danish Journal of Archaeology* 2013, 1–23.
- Kastholm, O. T. (2014) Under sejlet. Vikingetidens skibe i langtidsperspektiv. In H. Lyngstrøm and L. Sonne (eds), *Vikingetidens aristokratiske miljøer*. Copenhagen: Saxo-Institute, 103–112.
- Mannerling, U. (2017) *Iconic Costumes: Scandinavian Late Iron Age Costume Iconography*. Oxford: Oxbow books, 4–43.
- Ravn, M., Gebauer Thomsen, L., Andersson Strand, E. and Lyngstrøm, H. (2016) *Vikingtidens sejl*. Copenhagen: Arkeologiska skrifter.
- Reed, C. A. (1960) A review of the archaeological evidence on animal domestication in the prehistoric Near East. In Braidwood, R. J. and Howe, B. (eds), *Prehistoric Investigations in Iraqi Kurdistan, Studies in Ancient Oriental Civilisation* 31, 119–145.
- Sarauw, T. (2019) *Bejsebakken: en nordjysk bebyggelse fra yngre jernalder og vikingetid*. Copenhagen: Syddansk Universitetsforlag and Det Kongelige Nordiske Oldskriftselskab.
- Sørensen, T. F. (2017) The Two Cultures and a World Apart: Archaeology and science at a new crossroads. *Norwegian Archaeological Review* 50(2), 101–115.
- Ulriksen, J. (1998) *Anløbspladser, Besejling og Bebyggelse i Danmark mellem 200 og 1100 e.Kr.* Roskilde: Vikingeskibshallen i Roskilde.
- Ulriksen, J. (2018) *Vester Egesborg. En Anløbs- og Togtsamlingsplads fra Yngre Germansk Jernalder og Vikingetid på Sydsjælland. Katalog over Konstruktioner*. Aarhus: Aarhus Universitetsforlag.
- Ulriksen, J., Schultz, M. K. and Mortensen, M. F. (2020) Dominating the landscape – the emblematic setting of Borgring and the Viking Age ring fortresses of Denmark. *Danish Journal of Archaeology* 9, 1–22.
- Zeder, M. A. and Lapham, H. A. (2010) Assessing the reliability of criteria used to identify postcranial bones in sheep, Ovis, and goats, Capra. *Journal of Archaeological Science* 37, 2887–2905.
- Zeder, M. A. and Pilaar, S. E. (2010) Assessing the reliability of criteria used to identify mandibles and mandibular teeth in sheep, Ovis, and goats, Capra. *Journal of Archaeological Science* 37, 225–242.

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Christine Carnie and Jennifer Worrall

# Unpicking the Bacton Altar Cloth: innovative methodologies for interpreting embroidered textile artefacts

## Introduction

For more than a century, the embroidered textile known as the Bacton Altar Cloth (BAC) has been of interest to scholars, some of whom have speculated that it may have been created from an article of clothing worn by Queen Elizabeth I (Arnold 1988, 80; Lynn 2018). This rare survival presents an unusually broad variety of large botanical motifs worked directly on the silk and silver ground fabric by highly proficient professional embroiderers, as well as additional smaller motifs probably added later by skilled amateurs (fig. 1). Evidence of repeated cutting and piecing preserves an intricate record of the object's history of reuse and repurposing. The mixture of uncommon needlework techniques, such as polychrome speckling stitch and needle blending, with familiar methods including stem stitch, chain stitch and woven wheels, give this embroidery the potential to contribute significantly to scholarship of Early Modern textile art.

At the beginning of 2021, the BAC Stitch Research Group came together from a series of collaborative online presentations and discussion sessions about the textile hosted by the Medieval Dress and Textile Society (MEDATS) in the United Kingdom. The group members come from a variety of backgrounds with a mutual desire to share findings and pool resources to produce a richer research output through collaboration than would be possible by a lone scholar. The project progressed without set deadlines or timelines and has produced two conference papers, several workshops and blog posts. Work has begun on two articles for peer reviewed publication. The group's mission is to use a collaborative blend of research approaches to learn about the BAC and to share findings with the textile history community. These goals emerge flexibly and

adapt according to the findings of the investigation. Techniques include detailed examination of the artefact itself, including high resolution imaging and analysis, technical visual analysis, art historical interpretations of contextual sources (including botanical illustrations, paintings, and comparable surviving textiles), digital reconstruction and digital mapping of the artefact, and experiential reconstruction.

This project was launched in response to the cessation of normal academic pursuits during the COVID-19 pandemic. Travel to museums, libraries, archives, and historic sites was initially impossible. However, photographs taken by the authors before, during, and after conservation, both on and off display, allowed for remote analysis. Historic Royal Palaces conservators kindly supplemented these with additional photographs of the reverse of the BAC before it was mounted for exhibition, photomicrographs, and conservation reports. After restrictions eased, group members made additional visits to view the textile and captured more detailed photographs. Links to and notes about relevant resources were compiled in shared-access digital spreadsheets and slide shows to facilitate collaboration amongst team members during lockdown, and discoveries and observations were shared in weekly video meetings.

## Key research questions

Understanding the BAC will require investigating the past uses of the textile, identifying and interpreting the embroidered motifs on it, inspecting the materials employed in its construction, and both cataloguing and practising the techniques used to create it.

In 2015, the BAC was moved from its home in St Faith's Church in Bacton, Herefordshire (United

Kingdom) to the conservation studios at Hampton Court Palace, London (United Kingdom). In October 2019, it went on display as the focus of the exhibition *Elizabeth I's Long Lost Skirt*, curated by Eleri Lynn, then curator of the Royal Ceremonial Dress Collection. Lynn investigated the possibility of a link to the Tudor Court through Blanche Parry, Chief Gentlewoman to Elizabeth I, concluding that, despite an absence of documentary evidence to link the cloth to a garment worn by Elizabeth I, "the very strong inference to be drawn is that this late 16th-century, elite, professionally embroidered court gown entered the small church of Bacton by gift of the queen in memory of Blanche Parry" (2018, 22). Janet Arnold also conjectured that "it was one of Elizabeth's petticoats given for use in the church after Blanche's death" (Arnold 1988, 80). However, neither Arnold nor Lynn were able to conclusively determine the nature of the previous textile object from which the BAC was made, nor confirm that the cloth had a royal provenance. A more definitive answer to this question is a key objective of the BAC Stitch Group.

Embroidery added significant value to this already luxurious textile. Not only did it provide beauty and colour, it also reflected the social, political, and religious values of those who commissioned it from

professional needleworkers and of the amateurs who devoted considerable time and cost to adding additional images (Morrall and Watt 2008, 167). Embroideries were usually worked on linen, then cut and applied to more expensive textiles. Understanding why the motifs were embroidered directly onto the silk and silver ground may clarify the purpose for which it was initially commissioned.

The diversity of flowers, vines, trees, and woody shrubs worked on the BAC elevates its significance beyond that of most surviving Elizabethan embroideries, as it permits greater study both of the history of English gardens and of the importance embroidery patrons placed on depictions of both familiar and exotic specimens. Many authors acknowledge the complex symbolism of botanical motifs in art of the Early Modern era (Hayward 2010, 25–26; Reynolds 2013, 150; Lynn 2017, 96). The BAC may have been commissioned by a noble to represent their fashionable interest in formal gardens (Strong 2000, 20–26) and their knowledge of recently introduced foreign species. Accurate identification of the plants appearing on the BAC may help establish a date range for the creation of the primary botanical motifs and illuminate the cultural significance of a textile representing this species variety.



Fig. 1: The Bacton Altar Cloth after conservation: it is a natural colour (undyed) ribbed silk with a supplementary weft of flattened silver strips, embroidered with large botanical motifs in blended polychrome silk with gold and silver thread, and smaller animal images in silk and metal threads. On loan to Historic Royal Palaces courtesy of the Church of St Faith, Bacton, Herefordshire, UK (Image: Challe Hudson)



## Outcomes to date

The Bacton Altar cloth was conserved, framed and hung on the wall of the St Faith Church in 1909 (Lynn 2018, 4). During conservation in 2019, the previous linen and cotton patches, conservation stitching, and cotton lining were removed. The silk ground is fragile and degraded in many places, and the embroideries have faded. The BAC was cleaned with a low power vacuum and cosmetic sponges, then stabilised by stitching to a silk lining dyed to match. The BAC is now mounted on a padded board, stored and displayed flat in a T-shape measuring 117 cm by 201 cm (Henni and Thompson 2019).

The BAC Stitch Group first attempted to identify the species depicted in the 80 plus full and fragmentary botanical motifs. This process was complicated by the presence of motifs clearly representing the same plant, but worked from different patterns, as well as motifs with identical silhouettes, but for which the flower or fruit colours are dissimilar. Texts such as John Gerard's *The Great Herball, or, Generall Historie of Plantes* (1597) provided a reference for understanding how contemporary botanical knowledge could have informed the artists designing the motifs. The BAC Stitch Group shared their photographs and research

progress in virtual workshops, encouraging feedback about the species identifications proposed, and sought opinions from gardening experts. A total of 38 distinct species were identified. Although a small number are yet to be conclusively assigned a species name, every botanical motif has been numbered and catalogued, with accompanying visual or contextual references recorded for each identification.

The group also analysed the smaller embroidered motifs that had been worked amongst the botanical motifs. These secondary motifs were first organised into categories and mapped on the cloth with Graphical Image Manipulation Program (GIMP) computer software, then analysed based on emerging themes (fig. 2). Caterpillar motifs were embroidered throughout the BAC, but motifs such as insects, butterflies, birds, and trees were clustered near others of a similar type. Other motifs appear to have been positioned relative to one another conveying an idea or a story. One of these series became the subject of further investigation into the popular depiction of hunting scenes in a variety of 16th century decorative arts (Hudson et al. 2021). This scene was significantly altered by the deliberate removal of at least three animal motifs (ghosts) visible in traces of remaining

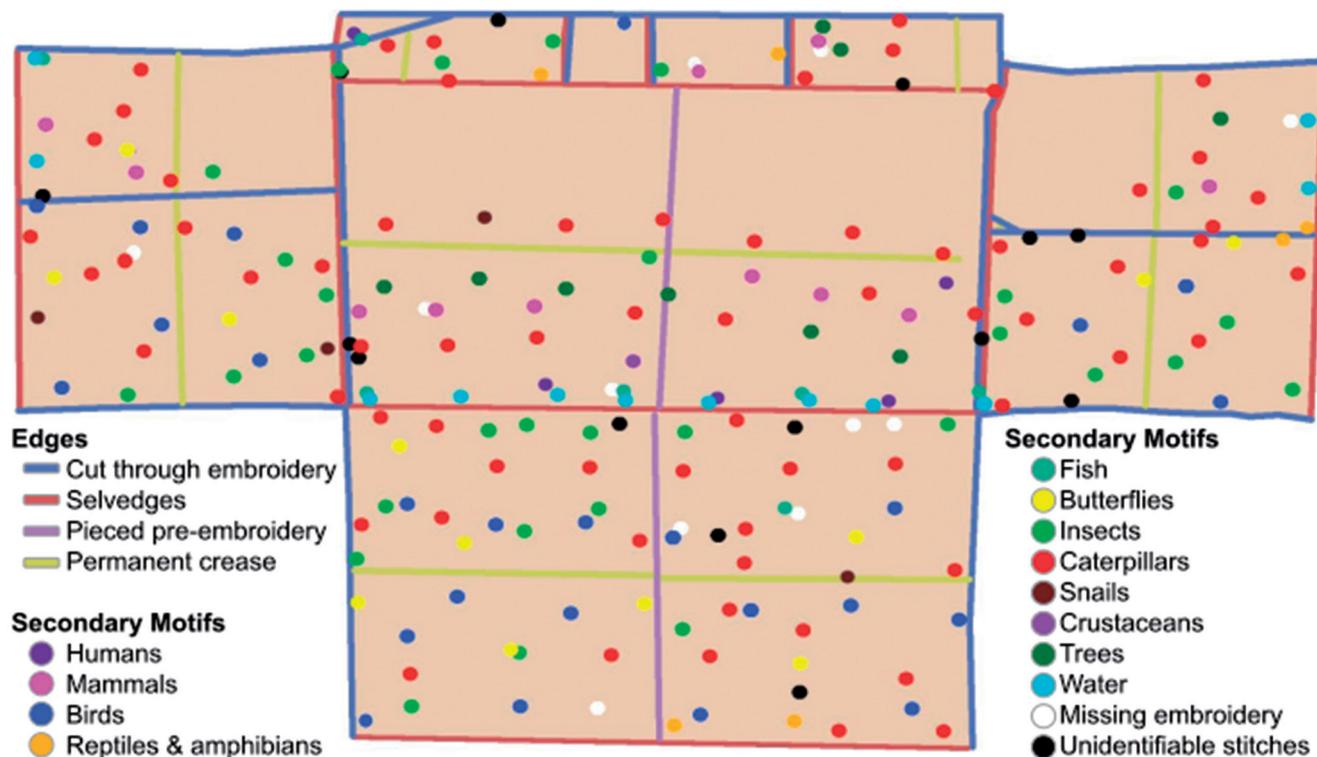


Fig. 2: The secondary embroidered motifs (dots) and the selvedges, seams, cut edges, and creases (lines) used to guide a digital separation of the Bacton Altar Cloth into its component fragments. Together with the embroidered botanical motifs (not pictured), the digital separation was used to reassemble the fragments into the textile's original trapezoidal panels (Image: Challe Hudson)

stitches and damage to the ground fabric (fig. 3). Another apparently narrative scene taking place on water featuring boats, men, and large aquatic creatures is depicted in a horizontal arrangement of motifs. Research into the source and meaning of this series is ongoing.

Mapping the smaller motifs also indicated a pattern to the placement of the categories, with birds and butterflies appearing only on some parts of the BAC, while the hunting and aquatic scenes were located on different panels from the flying animals. This led to the next phase of the project: identification of the individual pieces of fabric that were sewn together to create the altar cloth. Photographs were carefully studied to identify markers such as creases, selvages and severed motifs, which were digitally mapped onto the cloth using GIMP (fig. 2). These markers were then employed to reassemble the individual pieces into the positions they would have had prior to cutting by digitally unpicking the seams and rearranging the component parts of the altar cover (fig. 4). The digitally restored cloth confirmed the pattern suggested in the mapping: the smaller motifs had been embroidered onto two distinct and discontinuous trapezoidal panels before they were refashioned into a table cover (Hudson et al. 2022).

Possible sources for the specific patterns for the large botanical and smaller animal motifs were also sought. A potential source is Jacques Le Moyne's pattern book, *La Clef des Champs* (Lynn 2018, 15). This book contains several designs that are almost identical to those worked on the BAC, particularly larkspur, borage, and barberry. Other illustrations closely resemble the marigold, grapevine, and squirrel on the BAC. As the woodcuts for the pattern book were based on Le Moyne's earlier watercolour drawings, these were also considered, along with derivative works such as sketchbooks (British Museum 2022) and early 17th century printed pattern books based on Le Moyne's work (de Passe 1593–1603). Although these works resemble the botanical motifs on the BAC, none appear to be direct copies. Sources for the secondary motif patterns were also sought. The bear was probably copied from Nicolaes de Bruyn's bestiary, *Animalium Quadrupedum* (Lynn 2018, 17). By studying works by de Bruyn (1594) and other contemporary printmakers, as well as needlework pattern books, illustrated herbals and early zoological texts, additional possible sources were located which now merit further study.

The ground fabric has been identified as a silk camlet (Arnold 1988, 79; Lynn 2018, 12), "a warp-faced tabby with a pronounced weft rib" (Hayward and Ward 2012, 247). A supplementary weft of a fine flat strip of silver



Fig. 3: Detail of the Bacton Altar Cloth showing the outline of a mostly removed secondary embroidery, probably a lion, crouching behind a stylised tree (Image: Challe Hudson)

laid on top of every second weft thread adds value to this fabric. A limited number of extant contemporary examples of similar silver camlet survive to the present day, some with flat strips of silver in alternating passes of the weft and some with fine round silver wire or pairs of wires in every pick of both plain and twill fabrics. The camlet has been identified as of Italian manufacture (Lynn 2020, 64); further analysis of the weave structure and coloured patterning of the preserved selvages may help to establish a more precise place and date of manufacture. Signs of damage, such as a permanent crease lengthwise down the middle of the fabric, and the presence of seams in the ground fabric made before the embroideries were worked, may be significant clues to the cloth's past uses.

Investigation of the materials and techniques employed by the professional embroiderers who created the large botanical motifs was also undertaken. Other extant examples of the blended polychrome speckling technique were sought. Small items such as coifs and forehead cloths with similar motifs rendered in a speckling stitch were found, but none were worked in more than one colour and none in the quantity and scale appearing on the BAC. Four of the large motifs were drawn to scale and reproduced using materials as close as possible to the original

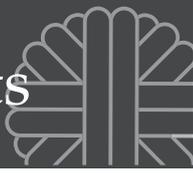


Fig 4: The component pieces of the Bacton Altar Cloth digitally separated along the seams and selvages (Image: Challe Hudson, original image © Historic Royal Palaces Courtesy of the Churchwardens and Parish Church Council of St Faith's Church, Bacton, Herefordshire, UK)

in order to provide insight into the skill level of the embroiderers and the difficulties they may have encountered. Creative blending of the coloured silk threads in a single needle proved to be a challenge and piercing the fabric through the denser bundle of weft fibres required concentration and dexterity. The denser the speckling stitches, the more compact the weave became, requiring considerable strength and perseverance. The results confirmed that the technical skill required to place the stitches quickly, carefully and efficiently was simultaneously demanding and tedious, suggesting that the 16th century embroiderer or embroiderers had been expertly trained and worked in a professional capacity.

#### Future work

Using the selvedge-to-selvage width of the silk ground (52 cm), estimated measurements of the fabric pieces that were cut to form the BAC have been calculated from the digital reconstruction. The shape and dimensions of these hypothetical panels will be compared to patterns taken from extant garments and domestic furnishings as well as inventory descriptions, tailor's pattern books, and representations of

embroidered textiles in art. Future work will aim to replicate these pieces in fabric with similar qualities to the BAC camlet and experiment with draping and shaping these pieces to better understand how this original textile may have been used. Mapping areas of significant damage to the ground fabric and the location of now lost embroidered motifs may also contribute valuable information about its past uses.

Visual analysis and categorisation of each of the small embroidered motifs with respect to stitch, thread, colour and design will aid in determining a better timeline for the application of the secondary embroideries. Additional experiential reconstruction will help to analyse the techniques used to create the animals, water creatures, birds, trees, and insects. The stitches used to create these motifs are freer, more intuitive, and reflect a less prescriptive placement of stitches and a larger selection of embroidery techniques than might have been chosen by a professional.

A survey of contemporary extant embroideries is being compiled to establish a basis for comparison. This will help determine the ways in which the materials, methods, designs, and past alterations of the BAC are similar and dissimilar to surviving decorative textiles.

A comparison of these features may answer some of the questions surrounding the BAC and illuminate its unusual qualities. This research may also inform our understanding of the interdependent relationship between professional and domestic embroiderers.

This continuing research will attempt to reconstruct the 500-year journey of this object from the loom to its current state and status, and consider its evolving cultural significance. The multilayered digital mapping of motifs, damage, and defining marks on both the current configuration of the BAC and the reconstruction of the panels that were cut to make the BAC is an essential process for future investigation of this textile. The expanding image library of both extant objects and related art will aid further research of the BAC, and inform scholarship not just of Early Modern textiles and material culture, especially the evolution of both professional and domestic needlework, but also botanical and horticultural history.

### Acknowledgements

Thanks are due to the curators of Historic Royal Palaces for arranging access to the Bacton Altar Cloth and for sharing their photographs and reports, and to the Parish Church Council of St Faith's, Bacton, Herefordshire for permitting study of their treasured embroidery.

### Bibliography

- Arnold, J. (1988) *Queen Elizabeth's Wardrobe Unlock'd*. Leeds: Maney Publishing.
- de Bruyn, N. (1594) *Animalium Quadrapedum*. Flanders: Assuerus van Londerseel. <https://www.artic.edu/artworks/83/three-bears-plate-ten-from-four-legged-animals> (accessed 27 June 2022)
- de Passe the Elder, C. (1593–1603) *Hortus Floridus: Altera Pars*. London: Hans Woutneel. Available online: [https://www.britishmuseum.org/collection/object/P\\_1952-0117-14-171](https://www.britishmuseum.org/collection/object/P_1952-0117-14-171) (accessed 19 June 2022)
- Gerard, J. (1597) *The Great Herball, or, Generall Historie of Plantes*. London: John Norton. Available online: <https://www.biodiversitylibrary.org/item/109874> (accessed 22 June 2022)
- Hayward, M. (2010) The 'Empresse of Flowers': The

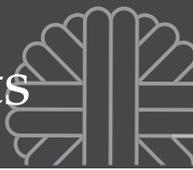
significance of floral imagery in two portraits of Elizabeth I at Jesus College, Oxford. *Costume* 44(1), 20–27.

- Hayward, M. A. and Ward, P. (2012) *The inventory of King Henry VIII: Volume 2 textiles and dress*. Turnhout, BE: Harvey Miller for the Society of Antiquaries of London.
- Henni, E. and Thompson, L. (2019) *Object report/Treatment proposal/Treatment report*. Internal Historic Royal Palaces Conservation Department report. Unpublished.
- Hudson, C., Worrall, J., Carnie, C., Jackson, C. and Bramwell-Booth, N. (2021) Dogs, deer, bears and ghosts: the hunting scene on the Bacton Altar Cloth. *Annual conference of the Medieval Dress and Textile Society*, online, 8 May.
- Hudson, C., Carnie, C., Jackson, C., Bramwell-Booth, N. and Worrall, J. (2022) Digitally reconstructing the embroidered fabric that became the Bacton Altar Cloth. *Annual conference of the Medieval Dress and Textile Society*, online, 29 May.
- Lynn, E. (2017) *Tudor Fashion*. New Haven and London: Yale University Press.
- Lynn, E. (2018) The Bacton Altar Cloth: Elizabeth I's 'long-lost skirt'? *Costume* 52(1), 3–25.
- Lynn, E. (2020) *Tudor Textiles*. New Haven and London: Yale University Press.
- Morrall, A. and Watt, M. (2008) *'Twixt Art and Nature. English Embroidery from the Metropolitan Museum of Art, 1580–1700*. New York: The Bard Graduate Center for Studies in the Decorative Arts, Design, and Culture.
- Reynolds, A. (2013) *In Fine Style: The Art of Tudor and Stuart Fashion*. London: Royal Collection.
- Strong, R. (2000) *The Artist and the Garden*. New Haven and London: Yale University Press for Paul Mellon Centre for Studies in British Art.

### Internet sources

- Drawing; sketchbook (museum number 1962,0714.1.40)*, British Museum (2022) [https://www.britishmuseum.org/collection/object/P\\_1975-U-1589-17](https://www.britishmuseum.org/collection/object/P_1975-U-1589-17) (accessed 19 June 2022)

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Jane Malcolm-Davies and Beatrice Behlen

# The Ghastly Garment: a knitted waistcoat associated with King Charles I

## Introduction

A waistcoat (inventory number A27050) in the collection of the Museum of London said to have been worn by Charles I is the focus of a new study which will apply archaeological scientific methods to historical material. The waistcoat is currently catalogued as “knitted of fine, pale blue-green coloured silk”, and, despite its iconic status in the museum’s collection, it has not been the subject of much published systematic study (Staniland 1999). Its intriguing history includes the claim that the ill-fated monarch was wearing it when he was beheaded on 30 January 1649.

Sections of the waistcoat are patterned differently, with the sleeves and body in an arrangement of knitted abstract motifs, and the upper body part in a diamond pattern. The sections are divided by a horizontal border below the neck opening, with the sleeve cuffs and welt at the bottom of the garment similarly knitted. The neckline slit is faced with a woven fabric and fastened with thread-covered buttons.

When it was first sold in 1898, the waistcoat was described as “a relic at once authentic and ghastly” (Anon 1898, 5). The waistcoat has a series of stains down the front and there are two areas of damage, where the fabric is broken and fragments are loose. These could have been sustained when the waistcoat was “lent to different friends” by Mrs Hardy, a former owner, resulting in it being “soil’d and defac’d” as reported in correspondence by the Reverend John Leigh Bennett in February 1827 (Fellowes 1828).

## Background to the project

The complex provenance of the waistcoat will be easier to substantiate than was the case in the past, using online resources which have become available in recent years. Interrogating this evidence via art

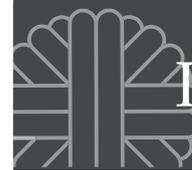
historical methods in tandem with scientific enquiry into its materials and construction will provide new insights into the waistcoat’s context and history. The project recognises the need for, and keen public interest in, more scholarly research into non-woven textiles of which this knitted garment is an excellent early survival. It is also an important example of men’s underwear from the Early Modern era, which is not well represented among extant garments.

The waistcoat was donated to the London Museum (now Museum of London) in 1924. The in-house documentation about it has grown over the years in an *ad hoc* fashion, offering an assortment of research materials for review. These include auction catalogue entries from its sale and purchase in the 19th and early 20th centuries, to reports on inconclusive analyses of the stains in 1959 and 1989, and their review by the Forensic Science Service at the Metropolitan Police in 2010.

There is little published literature about knitted waistcoats, and most relevant work concentrates on the fancier brocade or damask examples, usually interpreted as women’s dress, which are most numerous in Scandinavian collections (for example, Ringgaard 2014). Very few authors have written about this specific waistcoat, and those who have are cursory in their treatment (Thomas 1943; Rutt 1987; Staniland 1999).

## Aims and objectives

The study will undertake a systematic examination and description of the waistcoat according to the *Knitting in Early Modern Europe* protocol (Malcolm-Davies et al. 2018) and a review of all the current documentation with appropriate follow up on biographical information about previous owners to establish links (if any) to Charles I. An interdisciplinary approach to



the waistcoat project will employ the expertise of the museum's curator of fashion and decorative arts, its textiles and dress conservator, a knitting historian, specialists in scientific analysis, and a team of skilled craftspeople. The waistcoat will be subjected to detailed examination and rigorous recording. The project has three main research questions: how was the waistcoat knitted; from what materials is it made and how were they processed; and how old is it?

### How was it knitted?

The waistcoat has been laid flat on the same mounting board for about a decade, providing restricted access to the back of the garment. The relative fragility of the object, particularly the damage to the front, allows only limited access to the inside. New high-resolution digital photographs will be

commissioned to minimise the need for handling the garment and facilitate analysis of its structure.

The research will gather and interpret the evidence in the waistcoat for handknitting, frame knitting, or both. If all or some of the elements are handknitted, it will be necessary to identify whether it was knitted round, flat, or in a combination of the two.

Comparative material such as similar extant waistcoats has been identified, although several are fragmentary and/or their provenance is unclear. These will also be investigated to shed light on the potential construction methods.

Elements of the waistcoat will be reconstructed to explore its original construction in collaboration with craftspeople, including spinners and knitters who work with contemporary fibres, with the aim of reflecting early modern era materials as closely as



Fig 1: Front of the knitted waistcoat (inventory number A27050) said to have been worn by Charles I at his execution in 1649 (Image: © Museum of London)



Fig 2: The waistcoat (inventory number A27050) thought to have been photographed in the 1980s (Image: © Museum of London)

possible.

### What are the materials?

The second research question concerns the materials with which the waistcoat is made: the fibre in the knitted body and sleeves, the woven fabric facing at the neck opening, the thread and structural support of the buttons in the same location, and the sewing thread used to work the buttonholes. Knowing more about these will suggest avenues of research about the origin of the raw materials used in knitted garments of this type in the 17th century.

Fourier transform infrared spectroscopy (FTIR) will ascertain the main material. It is presumed to be silk but no investigative work has yet been undertaken to confirm this; if so, further study will determine whether it is reeled or spun. An analysis of the thread will determine whether it is plied or single yarn. FTIR will also identify any anachronistic materials or contaminants in the waistcoat.

Permission has been requested to sample the waistcoat with a view to undertaking dye analysis and microfading tests. Dye analysis will explore the likelihood that the current faded blue colour is original by identifying the dyestuffs and any mordants

present. This will confirm or contradict its agreement with reports of the king's "sky-coloured" waistcoat, which he wore to prevent him from shivering with cold and appearing afraid of his fate on the scaffold. These observations of the king's clothing come from contemporary accounts by William Sanderson in 1658 and Thomas Herbert in 1678 but it is not known whether both men were reporting what they observed with their own eyes or repeating second hand accounts.

A thorough analysis of the garment's condition will be undertaken and recommendations drawn up for its long-term storage, display, and access. Microfading will provide guidance on the lighting exposure.

### How old is it?

One way in which historical dress and textiles are dated takes into account their shape, style, and technique. While this art historical approach can be helpful, it is not a perfect solution and often poses more questions than it answers. Radiocarbon dating has the advantage of providing a calendar age range, which will either corroborate the historical assessment of the waistcoat or open new lines of enquiry. Dating the waistcoat in this way will help establish whether it is 17th century and potentially whether it dates to the time of Charles I's execution.

Other aspects of the waistcoat yet to be thoroughly researched will suggest the likelihood of its association with the king. An accurate record of its dimensions will permit comparison with what is known about Charles I's physique.

Contextual evidence will be collected from the royal wardrobe accounts of the 17th century, other household accounts of the time, and import and export records. This will determine the extent to which similar garments existed and whether they match this example.

### Further research

This project is intended as an exploratory phase in a longer study which aims to understand this unusual survival of men's early modern underwear. Even if it is not a royal garment (and this may never be established with certainty), it is potentially more interesting as a previously undocumented item of ordinary men's dress. Such functional knitted clothing is mentioned (but not numerous) in documentary sources and occasionally seen in pictorial evidence. The waistcoat is also an important item in the corpus of extant knitted garments, known as *nettrøje* in Scandinavian collections (Ringgaard 2014), which are characteristically decorative, and usually interpreted as women's clothing. Other examples of patterned or



Fig 3: Detail of the neck opening of the waistcoat (inventory number A27050) (Image: © Museum of London)

plain but otherwise unembellished garments knitted in a single fibre and colour are recorded, although some only as archaeological fragments. They offer useful points of comparison with the Museum of London's example. Future investigation will consider the appropriateness of archaeological analyses such as isotope testing and proteomics. These may reveal more about the knitted waistcoat's provenance – both the raw materials and its manufacture.

### Conclusion

The aim of this project is to deepen knowledge of the waistcoat said to have been worn by King Charles I on the scaffold in 1649. There are currently many outstanding questions about the attribution, dating and production of this "ghastly" object. This project will exploit recent developments in textile research methodology and new ways of communicating the results to a wide audience. Publication of the

waistcoat and a methodology for recording others will be disseminated via traditional academic publications, the craft press, and social media. The project will also inform improved interpretation for the object's display and further research opportunities at the Museum of London. The more we can discover about the waistcoat's physical and material properties, the more its history and purpose are likely to be revealed. The waistcoat is on display at the Museum of London's Docklands site as part of the *Executions!* exhibition until April 2023.

### Acknowledgements

This interdisciplinary project has been funded by a Janet Arnold Award from the Society of Antiquaries of London and grants from the Worshipful Company of Dyers and the Worshipful Company of Weavers. Thanks are also due to the Makower family, descendants of the original donors of the garment to the museum, who are championing the project.

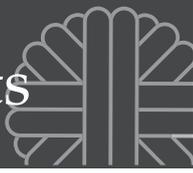
### Bibliography

- Anon (1898) London, Wednesday, November. *The Standard*, 9 November, 5.
- Malcolm-Davies, J., Gilbert, R. and Lervard, S. (2018) Unravelling the confusions: Defining concepts to record archaeological and historical evidence for knitting. *Archaeological Textiles Review* 60, 10–24.
- Fellows, W. (1828) *Historical Sketches of Charles the First, Cromwell, Charles the Second, and the Principal Personages of that Period*. London: J. Murray, 205–206.
- Ringgaard, M. (2014) Silk knitted waistcoats: a 17th century fashion item. In T. Engelhardt Mathiassen, M-L. Nosch, M. Ringgaard, K. Toftegaard and M. Venborg Pedersen (eds), *Fashionable encounters: perspectives and trends in textiles and dress in the early modern Nordic world*. Ancient Textiles Series 14. Oxford: Oxbow Books, 73–104.
- Rutt, R. (1987) *A History of Hand Knitting*. Loveland, CO: Interweave.
- Staniland, K. (1999) The king on the scaffold. *History Today* 49(1), 41–43.
- Thomas, M. (1943) *Mary Thomas's book of knitting patterns*. London: Hodder & Stoughton, 49–53.

### Internet sources

Museum of London online collection:  
<https://collections.museumoflondon.org.uk/online/object/88989.html> (accessed 3 October 2022)

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Magali An Berthon

# TEX-KR project: From textile remains to lost practices, investigating the textile material culture of conflict of the Khmer Rouge regime

## Introduction

The question of loss and absence is inherent to the study of archaeological and historical textile artefacts and garments. Textile historian Mary Brooks has indeed argued that in dress collections, garments necessarily become “surrogate bodies evoking and memorialising the absent wearer” (Brooks 2017, 20). Archaeologist Elizabeth E. Peacock has stressed the intimate relationship between textile finds and human remains and the ethical issues associated with their treatment and study (Peacock 2007). These central debates in the field of textile studies take a specific meaning in the context of war, genocide, and forced migration. The TEX-KR project explores Cambodian textile crafts and dress practices from 1970 to the mid-1980s, especially examining the unprecedented disruptions brought by the civil war and the Khmer Rouge regime. Facing lost lives, fragmentary material evidence, missing artefacts, and the disappearance of textile technical know-how, TEX-KR is a 20th-century-focused project that strongly resonates in its approach with the field of textile archaeology and contemporary conflict archaeology (Theune 2018). This project outlines a nuanced and precise understanding of what Cambodians wore in the years before the dictatorship, during, and after, and how the regime affected textile craft practices, fibre production, manufacturing, and trade. Over the last three decades, scholarly interest in the Khmer Rouge tyranny and its tremendous political, human, and social cost has gained prominence, while mostly overlooking its material facets (Chandler 1991; Kiernan 2008). On the other hand, textile literature has largely centred on the history, iconography, and technical specificities of Cambodian textiles before 1970 and after 1990

(Green 2003; 2008). However, during the 1970s, textile production and exchanges continued, even in limited and shifting forms. TEX-KR aims to redress this major knowledge gap through the study of material remains and lack thereof, to shed light on an essential aspect of Cambodian material culture, and expand current knowledge on the Khmer Rouge regime. This multidisciplinary study combines politics, archives, materiality, and theoretical perspectives on trauma, memory, and embodiment.

## Context

Textile crafts are ancestral practices that have been commonly carried by women in the household in Cambodia since at least the 13th century. In his eyewitness account *Record of Cambodia: The Land and Its People*, Chinese diplomatic envoy Zhou Daguan, who had been sent to the court of Angkor, commented on dress customs among the elite and commoners, cotton cloth trade at the market, and weaving activities (Zhou and Harris 2007). Thereafter, silk and cotton weaving continued as a cottage industry, mainly for the domestic market. Silk textiles were used by both men and women to attend ceremonies such as Buddhist rituals and weddings. Cambodian silk textiles also gained international recognition. By the 17th century, these were considered prestige items traded within the Southeast Asian courts, especially by the Siamese, and offered as prized diplomatic gifts (fig. 1). Cambodia also became a leader in cotton production and exported in the region up to the mid-20th century. Until the 1970s, silk farmers yielded between 20 to 50 metric tonnes of yarn a year for a national consumption of 80 tonnes (Delvert 1994). Decades of political upheavals in the second half of



Fig. 1: *Sampot hol chawng kbun* (silk weft ikat hip wrap), catalogue number: E83, from King Mongkut of Siam to US President Franklin Pierce, around 1856 (Image: courtesy of the National Museum of Natural History, Smithsonian Institution)

the 20th century brought unprecedented disruptions to the practice of sericulture and artisanal weaving. By 1970, Cambodia plunged into civil war when General Lon Nol ousted prince Norodom Sihanouk and established the Khmer Republic. In January 1975, the Khmer Rouge marched over Phnom Penh and rose to power, changing the country's name into Democratic Kampuchea, and turning Cambodia into a nationalist revolutionary regime. Between 1975 and 1979, nearly 2,000,000 people died of bloody purges, armed conflicts, harsh treatment, hunger, and diseases (Chandler 1991). Cultural geographer James Tyner argued that “before the Khmer Rouge constructed their own communist spaces, they deliberately set out to *deconstruct*, or unmake previous spaces” (Tyner 2008, 110). In this deliberate process of “unmaking”, the Khmer Rouge controlled the dress practices of the population, forbidding people to wear colourful or festive attire (Narin et al. 2003).

The regime imposed a unisex national uniform comprised of unfitted black cotton pyjamas, inspired by the common peasant garb, worn with a red and white gingham *krama* (scarf), a Chinese-style *kadep* (cap), and black sandals made from rubber tyre (Berthon 2018) (fig. 2). Phnom Penh was deserted by its inhabitants, with the ruling party only keeping administrative headquarters, hospitals, and prisons open, including S21, the largest

secret central prison and torture centre in the country, through which transited about 18,000 people with only a handful of survivors (Chandler 1999).

A few textile factories remained active but were operated by new workers coming from outside the city. Simultaneously, the National Museum of Cambodia, founded in 1920 during the French protectorate, was closed and abandoned in 1975. Upon reopening in 1979, the institution had lost three quarters of its extensive silk textile and costume collection. Silk production and weaving practices were heavily affected by the destruction of mulberry tree fields, the dismantlement of villages, and the displacement of craftspeople in other provinces. More significantly, in the aftermath of the regime, local silk fibre production had fallen to an estimate of 0.8 metric tonnes a year, the lowest level ever recorded in the 20th century (Cambodia Ministry of Commerce and International Trade Center 2016). As a result of the continuous armed conflicts in the country, more than 600,000 Cambodians, including ethnic Vietnamese and Chinese populations, fled (Slocomb 2010). About 350,000 people relocated to refugee camps at the Thai border, or managed to cross the borders to Thailand and Vietnam, including weavers who tried to pursue their activity in displacement (US General Accounting Office, National Security and International Affairs Division 1991).



Fig. 2: Khmer rouge black peasant dress: a – Textile workers in a textile storage room; b – Women harvesting rice fields. Propaganda images, around 1976 (Image: *Kampuchea Democratique*, March 1976, Department of Information, Ministry of Foreign Affairs, Democratic Kampuchea)

### Project's description and objectives

To address the project's central theme of human, material, and technical destruction, TEX-KR turns to a diversity of finds whose significance advances the understanding of the living and surviving conditions of Cambodian people during the civil war and Khmer Rouge regime. The context of war and displacement entails the study of fragmentary evidence of textile activities, production, circulation, and consumption within Cambodia and in the refugee camps at the Thai border. As a result, material remains (clothes, textile fragments, paper documents, photographs, and tools) are scarce and require careful examination and interpretation to help reconstruct past making processes and textile uses. Issues of continuity, change and loss in textile production, weaving knowledge, and dress practices in Cambodia under the dictatorship are addressed through historical and ethnographic strategies that include archival, object and material-based studies, oral history, and practice-based approaches with weavers in Cambodia. This project is articulated around the study of two textile collections from the country's leading cultural institutions and sites: the National Museum of Cambodia and Tuol Sleng Genocide Museum. During the regime, nearly all of the National Museum staff had died, resulting in a tremendous loss of knowledge about the museum's history and objects. By the 1980s, the textile collection formed during the

French colonisation, comprised in particular of an extensive number of intricate silk polychromic weft ikat (*sampot hol*), pictorial ikat (*pidan*), and brocaded pieces (*sampot chorebap*), had taken a heavy toll due to environmental damages, lack of conservation, and looting (Khun and Hab 2003).

The museum only recovered 73 flat textiles and about 30 royal dance and theatre costume items (fig. 3). In parallel, the S-21 prison became the Tuol Sleng Genocide Museum and memorial site in 1980

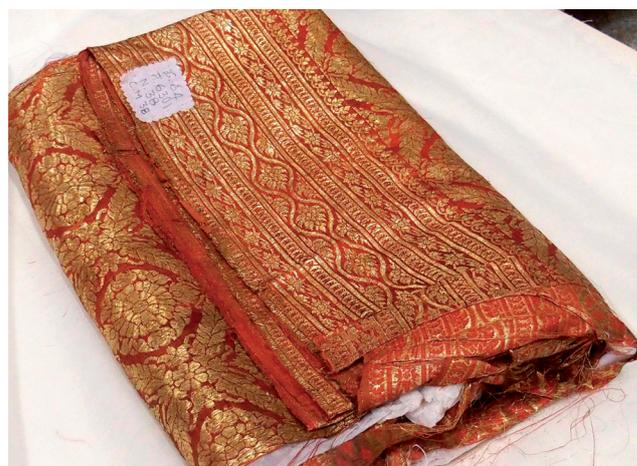


Fig. 3: *Sampot chorebap* (brocade), silk and gilt *filé*, acquired by the museum in 1921, Cha.64 (Image: Magali An Berthon, 2018, courtesy of the National Museum of Cambodia)

(Chandler 1999; Cambodia Ministry of Culture and Fine Arts 2020). Since 2018, about 3,000 prisoners' garments and fragments were found in situ and reclaimed during an ambitious textile conservation plan to be integrated with the museum's collection of photographs and paper archives (fig. 4). Comprised of a majority of military uniforms, caps, belts, male pants and shirts, and a range of more unusual civilian-owned clothes often heavily patched and mended, the objects found at Tuol Sleng tell a history of war, hardship, and survival. Looking in particular at signs of tears and repairs, as well as names stitched onto a few pieces, give invaluable clues to the identities of their owners, and point to the scarcity of material resources in that period. This material study may also inform the procedures and torments inflicted by the prison guards and the prisoners' strategies of survival. Given this, this project investigates the ways in which these collections – one missing, one found – are by-products of the Khmer Rouge atrocities, embodying two complementary sides of this traumatic period of human, cultural, and artistic destruction.

TEX-KR aims to provide an embodied sensory perspective to existing Cambodian genocide studies, in the footsteps of the most recent scholarship on the materiality of genocide (Caswell 2014). The project offers new ways of working with textile materials as part of cultural memory to make past connections, techniques, and practices visible and known. In the words of the Chief Conservator for the United States Holocaust Memorial Museum Jane E. Klinger, these clothes and textiles “tempered by trauma” carry several functions as historic markers, second skin for the missing and the dead, commemorative objects, evidence of hardship or survival with “the ability to invoke highly personal feelings in the viewer that inextricably link the tangible and historic” (Klinger 2017, 95–96). In a second phase, this archival and object-based research will support the development of practice-based strategies through visual documentation, interviews, and participatory methodologies to explore further the links between textile making, memory, loss, and cultural identity. Based on a selection of missing pieces' descriptions found in the National Museum's archives, Cambodian weavers and artists will be invited to develop new silk textiles to reconnect lost skills to contemporary forms of artisanal making. In a dynamic approach to cultural heritage, this project considers crafts not as static traditions but as living practices in dialogue with historical artefacts in museum collections. Placing human experience at the centre of the research



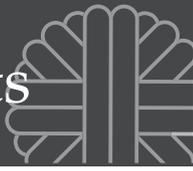
Fig. 4: Picture of a female prisoner on display in the permanent gallery of Tuol Sleng Genocide Museum, surrounded by other prison mugshots (Image: Magali An Berthon, 2020, courtesy of Tuol Sleng Genocide Museum)

process helps to create the required space to welcome Cambodian individual narratives, from the memory of the Khmer Rouge regime victims and survivors to weavers, refugees, and immigrants, and to explore community relationships with past textile practices and artefacts.

Ultimately, the project finds inspiration in the field of Transitional Justice in implementing research outputs and activities aiming to redress the dignity of victims of mass atrocities and foster dialogues between objects, histories, and women weaving communities through making (Rush 2014). TEX-KR develops an innovative sensory methodology incorporating materiality, emotions, and memory to study sensitive textile artefacts in a Cambodian context with the potential to inform other histories of conflict.

#### Acknowledgements

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## Bibliography

- Berthon, M. (2018) Textile Remains at Tuol Sleng Genocide Museum. *Mémoires en Jeu* 6, 85–90.
- Brooks, M. (2017) Reflecting Absence and Presence: Displaying Dress of Known Individuals. In M. Brooks and D. Eastop (eds), *Refashioning and Redress: Conserving and Displaying Dress*. Los Angeles: Getty Publications, 19–32.
- Cambodia Ministry of Commerce and International Trade Center (2016) *Cambodia National Silk Strategy*. Phnom Penh: Cambodia Ministry of Commerce and ITC.
- Cambodia Ministry of Culture and Fine Arts (2020) *Tuol Sleng Genocide Museum 40 years: Remembering the Victims of S-21*. Phnom Penh: Tuol Sleng Genocide Museum.
- Caswell, M. (2014) *Archiving the Unspeakable: Silence, Memory, and the Photographic Record in Cambodia*. Madison: University of Wisconsin Press.
- Chandler, D. (1991) *The Tragedy of Cambodian History: Politics, War, and Revolution since 1945*. Thailand: Silkworm Books.
- Chandler, D. (1999) *Voices from S-21*. Berkeley: University of California Press.
- Delvert, J. (1994) *Le paysan cambodgien*. Paris: L'Harmattan.
- Green, G. (2003) *Traditional Textiles of Cambodia: Cultural Threads and Material Heritage*. Chicago: Buppha Press.
- Green, G. (2008) *Pictorial Cambodian Textiles*. Bangkok: River Books.
- Khun S. and Hab T. (2003) Textiles in the Collection of the National Museum of Cambodia. *The IKTT Seminar program Hol' the Art of Cambodian Textile*. Siem Reap.
- Kiernan, B. (2008) *The Pol Pot Regime: Race, Power and Genocide in Cambodia Under the Khmer Rouge, 1975–79*. New Haven: Yale University Press.
- Klinger, J. E. (2017) When So Few Traces Remain. *UMR Sirice* 2017/2 (19), 93–104.
- Narin, C., Sopheary, C., Sinine, K. and Chanmara, P. (2003) *Seams of Change: Clothing and the Care of the Self in late 19th and 20th Century Cambodia*. Phnom Penh: Reyum Publishing.
- Peacock, Elizabeth E. (2007) Study of Archaeological Textiles Intimately Associated with Human Remains – Where is the Ethical Dilemma? In A. Rast-Eicher and R. Windler (eds), *NESAT IX Archäologische Textilfunde, Archaeological Textiles*. Ennenda: ArchoTex, 12–16.
- Rush, P. (2014) Preface After Atrocity: Foreword to Transition. In P. D. Rush and O. Simic (eds), *The Arts of Transitional Justice Culture, Activism, and Memory after Atrocities*. New York: Springer, v–xi.
- Slocomb, M. (2010) *An Economic History of Cambodia in the Twentieth Century*. Singapore: NUS Press.
- Theune, C. (2018) *A Shadow of War: Archaeological Approaches to Uncovering the Darker Sides of Conflict from the 20th Century*. Leiden: Sidestone Press.
- Tyner, J. (2008) *The Killing of Cambodia: Geography, Genocide and the Unmaking of Space*. Abingdon: Routledge.
- US General Accounting Office, National Security and International Affairs Division (1991) *Relief Efforts for Cambodian Camps Fact Sheet*. Washington: US General Accounting Office.
- Zhou, D. and Harris, P. (2007) *A Record of Cambodia: The Land and Its People*. Bangkok: Silkworm Books.

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# EuroWeb COST Action CA 19131 Europe through Textiles. Network for an integrated and interdisciplinary Humanities: A mid-term report

## Introduction

COST Action CA 19131 *Europe through Textiles: Network for an integrated and interdisciplinary Humanities*, with the acronym EuroWeb, forms a pan-European network of scholars and stakeholders from different disciplines across academia, museums, conservation, cultural, and creative industries. Within the limited timespan of four years (2020–2024), it aims to formulate a new vision for European history based on textiles: their mass production, trade, economic and symbolic meanings, consumption, and reuse. By employing textiles as a prism through which the technology, economy, and culture of Europe are explored, EuroWeb proposes a more nuanced understanding of the past, in which textiles, seen as central components of societies for more than 10,000 years, shaped economies as well as cultural and individual identities such as gender, age, and status.

With 158 formal members from 32 participating countries and 382 participants in total, EuroWeb has already set up a prominent and active community exploring textiles and their formative roles in both present and past societies. With this contribution, we wish to present a mid-term report of the EuroWeb activities undertaken in years 2020–2022, as well as introduce the COST Action's scheme to ATR readers and, thereby, invite even more participants to join us for the remaining two years.

## The main objectives and structure of EuroWeb

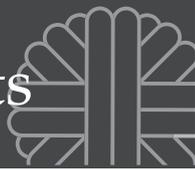
The EuroWeb Action transforms current textile research by bridging the gaps between: 1) universities, academic, and cultural heritage institutions, practitioners, and designers; 2) institutional and research approaches to textiles in different European

countries and contexts; 3) gender, age, and status of the Action participants with a special focus on promoting young researchers and innovators (individuals below 40 years of age) and participants from the so-called Inclusiveness Target Countries (countries which are less active in the EU funding schemes, thereafter ITC). EuroWeb's main objectives aim at: 1) formulating a new vision of European history based on textiles; 2) uncovering the underlying structures connected to textiles in languages, technologies, and identities; 3) implementing, testing, and disseminating new analytical and multi-disciplinary methods that bridge different theoretical and methodological approaches grounded in European scholarship; 4) dissolving the traditional and often obsolete and obstructive dichotomies of practice and theory through a more integrated approach of disciplines and cultural institutions; 5) forging new notions of inclusive European identity based on a shared heritage and experience of textiles as identity, a sense of belonging, and social cohesion.

All COST Actions achieve their aims and objectives through sharing, creation, dissemination, and application of knowledge organised in Working Groups, which are the Action's networking nodes. The main scientific objectives of EuroWeb are to be achieved with the help of four Working Groups (thereafter WG) and their leaders:

*WG 1 Textile Technologies* – leader: Christina Margariti, GR; vice-leaders: Maria Emanuela Alberti, IT and Tina Chanielaki, GR; 135 participants – technology behind textiles through instrumental analysis, textile tools, experimental archaeology, traditional crafts, and conservation.

*WG 2 Clothing Identities: Gender, Age and Status* – leader:



Magdalena Woźniak, PL; vice-leaders: Cecilie Brøns, DK and Paula Nabais, PT; 124 participants – gender, age and status: meaning of clothing through ages, areas, and cultures; a key to explain values in society and to understand individuals, self-representation, and groups.

*WG 3 Textile and Clothing Terminologies* – leader: Louise Quillien, FR; vice-leaders: Susanne Lervad, DK and Joanna Sequeira, PT; 117 participants – exploring and comparing the vocabulary of textiles, garments, tools, and textile production in Europe and its neighbours across time.

*WG 4 The Fabric of Society* – leader: Francesco Meo, IT; vice-leaders: Alexandra Attia, CH and Irina Petroviciu, RO; 155 participants – economic and agricultural impact of textile production and consumption; the basis for textile crops and trade by tracing textile trade patterns and paths through Europe and through time.

Additionally, there are formal structures that support and monitor networking, communication, promoting young researchers and innovators, and ensure gender balance and inclusiveness among the Action participants. These are grouped under the Science and Communication Manager and the Internal and External Communication WG (leader: Francisco B. Gomes, PT), the Grant Awarding Coordinator and the Management WG (Riina Rammo, EE; vice-coordinator: Cécile Michel, FR), and overseen by the Virtual Networking Manager (Hana Lukesova, NO), the Gender Balance and Inclusiveness Managers (H. Lukesova and F.B. Gomes) and the Senior Mentors (Mary Harlow, UK and S. Lervad, DK). Achievement of the main deliverables – the Digital Atlas of European Textile Heritage and the EuroWeb Anthology – are monitored and implemented by teams led by Angela Huang (DE) and Kerstin Droß-Krüpe (DE) accordingly. The concept of EuroWeb was originally conceived at CTR with Marie-Louise Nosch as the main proposer, but since the first Management Committee Meeting in October 2020, the Action was transferred to the Faculty of Archaeology, University of Warsaw, which took the administrative responsibilities as the Grant Holder. The Management Committee is a body formed by the representatives of all the participating countries, including the Action leaders, and it is led by the elected Action Chair (Agata Ulanowska, PL; vice-chair: Karina Grömer, AT). The role of the Management Committee is to manage the Action in the manner reflecting the intergovernmental and collective character of COST.

## **An overview of the EuroWeb activities in years 2020–2022**

COST networking is based on a series of activities

classified as: 1) meetings comprising conferences, workshops, meetings of the Management Committee, leading Core Group, and WGs; 2) training schools with formally appointed trainers and trainees. Additionally, participants of the COST Actions are offered individual mobility grants: for short research stays in other institutions (Short Term Scientific Missions, STSMs) and grants for conference presentations (ITC conference grants and Dissemination conference grants). In response to anti-COVID-19 mobility restrictions in years 2020–2022, a new grant offer was introduced for so-called “virtual mobility”.

Ideally, all COST activities are supposed to be organised through physical mobility of Action participants. However, due to a series of lockdowns, it is only in 2022 that we could start meeting and getting to know each other in person. Nevertheless, the EuroWeb members and participants have been very active and creative using both virtual and hybrid modes of networking. Many of the online events and lectures have now been posted as videos on the EuroWeb YouTube channel (see below). All events were organised by the WGs and EuroWeb teams either individually or collaboratively. A brief overview of the most important EuroWeb meetings and training schools is presented below.

## **Working Group 1**

### *Meetings*

The online workshop *Advanced Analytical Techniques for Textiles* was organised by Ch. Margariti in collaboration with H. Lukesova and F. B. Gomes in autumn 2021 as a cycle of six consecutive lectures.

The invited speakers and themes: 1) B. Holst, University of Bergen, NO – MICROSCOPY; 2) L. Bertrand, CNRS/University Paris Saclay, FR – SYNCHROTRON; 3) L. Ørsted Brandt, UCPH, DK – PROTEOMICS; 4) S. Lipkin, V. Karjalainen and M. Finnilä, University of Oulu, FI – CT SCANNING; 5) M. J. Melo and P. Nabais, NOVA School of Science and Technology, PT – DYE ANALYSIS; 6) I. Hajdas and K. Wyss, ETH Zurich, CH – RADIO-DATING.

As an outcome, the discussed topics will be published in a special issue of the Open Access Journal *Heritage Science* titled “Advanced Analytical Techniques for Heritage Textiles”. For the call for papers, see <https://euroweb.uw.edu.pl/news/members-and-research/call-for-papers-special-number-of-heritage-science/>.

### *Training Schools (TS)*

In collaboration with WG 2. The TS *First Aid, Fibre Identification, and Documentation of Excavated Textiles* was hosted by the Centre for Textile Research (CTR),



Fig. 1: Training School at the Centre for Textile Research in Copenhagen, August 2022. Trainees preparing mounts to store the recently excavated textile fragments (Image: Christina Margariti)

University of Copenhagen on 22–26 August 2022. The organisers and trainers were Ch. Margariti, H. Lukesova, A. Bruselius-Scharff, E. Yvanez, Ch. Spinazzi-Lucchesi and E. Andersson-Strand. The invited lecturers: A. Kwaspen and L. Viñas Caron. Ten trainees came from eight participating countries (fig. 1).

The Training School started with a day of interesting lectures on biomolecular textile archaeology (L. Viñas Caron), databases for recording finds in the field (Ch. Spinazzi-Lucchesi), integrated research design (E. Yvanez), how to combine textile conservation with analysis in the field (A. Kwaspen), with a closing talk on the integration of tools and experiments in textile studies (E. Andersson-Strand). The second day started with a lecture by H. Lukesova on first aid for textile finds and an introduction to the appropriate materials that should be used for packing excavated textiles. The trainees had an opportunity to make their own samples of the main materials. In the afternoon, they had a chance to conduct their own excavation at the CTR patio. On day three, Ch. Margariti discussed how conservation strategies for excavated textiles are decided based on the future role and special needs of the objects, which followed a lecture by H. Lukesova on optical microscopy. In the afternoon, the trainees collected samples from their own excavated fragments, prepared slides for optical microscopy, and attempted identification of their samples using different optical microscopes. The fourth day started with a lecture on textile documentation by Ch. Margariti and an exercise on the documentation of textile objects conducted by Ch. Margariti and A. Bruselius-Scharff.

In the afternoon, the trainees put their new knowledge into practice with the documentation of their own excavated fragments using stereomicroscopes. On the last day, the trainees spent some time in the morning to prepare presentations on the excavation, first aid, fibre identification and documentation of their fragments, while they were also asked to plan analytical protocols based on different scenarios. In the afternoon, each participant gave their presentation and their choice of analytical protocol, followed by discussions among the group.

### *Working Group 2*

#### *Meetings*

The online *Kick off meeting of WG 2* on the 15 January 2021 gathered 42 members from 21 countries. Participants discussed common research themes by overviewing the vast geographical areas and large chronological frame covered by their expertise.

The *Meet the Team* online cycle organised by M. Woźniak was the WG 2's response to the pandemic restrictions. It comprised a series of short seminars, in which several members presented their research topic in 10 minute slots.

In the course of these meetings, the WG 2 members decided to frame their networking into five main themes: Funerary Textiles – Iconography – Colour – Theoretical Approaches – Reconstruction and Display, which later were merged into three thematic groups: Gender and age – Sumptuary laws and prohibition – Re-thinking dress exhibitions in museums in a more inclusive way and the potential of dress collections for re-writing European history.

The online workshop *Funerary Textiles in Situ* was organised in a virtual mode on 15 April 2021. The event was organised by M. Woźniak and E. Yvanez as an outcome of a collaboration between the Polish Centre of Mediterranean Archaeology (PCMA), University of Warsaw (project *Unravelling Nubian Funerary Practices*, PI E. Yvanez, PPN/U LM/2020/1/00246), and EuroWeb. The workshop *Theoretical Concepts on Dress and Identity, Visual Codes in Prehistoric and Historic Societies* was organised by K. Grömer (Natural History Museum, Vienna), K. Saunderson (University of Vienna), and E. Trinkl (University of Graz). The workshop took place on 25–27 April 2022 at the Natural History Museum Vienna, with 16 participants from Austria, Poland, Estonia, Lithuania, Iceland, Denmark, Germany, Greece, and France (fig. 2).

In this workshop, participants worked on theoretical concepts and different perspectives for studies of dress and identity, such as cultural anthropology, material culture studies, social psychology, evolutionary

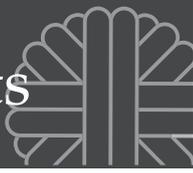


Fig. 2: Theoretical Concepts on Dress and Identity workshop in Vienna, April 2022. Discussion on the workshop readers (Images: Julia Unger)

anthropology, and modern fashion studies. The discussions and practical sessions included theories of visual coding, body language, fashion theory, gender and age, and social hierarchies. Before the workshop, the participants received a reader consisting of 10 articles covering various aspects of theoretical approaches to dress, which were used as a point of departure for the discussions. Moreover, participants prepared a 10 min presentation and a mood-board illustrating their individual research topics.

The online conference *Clothing Identities* was organised by M. Wozniak, P. Nabais and C. Brøns on the 4–6 May 2022. In altogether 33 talks, clothing as an expression of identity was discussed in a broad chronological (from the second millennium BCE until the 19th century CE) and geographical framework (from Finland to southern Portugal).

The conference programme reflected the main research topics of WG 2: 1) Age and gender; 2) Clothing regulations in sumptuary and religious dress; 3) Clothing identities in museums and how we can rethink and re-make dress exhibitions in museums in a more inclusive way, and discuss their colonial, ethnic, nationalistic, and religious markers, and symbolism. The sessions also included papers presenting various dissemination strategies to prompt interaction between textile collections in museums and the public.

#### *Training Schools*

The TS *Clothing as a Spectacle of Identities. A theoretical toolbox* took place online on 7–8 April 2022. It was organised by the two trainers Z. Kaczmarek and E. Yvanez. Altogether, six formal trainees from Finland, Hungary, Portugal, Lithuania, Iceland, and Greece took part.

This TS comprised of two sessions: in the first one,

open to the public, the trainers presented lectures on the state-of-the-art and notions of “spectacle” and “identity”, their own case studies, as well as provided tips for creating theoretical frameworks, such as active reading, mind-maps, and conceptual diagrams. Then followed a practical session, where trainees had to work on their own case studies. The next day, the trainees presented the theoretical concepts they applied to their material and received feedback from both trainers and other trainees.

#### **Working Group 3**

##### *Meetings*

A series of WG 3 online meetings took place during the two first years of the Action. They aimed at creating an effective network of textile terminology specialists and, in the next step, at providing correct vocabularies with terminological keywords describing the European textile heritage to the Digital Atlas team. Two terminology workshops, contributing towards building the online platform hosting a lexicon of basic textile terms translated in all EuroWeb languages and relevant bibliographies, were organised by S. Lervad, L. Quillien, and J. Sequeira. The platform will also host a corpus of ancient textile terms, which reflects the specific areas of research of the EuroWeb members sharing their data. The first workshop, entitled *Historical Textile Terminology Online Projects*, took place online on 28 October 2021. The second, *Building the EuroWeb online platform for textiles and clothing terminologies*, was organised in a hybrid mode at Nanterre (FR) on 9 May 2022.

The hybrid seminar *What's in a name? Toponyms and loan words as textile labels across time* was organised by J. Sequeira and A. Huang on 29 June to 1 July at the University of Minho, Braga, Portugal. Ten talks, one round-table discussion, and a practical workshop on

dyeing and weaving were offered to the participants online and in person (fig. 3).

This conference aimed at studying the interrelations between textile terminology and European geography and social mobility. It focused on two major naming practices we find over time and space: toponyms and loan words. Presented case studies highlighted various strategies and purposes for naming textiles and garments and demonstrated how these words circulated and developed in unison with technical innovations, discoveries, fashions and trade, and how cultural and linguistic transfers operate and adapt. The participants are working all together in a joint paper that will integrate the EuroWeb Anthology.

#### *Training Schools*

The online TS on *Textile and Clothing Terminologies* was organised by S. Lervad, L. Quillien, and J. Sequeira on 4–5 May 2021. It aimed at providing general training on terminology-related research and to exchange information, ideas, and knowledge among members of the WG. The trainers (S. Lervad and L. Quillien) offered introductory lectures on non-verbal terminology and methodologies for studying ancient clothing and textile terminologies, while four formal trainees presented case studies from their research. The event was open to all members of EuroWeb and proved a success, having been joined by 41 participants from various countries and disciplinary backgrounds.

#### *Working Group 4*

##### *Meetings*

The online workshop *Who we are*, held online on 17 February 2021, gave to all WG 4 members the opportunity to present their research to other participants.

The online workshop *Textiles and Seals* was organised by A. Ulanowska as an outcome of the EuroWeb and the *Textiles and Seals* project funded by the National Science Centre of Poland (PI A. Ulanowska, UMO-2017/26/D/HS3/00145).

An open day, *Weaving Ideas*, was organised online by F. Meo on 29 October 2021. It was a planning meeting for all EuroWeb leaders on how to contribute to the best development of the Action.

The online conference *From the Household to the Factory: Modes and Contexts of Textile Production from Prehistory to Pre-Industrial Period*, organised by F. Meo, A. Huang, J. Sequeira, F. Matau, and F. B. Gomes and held online on 25–26 November 2021, aimed at understanding how different modes and scales of textile production were articulated across time and space.

In 24 conference presentations, the participants



Fig. 3: Round-table discussion at the seminar *What's in a name? Toponyms and loan words as textile labels across time*. University of Minho, Portugal, 30th June 2022 (Image: A. Cardoso)

discussed several aspects of textile production, asking the following questions: 1) How were different phases of production articulated? 2) How did modes of production change through time? 3) What was the real impact of technical and technological innovations in past societies? 4) How can the type of product (luxury or mass consumption) be related to a specific mode of production? 5) How was textile production regulated? 6) Are there suitable theoretical frameworks to compare our research with different periods and areas?

The hybrid conference *Textile Production, Consumption and Trade in Iron Age Europe (19–20 May 2022)*, organised by F. Meo and F. B. Gomes, was one in a series of events held at Muro Leccese (Italy) under the general label *Ancient Fashion Week*. Through nine presentations, this conference focused on the Iron Age, which is a key but often neglected period for the understanding of textile techniques and technologies. This conference aimed at exploring textile production, consumption, and trade in the different European Iron Age societies in order to compare them and develop an integrated panorama of Iron Age textile cultures and their interactions.

#### *Training Schools*

IN COLLABORATION WITH THE DIGITAL ATLAS TEAM  
Between 7 and 9 of October 2021, altogether 29 participating EuroWeb members had the opportunity to learn more about digital tools for data processing and about digital databases during the *Training School on Digital Data* organised by J. Sequeira and A. Huang in collaboration with WG 4 and the Digital Atlas Team.

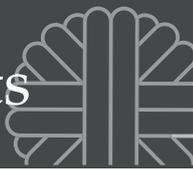


Fig. 4: Embroidery Training School in Muro Leccese (Italy), May 2022; Filet work (Image: Francesco Meo)

#### IN COLLABORATION WITH WG 2 AND 3

The TS entitled *Embroidery: Terminologies and Practices from Antiquity to Early Modern Times* was organised at Muro Leccese (Italy) on 16–18 May 2022 and led by F. Meo, L. Quilien, and M. Woźniak as the opening event of the *Ancient Fashion Week*. Twelve trainees, who also shared their knowledge and expertise, were introduced to embroidery techniques by two craftspeople trainers (fig. 4).

The TS offered theoretical and practical training by addressing several themes, such as 1) the terminology used to describe techniques, tools, and materials in ancient languages and how to properly translate them in modern languages; 2) how to identify embroidery through ancient sources: textile remains, texts, and iconography; 3) what embroidery and embroiders can tell us of past societies and cultures: what stories are told by embroidered textiles; 4) when and how people wore embroidered garments and made embroidered textiles; 5) who the embroiders were. During the hands-on session, the trainees had the opportunity to learn several traditional embroidery techniques, such as Punto Maglie and filet, directly taught by craftspeople.

#### Gender balance and inclusiveness

EuroWeb promotes gender balance and inclusiveness values within all its activities. The need for gender balance has been obvious, since the textile field has long been dominated by a strongly gendered and predominantly female community. In addition, prejudices that the field is “not scientific enough” have been quite common. EuroWeb aims to ensure equal opportunities and gender-friendly paths towards a better understanding of the textile field. Due to its focus, EuroWeb has raised questions and challenges regarding gender representation and its reflection among textile professionals and practitioners. In 2021, a detailed questionnaire comprising 31 questions

aimed to generate quantitative and qualitative insights has been applied in the development of internal measures and policies to foster a more open, inclusive, and gender-balanced environment in the network (Gender-Survey-Report\_for-website.pdf (uw.edu.pl), accessed 22 August 2022).

The questionnaire was anonymous, and any personal information was used for statistical purposes exclusively. A sample of about 100 answers was used for the final report. The goal was to achieve a better understanding of several key issues, including: a) the ways and degrees in which gender identity has moulded career paths and choices (with regard to the textile field); b) the existing perceptions regarding gender connotations of the topic of textiles and its impact on individual scholars and practitioners; c) the possible intersections between gender identity and other factors in structuring the engagement with the subject of textiles.

#### Dissemination and communication of the EuroWeb results

Internal communication and external outreach and dissemination of the Action’s activities and results have been one of EuroWeb’s priorities during its first two years. Beyond regular communication in the framework of the different Working Groups, through meetings and dedicated networking events such as the already mentioned *Weaving Ideas* day, a number of tools have been set up to ensure that information about ongoing work and future activities is available both to members and to the wider public.

The cornerstone of these communication efforts has been the EuroWeb website (<https://euroweb.uw.edu.pl/>), developed by the Centre for Digital Competences of the University of Warsaw and regularly updated by the Action’s members. Since its launch in October 2021, it has functioned as the primary platform for the dissemination of news, events, calls for papers, and grant applications, as well as an archive for EuroWeb’s past activities and a repository for relevant documents and data. In order to reach a wider and more diverse audience, EuroWeb has also secured a presence in various social media platforms, including Twitter, Facebook, and Instagram (see below). The latter aspect of EuroWeb’s social media presence has been achieved with particular success through dedicated national takeovers, during which all the various channels showcase the textile heritage, textile art projects, and ongoing textile research in one of the Action’s member countries. Very successful editions have so far been held for Poland, Romania, and Greece, and many others are scheduled for the next few months.



Fig. 5: The EuroWeb stand at the New European Bauhaus Festival in Brussels in June 2022 (Image: Francisco B. Gomes)

In addition to the platforms mentioned above, EuroWeb has also ensured a presence on YouTube. The previously mentioned Action channel has proven an invaluable tool to ensure accessibility to online events organised during the pandemic, and the streaming of those events, together with the recording of others and some purpose-made material, has allowed the construction of a library of more than seventy videos and several playlists. Apart from streamed or recorded networking meetings and some training schools, there are also unique EuroWeb events, such as the *EuroWeb Book Corner* series of talks, in which new textile-related publications are presented by their authors.

EuroWeb has also been present at events organised by third parties, of which the most important is our participation in the New European Bauhaus Festival, organised by the European Commission in Brussels in June 2022 ([new-european-bauhaus-festival.eu](http://new-european-bauhaus-festival.eu)). After a competitive selection process in which more than 300 projects across Europe participated, EuroWeb was selected as one of the 100 projects showcased in the fair, which took place during the festival in the Gare Maritime of Brussels. In keeping with the tenets of the festival – sustainability, aesthetics, and community – the EuroWeb stand displayed natural textile fibres and dyes, which opened avenues to explain how research into archaeological, historical, and traditional textile production can offer insights into a more sustainable and socially responsible textile and fashion industry (fig. 5). Over 200 visitors stopped at the stand, proving that this is a topic of wide concern for a diversity of stakeholders, from politicians and science project

managers to members of the general public, not forgetting textile artists and craftspeople.

EuroWeb has also been present at several international conferences:

At the 28th European Association of Archaeologists Annual Meeting in Budapest (for more information on textile related sessions at the EAA, see in this volume Mannerling's "28th EAA annual meeting" conference report): Session #232 *Dressing Europe: Mapping and Disseminating European Textile Heritage through Digital Resources*, was organised by C. Costeira, A. Iancu, and F. B. Gomes and offered 11 presentations discussing various topics related to the European textile heritage and its digital, often open access dissemination (fig. 6); Session #177 *Organic Materials in Tombs: The Quiet Protagonists*, organisers D. Andrianou and A. Kwaspen; Session #195 *Silk: A Catalyst for Interconnection in the Sixth to Tenth Centuries AD/CE*, organisers A. Makin, S. Harris, H. Březinová, and A. Klein.

The challenges for creating the Digital Atlas were also discussed at the Conference *DRESSED. The Widespread Role of Clothes, Textile Production and Clothing Concepts in Society. Interweaving perspectives* (22–24 June 2022) in a talk by C. Costeira and A. Iancu titled *The EuroWeb Digital Atlas of European Textile Heritage: The Challenges of a Common Project*.

A general introduction to EuroWeb, titled *Europe Through Textiles: Network for an integrated and interdisciplinary Humanities: COST Action CA 19131 (2020–2024) – a new hub for textile research*, has been presented by A. Ulanowska at the 29th CIETA Congress in Zurich on 5 October 2022.



Fig. 6: European Archaeologists Association Conference in Budapest in August/September 2022. Participants of the Session #232 (Image: Francisco B. Gomes)

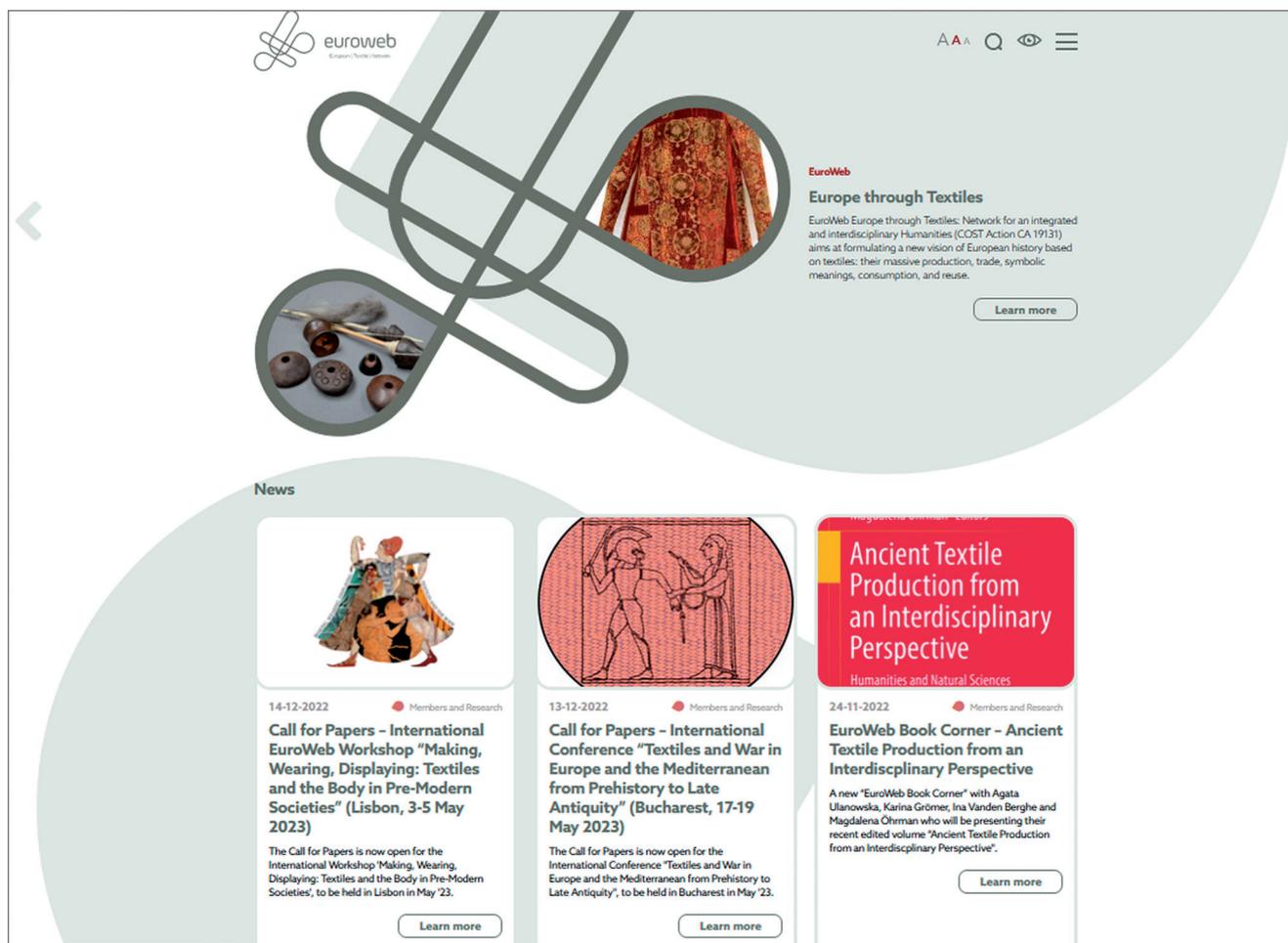


Fig. 7: The EuroWeb project as represented on <https://euoweb.uw.edu.pl/> (Screenshot, 17 December 2022)

## **Digital Atlas of European Textile Heritage**

The Digital Atlas is a dissemination tool that will give access to a fascinating alternative history of Europe by logging evidence of the vast material culture of textile production and consumption through the continent. It is created to communicate the EuroWeb motto "Europe through Textiles" visually, by the mapping of textile heritage within Europe and across time. Its online publication is planned for 2023, but data will be added continuously from the publishing day onwards. This important collaborative task involves all the Working Groups and is organised and monitored by the Digital Atlas team, composed of A. Huang (leader), C. Costeira (vice-leader), A. Iancu (vice-leader), M. Nørtoft, M. Mordovin, and J. Unruh. Additionally, the Digital Atlas team is active in creating events together with other WGs (see above) as well as in organising its own events, such as:

The hybrid Digital Atlas Workshop held at CTR: *The EuroWeb Digital Atlas of European Textile Heritage*

*Recent development and future outcomes*, 9–10 May 2022. Twenty-eight participants learned about the Atlas's structure and gained detailed instructions for contributing data and promoting the Digital Atlas in their own scientific network.

## **EuroWeb Anthology**

The EuroWeb Anthology is the second main deliverable of the EuroWeb project. Formally assigned to WG 2, it is open to contributions from all participants. Its aim is to show the progress of recent research in textile history, archaeology, and conservation as well as to reflect the new subjects studied and the new methodologies developed by EuroWeb members. The volume will have to conform with the following guidelines: all papers have to be co-authored by at least two researchers, the co-authors have to come from at least two countries participating in EuroWeb, and the publication should be in English, peer-reviewed, and open source. The requirements of the EuroWeb



Anthology are to present original and most recent research without chronological or methodological boundaries, to encompass areas of research connected to Europe and its close neighbours and to highlight the connections between the different fields of research within EuroWeb.

### **National survey of the European textile, dress and fashion sectors**

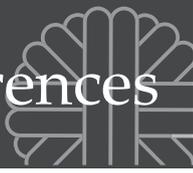
The inclusion of 32 countries and more than 300 engaged textile scholars from all fields gives EuroWeb an exceptional coverage: it creates a major hub for textile research and represents an exceptional pool of scholars. The European landscape of textile industries, designers, trade, and textile culture is shifting rapidly in these years, and therefore, following the original idea of M.-L. Nosch, we decided to use EuroWeb as a documentation and monitoring instrument to get a fuller picture of the textile transformations in Europe. We circulated a questionnaire to all Management Committee members and asked them to complete the survey for their country with the help of other textile colleagues in their country. The survey details for each country: 1) The current industry, design, and business sector (number of jobs, annual expenditure on clothing/citizen, major fairs, fashion weeks, companies, R&D initiatives for sustainability, business and design educations and graduates); 2) Cultural heritage of textiles and dress (research clusters, education in textile conservation, history or archaeology, museums,

collections, exhibitions). As it was clear since spring 2020 that the COVID-19 pandemic would disrupt or strongly impact the European economy, museums, tourism, and textile businesses, we aimed to first document, nation by nation, the status of textile culture, business, industries, and recycling initiatives before the pandemic. The plan is to follow up at the end of the EuroWeb period with an addendum describing how these crises have impacted each country. The full report is edited by P. Nabais, M.-L. Nosch, and A. Ulanowska, and includes chapters for Austria, Belgium, Bosnia and Herzegovina, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Iceland, Israel, Italy, Lithuania, Malta, North Macedonia, Norway, Poland, Portugal, Romania, Slovakia, Spain, Switzerland, Turkey, and the UK, and a summary and discussion by the editors.

### **For more information about EuroWeb past activities and future events**

- EuroWeb website: <https://euoweb.uw.edu.pl>
- EuroWeb YouTube channel: <https://www.youtube.com/channel/UCnFNuMtJ7hEmzRU3lpC2okQ>
- EuroWeb social media: [www.facebook.com/EuroWebCOST](http://www.facebook.com/EuroWebCOST), [www.instagram.com/euro\\_web](https://www.instagram.com/euro_web), EuroWeb (@EuroWeb4) / Twitter – managed by Nathalie Rudolph

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# Reconstructing Textiles and their History

26 March 2022, online workshop hosted by the Centre for Textile Research, University of Copenhagen

The international workshop *Reconstructing textiles and their history* was organised within the framework of the project *RECONTEXT: Reconstructing the history of Egyptian textiles from the 1st Millennium AD at the National Museum of Denmark*. This one-year project ran from 1 May 2021 to 30 April 2022. It was led by Maria Mossakowska-Gaubert, hosted by the Centre for Textile Research at the University of Copenhagen (CTR), and funded by two Danish foundations: Aage og Johanne Louis-Hansens Fond and Beckett-Fonden. The overall aim of the project was to establish an overview of the history of the Egyptian textiles collection at the National Museum of Denmark by reconstructing the way the objects were acquired, information about their provenance, as well as their look and shape.

The National Museum of Denmark has 112 textiles in its collection from Roman, Byzantine, and Early Medieval Arab Egypt, comprising the richest ensemble of its kind in Denmark. This Egyptian textile collection was created during the period from 1886 to 1964, and four stages of object acquisition can be distinguished. The first is connected to the thriving art market of the late 19th century (56 fragments). These fabrics were purchased from dealers and art collectors, such as Theodor Graf, Ahmed Mustafa, and Robert Forrer. In the 1930s and 1940s, a smaller batch of textiles was acquired from collectors (12 fragments) such as Walter Carl and Peter Johansen, as well as through donations and wills (4 fragments) made by two Danish egyptologists, Erik Iversen and Hans Ostenfeld Lange. Again, in the 1930s, 16 or perhaps 17 objects were transferred to the National Museum of Denmark from University College London, and most likely also two or three fragments from the Kaiser-Friedrich-Museum in Berlin, for analysis by the Danish textile expert Margrethe Hald. The last batch of acquired fabrics (6 fragments) in the 1950s and 1960s came from the Egyptian and European art market. To date, it has not been possible to document the provenance of 15 fragments belonging to the National Museum of Denmark.

During the workshop, the results of the research carried out by specialists from various fields involved in the RECONTEXT project was presented. The workshop

day was divided into three sessions. The first covered studies on textiles from the Copenhagen collection with the following presentations: Barbara Thomas (PhD candidate, Department of Art History, Bern University) "Well-chosen examples: The history and technique of three complex fabrics from the National Museum of Denmark"; Alexandra Van Puyvelde (Art and History Museum, Brussels) "Silk textiles said to come from Akhmim and donated by Isabella Errera to the Art and History Museum in Brussels, with focus on a medallion representing two figures (ACO.Tx.3)"; Anne-Marie Decker (independent researcher) "A fringe study in footwear: lessons learned from a sock in a box"; Anne Kwaspen (CTR) "Technical analyses of the Egyptian textiles collection from the National Museum of Denmark".

The second session concerned various stages of the creation of the collection: Anne Haslund Hansen (Ancient Cultures of Denmark and the Mediterranean, National Museum of Denmark) "From the archives of the National Museum"; Anna Głowa (Institute of Art History, Catholic University of Lublin) "Step-back in the history of Copenhagen and Polish collections – Forrer's supplier, Marius Panayiotis Tano"; Cäcilia Fluck (Skulpturensammlung und Museum für Byzantinische Kunst, Staatliche Museen zu Berlin) "The Berlin-Copenhagen textile connection"; Morten Valner Grymer-Hansen (CTR) "Traders of Archeological Textiles in 20th Century Denmark, their network, and methods: Captain Peter Johansen (1881–1948) and Dr Margrethe Hald (1897–1982)".

The last session was related to the "contextualisation" of fabrics from museum collections: Petra Linscheid (Institute of Archaeology and Anthropology, Bonn University) "Multiple production in Early Byzantine textiles"; Maria Mossakowska-Gaubert (CTR) "How to reconstruct a history of the Egyptian textile collection at NMD". Data from the project and workshop will be presented on the website of the National Museum of Denmark sometime in winter 2022/2023 in the format of an online exhibition entitled "Archaeological Puzzles in a Museum" (<https://en.natmus.dk/>).

*By Maria Mossakowska-Gaubert*

# Margrethe Hald and the Nordic History of Textile Research

22 April 2022, Centre for Textile Research, University of Copenhagen, and online

Since 2019, the Centre for Textile Research (CTR) has researched the work and life of the Danish textile researcher Margrethe Hald, starting with the digitalisation of an archive of photos. Margrethe Hald was an outstanding researcher both in Denmark and in the Nordic network of textile researchers, working closely together with her contemporaries to advance textile research and not least to advance a terminology of textile terms.

The focus of the seminar was the history of the collaborations that became her life quest, her textile networks, and how textile research became a research field in its own right within the Nordic countries. The seminar was divided into a session on “Margrethe Hald and the textile research in Denmark”, and a session on “Textile research in a Nordic context”. The seminar was to be concluded with a panel discussion, but instead the attendees decided to visit the Margrethe Hald exhibition across the university campus at the end of the day.

The seminar started with an introduction to the beginning of textile research, the early female researchers, and their way into textile research and academia. Morten Grymer-Hansen focussed on the suffragette movement and how *Tegneskolen for kvinder* (The Drawing School for Women) became a hothouse for textile researchers. Amongst these was Elna Mygdal, who became the first woman to hold the position as curator at the National Museum of Denmark and who also later cleared the way for Margrethe Hald to be employed at the museum.

The impressive collection of prehistoric textiles and skin objects, which was researched by Margrethe Hald throughout her career starting with the first project in the 1930s until her retirement in 1967, was presented by Ulla Mannering from the National Museum of Denmark. It was also this material that formed the basis of her academic Dr.Phil degree in 1950. The groundbreaking work by Margrethe Hald has recently been updated using modern methods such as fibre and dye analyses that have provided new information about the development of textile production and textile design, and the use of raw materials in the prehistoric

period.

Eva Andersson Strand presented the use of experiential and experimental archaeology, for which Margrethe Hald became a trailblazer. Although experimental archaeology can be difficult to work with due to its many variables, it is still relevant and has recently been successfully used in the reconstruction of Viking Age textiles in the *Fashioning the Viking Age* project, but also in the understanding of how the textile work itself affects the craft person, as it is examined in the *Practise of Practises* project at CTR. Here, motion capture is used to understand the way weavers use their bodies and how this could be recognised in osteology.

The experimental archaeology exercised by Margrethe Hald included a quest for authenticity during her many ethnographic studies and travels, as presented by Ulrikka Mokdad. Her travels to the Middle East and Latin America during the 1960s provided a wealth of information, especially on looms and the use of traditional tools and techniques, such as the two-beam loom. Margrethe Hald concluded that this particular loom type was used for making some of the Danish

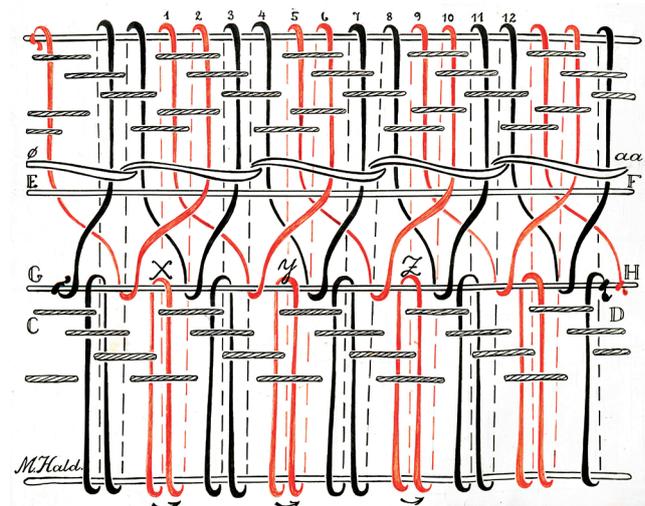


Fig. 1: One of Margrethe Hald’s technical drawings explaining the method of making a tubular warp using a warp-lock. The finished drawing is shown in Hald 1980, fig. 222b (Drawing: Margrethe Hald, © Centre for Textile Research)



prehistoric textiles, especially the Early Iron Age textiles, although no remains of this loom type have ever been preserved. However, on her travels to Latin America, she saw several types still in use and in this way she pioneered this methodology.

The Nordic network of textile researchers not only researched textile collections, they also recognised and developed the *Nordisk Textilteknisk Terminologi – NTT* (Nordic textile technical terminology), allowing for a common understanding of creation and work processes. In relation to CIETA, Susanne Lervad presented the collaboration between Agnes Geijer, Elisabeth Strømberg, Martha Hoffmann, and Margrethe Hald, in between others, which eventually led to the NTT vocabulary first published in 1969, and today an invaluable online tool.

Margrethe Hald's colleague and good friend from Sweden, Agnes Geijer, was one of the leading researchers in the Nordic countries at the time. Her work and life were presented by Margareta Nockert, who also described her own working relationship with Agnes Geijer. Helen Persson presented two other important female textile researchers, Vivi Sylwan and Ulla Cyrus-Zetterström, contemporary with Agnes Geijer. Together, the three women shaped the research in early Chinese textiles and provided a basis for both textile research and female researchers. Hana Lukesova presented the history of textile research in Norway, detailing the development of textile research as a field. From the group of textile researchers, Marta Hoffmann collaborated especially closely with Margrethe Hald.

Sanna Lipkin presented the history of textile research in Finland, based on the first excavations which focused on National Romanticism to create an ancient Finnish costume. Much work has gone into reconstructing entire costumes, using scientific methods to approach an understanding of the costumes as representing the intersection of identities in people.

The seminar ended with a visit to the Margrethe Hald exhibition at the Copenhagen University library. The exhibition presented Margrethe Hald's work with textile methods such as nalbinding, but also some of her intricate drawings of weaving methods. The exhibition also included some of her photos from her many travels as well as a painting of Margrethe Hald by the loom, painted by her brother.

The seminar framed the academic life of Margrethe Hald and her network with other female textile researchers in the Nordic countries in a beautiful way, and brought forward Margrethe Hald as a trailblazer both within textile research and as a woman in academia. The fertile relationship that grew between these early researchers clearly forged a new methodology and approach to textile archaeology, which modern researchers still use. By presenting both Margrethe Hald's impact on the Danish prehistoric textile material and showing the research in the other Nordic countries as well as internationally, the seminar provided a solid introduction to early textile research.

*By Anne Drewsen*

## Smart Textiles from Antiquity to Modern Times

28 to 30 April 2022, University of Lille, France, and online

This international conference organised by Audrey Gouy (University of Lille) and Yann Lorin (INRAP – Institut National de Recherches Archéologiques Préventives) aimed at investigating smart textiles through time, from Antiquity to our contemporary world. Textiles are smart materials, constantly responding to, adapting to, and interacting with their environment. They constantly communicate, they are optimised, they have active functions, they ease, assist, monitor, regulate, protect, reinforce, and raise capabilities. In this regard, the conference focused on how, why and to which extent clothes

and textiles have been used and are still used as an extension, development and augmentation of human identity, intelligence, and physical capacities. We also questioned how textiles impact and what they require in terms of production, consumption and use. Based on the latest discoveries and research, this international conference was thought as an exploratory dialogue, with insights and stimulation between research on ancient textiles production and use, and research on modern textile performance and clothes' properties, resistance, and consumption. Held at the University of Lille, the event also built on

## International conference

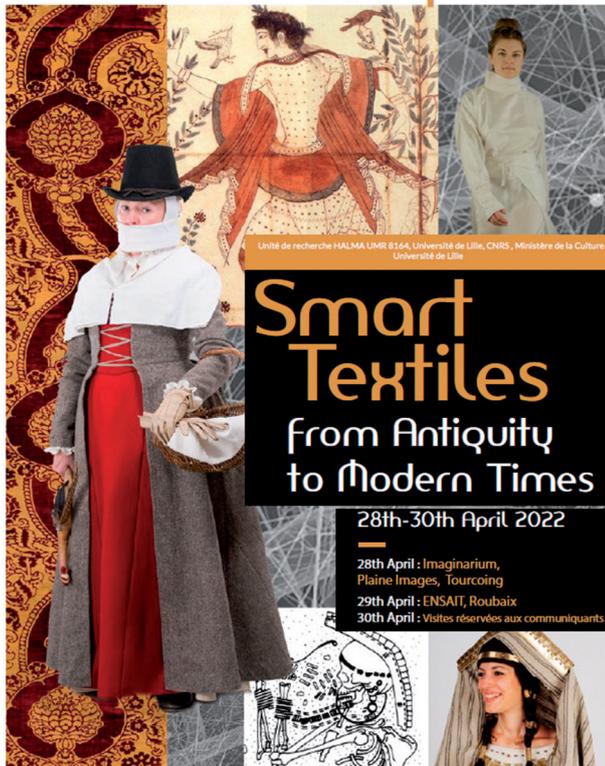


Fig. 2: The Smart Textiles conference announcement

the exceptional history of textile production, ground-breaking research, and innovations that have been at the heart of the French region Hauts-de-France for centuries. Three main topics were taken as crossover points: Personalised Textiles (What do clothes communicate? How and why?), Intelligent Textiles (What are textiles and clothes optimised for, and how? Do clothes have memory? Can we use them to retrace someone's behaviour, movement, and health, for example? How do clothes and textiles regulate, ease, assist?), and Digital Textiles (Which digital tools can be used for textile research and conception? How and to which extent do they enhance research, our understanding, the processes, and the intelligence of textiles and clothes?).

The first day of the conference, 28 April, took place at the Research Federation for Visual Sciences & Cultures (FR-SCV) in Tourcoing, which is a new hub associating researchers specialised in the historical study of visual and material cultures, the understanding of the psychological and neuroscientific processes of visual perception and cognition, and the production of innovative digital tools for the processing and visualisation of complex

multimodal data and their cultural mediation. The morning was dedicated to introducing the event. It started with the welcome of Yann Coello, director of the FR-SCV and Sandrine Huber, director of the lab HALMA UMR 8164, followed by a speech by Marie-Louise Nosch (University of Copenhagen) on smart textiles, and the introduction of the organisers, Audrey Gouy and Yann Lorin. The organisers replaced the topic in the textile history and perspective of the region Hauts-de-France, with an archaeological approach. The contribution of the French researcher Hubert Masurel, who started first in the textile industry and quickly decided to unravel the ancient textile production from the north of France, was recalled. Specific ancient production sites, such as Apremont (Vendée) and Amiens-Recancourt, were presented. Few textile tools are known but they allow to propose a *chaîne opératoire*, and pseudomorphs from protohistoric times attest the use of specific weaving techniques such as tabby. Three specific types of loom weights were in use in three different areas of the north of France: cylindrical (north-west), triangular (north and central), and pyramidal (north-east) shapes, until the pyramidal shapes were used above all others. The discovery of loom weight assemblages in several sites indicates the extraordinary presence of complete looms (site of La Montignette), which is interesting in order to understand the precise function of such looms and loom weights. A craft and domestic production were maintained for centuries, from the Neolithic until the emergence of a textile industry later on, especially in Picardie.

Two inaugural papers aimed at giving an overview of smart textiles, first from an ancient point of view and secondly from a contemporary angle. The paper by Susanna Harris (University of Glasgow) highlighted the different strategies at stake to enhance textiles for the human experience during Antiquity. She shed light on crucial periods of technological innovation based on plant knowledge, such as the appearance and the use of strings around 200,000 BCE, followed by the use of structures of twisted strings to be worn around 20,000 BCE, and then cultivation and animal husbandry around 8000 to 4000 BCE. It is the intersection of two or more distinct technologies, as well as human interactions and possible travels and trade that led to profound innovations and changes. Sensory and phenomenology approaches in textile research contribute in highlighting textiles as active components, as they "sense and respond to stimuli through an external sense feedback system". Finally, three case studies (linothorax and textile armours,

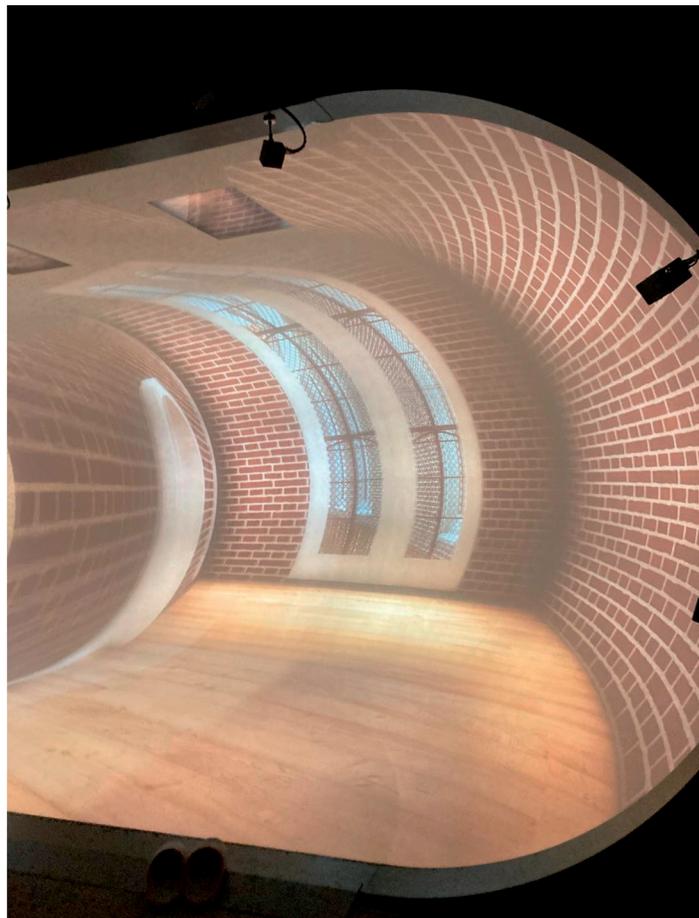
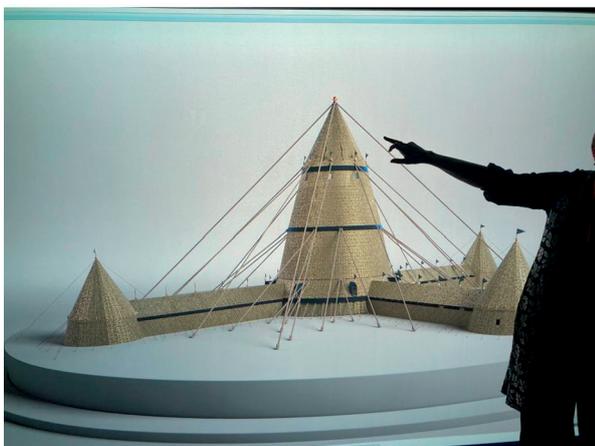


Fig. 3: Smart Textiles Conference: Upper left: presentation by Audrey Gouy on Digital Textiles for Ancient Dance on 28 April at the FR-SCV (Image: Audrey Gouy). Bottom left: 3D reconstruction of the Field of Gold Cloth at the FR-SCV (Image: Isabelle Paresys). Right: detail of the TORE at the FR-SCV (Image: Audrey Gouy)

Viking Age sails from the eighth to tenth centuries CE, and Etruscan cloaks from 750 to 500 BCE) illustrated how ancient textiles were smart and how they were active in their relationship to people, other materials, structures, and the environment. The paper by Cédric Cochrane presented the ENSAIT (École Nationale Supérieure des Arts et Industries Textiles) and its labs. The ENSAIT is entirely dedicated to textile research and performance. It is conceived around three clusters: 1. Human centred design, 2. Multifunctional textiles and processes, 3. Mechanics of textile composites, which constantly develop projects for smarter textiles. Smart textiles are determined by a cause-and-effect relationship with their environment. The smart function can be provided by the material (shape memory material, thermochromic, etc.), the structure (biomimetic, microcapsule, etc.), the finishing (fluorescent, etc.), or an exogenous element (electronics, flexible sensors, e-textiles, etc.). In this regard, smart textiles

are extensions of technical textiles and they are conceived to improve, cure, protect, and connect the body. Today, smart textiles are highly valuable commercial products, but acceptability, end of life and sustainability are issues to be considered.

The afternoon was dedicated to papers presenting cases of *Digital textiles*. Laurent Grisoni (University of Lille) presented a new project developed between the IRCICA (Institut de Recherche sur les Composants logiciels et matériels pour l'Information et la Communication Avancée) and the CETI (Centre Européen des Textiles Innovants), called *CoFaDeVR – An exploration of 3D collaborative sketching for textile industry*. The aim is to help crucial actors of the fashion industry in the clothes-making process with a new software. More particularly, augmented reality is used as a tool for interactions between designers, manufacturers, and users to reduce costs as well as conception and design time. The paper by Audrey Gouy presented her new project *TEXMOVE* that is

developed in collaboration with IRCICA and builds on the results of her Marie Curie project *TEXDANCE* (<https://texdance.eu>) at the University of Copenhagen in 2019 to 2021. This project aims at digitally reconstructing and understanding the movement of clothes in performative rituals, especially during dance, in the Ancient Mediterranean. The paper by Isabelle Paresys (IRHIS, University of Lille) and François Roussel (LISIC, University of Littoral) presented the latest results of their project on the digital *Field of Cloth of Gold* that aims at understanding a remarkable event held in June 1520 in the south of Calais, France, when Henry VIII Tudor and François I decided to meet. For three weeks, they lived as if they were in castles, but in ephemeral installations and tents of gold cloth. The project aims to reconstruct the exceptional architecture of those tents by immersive 3D digital images and to reproduce as realistically as possible the luxury fabrics of the Renaissance. The paper presented the obstacles to this research, which

need to be overcome by both historians, computer scientists, and engineers in image synthesis. The participants were then invited to visit the digital facilities of the FR-SCV, such as the globally unique TORE (The Open Reality Experience), before heading to the ANMT (Archives Nationales du Travail), located in the Motte-Bossut Factory, which is a jewel of textile industrial architecture in the north of France and listed as a historical monument since 1978. A former cotton spinning mill, it now keeps the national labour archives, and especially an important collection of archives related to textile production in the north of France. The evening event at the ANMT was particularly thought to question textiles in relation to work, production, industry, and trade. Thus, Tsiriniaina Hajatiana Irimboangy (Ensaama, Yavarhoussen Fund) presented his project re-evaluating the *lamba*, a traditional garment from Madagascar that took a turn to industrial manufacture. Nika Timashkova (Zurich University of the Arts)



Fig. 4: Smart Textiles Conference: Upper left: presentation by Zahra Kouzehgari's on The Honour Amphitheatre on 29 April at the ENSAIT (Image: Zahra Kouzehgari). Bottom left: visit to the Textiles Gallery in La Piscine Museum, Roubaix on 29 April (Image: Audrey Gouy). Right: textile samples in the Textiles Gallery in La Piscine Museum, Roubaix (Image: Audrey Gouy)

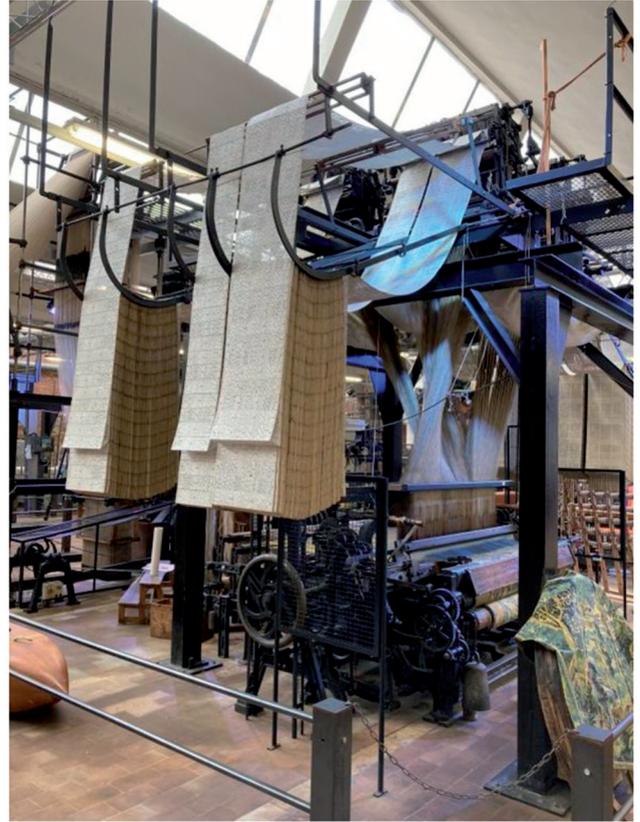
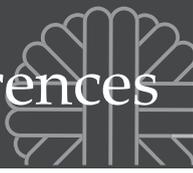


Fig. 5: Smart Textiles Conference: Upper left: ENSAIT's lab on thread production, experiments and spinning (Image: Audrey Gouy). Upper right: view of a jacquard loom at La Manufacture Museum, Roubaix (Image: Audrey Gouy). Bottom: performance of Hank Bamberger in the ENSAIT's courtyard on 29 April (Image: Hank Bamberger. Screenshot from Hank Bamberger's Youtube Channel)

presented her reinterpretations, as an art performer and researcher, of national costumes from Ukraine, Switzerland, and Uzbekistan. She stressed that those three countries have been historically connected since the 17th century, when Europeans went to Asia and brought back traditional hand-painted textiles that were copied in Europe and then reproduced in factories. The patterns were adapted locally and were traded back to where they came from originally.

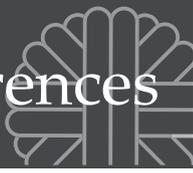
On the second day, 29 April, the conference took place at the ENSAIT in Roubaix. The morning was dedicated to five papers, followed by a visit of one of ENSAIT's research labs for thread production and spinning. The paper by Aurélie Cayla (ENSAIT) proposed a presentation of the conductive polymer composites that are nowadays used in smart textiles applications, which offer extraordinary possibilities for future projects and applications. The paper by Jane Malcolm-Davies (Globe Institute, University of Copenhagen) took reconstruction as a viewpoint, allowing to present and understand the different strategies, datasets and disciplines at stake in Early Modern England's dress. Ulrike Beck (Berlin University of the Arts) presented some very well preserved textile finds from the 1st millennium BCE in Xinjiang, Central Asia. Thanks to a mix of textile design research perspective, reverse engineering, and forensics techniques, she showed how she could extract crucial data and discover unexpected structural changes in clothing production, such as tailoring, division of labour, and craft specialisation, which spread to other areas of the society. Those changes contributed to creating more dynamic, flexible, body-motion-adaptable, and efficient garments. The paper by Zahra Kouzehgari (Archéorient, Lumière University Lyon 2) focused on textiles as social status markers in the Ancient Near East, and especially on the *kaunakes* that were garments of high technological standard, woven in a tufted pattern suggesting overlapping petals or feathers, either by sewing tufts onto the garments or by weaving loops into the fabric. This kind of clothing, that considerably interacted with the body's motion, appeared especially on female deities and high-ranking women such as queens and priestesses. The paper by Romina Laurito (National Etruscan Museum of Villa Giulia, Rome) focused on the tools used in southern Etruria in textile production from the tenth to fifth centuries BCE. Based on a techno-morphological approach and experimental archaeology, she argued that spinning tools varied considerably over the centuries and from one area to another. This variability certainly suggests different types of textile production and indicates

different traditions and demands through time. Moreover, some tools are more personalised (with signs, not functional, etc.).

This second day ended with two keynote lectures by Karina Grömer (Natural History Museum Vienna) and Joseph Lejeune (ENSAIT), and a dance performance by Hank Bamberger (Centre for Dance Research C-DaRE, Coventry University). The lecture by Karina Grömer highlighted the different strategies at stake through textiles to transform the body, altering its shape or surface, creating a language and non-verbal communication, and being functional in terms of motion. This paper particularly focused on how clothing has supported and restricted movement through time, based on case studies from Europe and Ancient Persia. In particular, it questioned the functionality of clothing that restricted movement. It appears that movement restriction is mostly an upper-class phenomenon and affects both men and women. There are four aspects in restricting movements: narrowing the stride, influencing the posture, impairing breathing, and heavy weight. Moreover, the motivations behind garments hindering mobility are: representation and status, awareness and perception, safety, discipline, and availability. The keynote lecture by Joseph Lejeune, based on current research at the ENSAIT, opened the discussion towards a more virtuous textile world that would reduce the high consumption of resources for textile production and conceive even smarter textiles. Two research approaches were presented: the *electrospinning* project of silk with the aim to reproduce the high quality of fibres with biodegradable, biocompatible technology, and the *photonitex* project that plans to create adaptative garments to prevent human body temperature loss through radiation, evaporation, convection, and conduction.

The performance of Hank Bamberger, in the ENSAIT's courtyard, resonated with all the discussions engaged and the papers presented during the conference. It particularly challenged the questions of identity, textile technology, and use. The full recording of this performance is available here: [https://www.youtube.com/watch?v=RoZKY4OK7Do&ab\\_channel=HankBamberger](https://www.youtube.com/watch?v=RoZKY4OK7Do&ab_channel=HankBamberger).

The second day of exchanges and discussions ended with a visit to the remarkable Textile Gallery in La Piscine Museum, Roubaix, where an important collection of nearly 2,000 sample books and 30,000 pieces of fabric is assembled as testimonies to technical potential and knowledge, covering a large period from Coptic Egypt to the present day. Created in 1835 by the city, this Textile Gallery, or *Tissuthèque*,



is constantly enriched by numerous donations and purchases of books, fabrics, textile designs and map layouts to offer the most complete documentation possible to researchers.

On the last day, 30 April 2022, visits were organised for the speakers. In particular, the visit to the La Manufacture Museum gave an overview of the textile production and research in the region Hauts-de-France from the Middle Ages until today. Different kinds of looms, which were in use until the 1970s and are all still functional today, were presented.

This international conference on Smart Textiles, that received exceptional support from the region Hauts-de-France, the University of Lille, and the INRAP, gathered eminent specialists and offered an interdisciplinary, ground-breaking, and fruitful dialogue that will be pursued. While textile research usually focuses on production, economy, and fashion,

the Smart Textiles conference announces a third venue in textile research. Indeed, it has made an important contribution by looking at these interactions between humans and clothes, suggesting a phenomenology of clothes: how we can perceive them in different ways, and how textiles have a way to interact with us as well. Also, this event is pushing forward on a scientific level that CTR has marvellously contributed to do, creating a dialogue between past and present practices thanks to crucial projects such as *THREAD* and *The Fabric of My Life (FABRIC)*. There is no doubt that the success of this new approach developed by the *Smart Textiles* conference will impact future research, as well as events, as it has been already the case with the *DRESSED* conference co-organised by Ulrike Beck in June 2022.

*By Audrey Gouy*

## DRESSED: The Widespread Role of Clothes, Textile Production and Clothing Concepts in Society — Interweaving Perspectives

22 to 24 June 2022, University of the Arts Berlin, Germany, and online

*The Widespread Role of Clothes, Textile Production and Clothing Concepts in Society* was the first conference in the DRESSED series about the multifaceted relationship between clothing and society. The BMBF-funded project INNOTEXGES organised the international conference at the University of Arts Berlin, Germany. It was held online from 22 to 24 June 2022. It included an in-person closing event and photo exhibition about clothing's past and future at the Berlin Open Lab and the University of Arts in Berlin, Germany.

The conference's content was closely aligned with the key topics of the INNOTEXGES research project, which investigates clothing's wide-ranging practical, communicative, and social functions and its qualities as a creative toolkit to enhance new skill sets. Within the project, new scientific methods are applied to primary data to investigate how clothing finds still provide wide-ranging information about their wearers

and the technological and cultural knowledge, the availability of resources and even the innovative skills of societies. The conference was designed to distribute these ideas into the scientific discussion for archaeological research and its implications for future research. Since the INNOTEXGES project scientifically unites textile and design research with data science, the conference provided three different tracks to discuss the complex topic from different perspectives and interlink expansive scientific fields and their methods and approaches into a bigger picture.

During the three conference days, the wide range of speakers and scientific fields opened new ways to investigate the multi-layered phenomenon of clothing's complex role, with contributions from textile, dress and design researchers, dress historians, curators, conservators, archaeologists, writers, practitioners, and museum professionals.



Fig. 6: Logo of the conference and the associated BMBF-funded project INNOTEXGES, University of the Arts Berlin, Germany (Image: Ulrike Beck)

In the three thematic sessions, 26 conference speakers from four continents presented their research about the expansive qualities and multifaceted roles of clothing in society. In addition, over 100 researchers from different scientific fields contributed as speakers, organisers, and attendees to the conference. Lively discussions about the interface of textile and design research and, in addition, innovative ideas about integrating data science were groundbreaking outcomes of the three-day conference.

On the first day, the conference started with "Track one – Perspectives on dress history: Understanding the past and finding the big picture". This session explored how historical and ancient clothing strikingly characterises the social structures and epochs in their ongoing change through its many functions and qualities. Track one presented multiple perspectives and methodological approaches to discover clothing from different angles and explored various insights by translating the complex language of clothing through versatile data and sources. The keynote by Karina Grömer about "Visuality – Body language – Identity – Recreating prehistoric dress from Central Europe (2nd and 1st millennium BCE)" started the conference. The following papers presented archaeological, historical, linguistic, and experimental research, covered different sources, methods, and approaches, and gave new insights into the multifaceted relationship between clothing

and society from Ancient Egypt and the Roman Empire as well as Central Europe and China.

On day two, track two explored how to structure and interlink data efficiently and, by doing so, how to problem-solve, think creatively, and ask meaningful questions. Through the papers and lively discussions, the session explored how to connect data and scientific thoughts and concepts by extension. The keynote lecture by Ulrike Beck about "Pattern Recognition: How to structure data methodically, create a repeatable reconstruction method, and understand clothing and motion in a mathematical system" started the second day with concepts about pattern recognition and methodological standards. The following presentations from different scientific fields explored the analysis of textiles from different viewpoints like patterns, fibres, and biomolecular methods.

During this session, various scientific projects and their efforts to build interconnected data archives were presented and discussed. Finally, a fruitful and broad discussion about the multiple challenges and the value of the data-driven methods ended track two with



Fig. 7: One of the research experiment results at the University of Arts Berlin, Germany, in which students, led by Ulrike Beck, developed a sustainable mono-material collection by modernly adapting remarkably resource-efficient production techniques from the 1st millennium BCE in Xinjiang, Eastern Central Asia (Image: Martin Jess)



many new ideas and approaches to interlinking the interdisciplinary research fields and their data. Day two showed that we are at an exciting starting point for a broader data connection between disciplines and historical timelines. It was concluded that integrating data science into textile research is challenging but opens a new dimension in archaeological clothing and textile research.

On the third day, “Track three – Creating the future: Responding to society” explored the political dimension of clothing, and the recent part clothing holds in society through new production strategies, materials, and clothing concepts. This session provided a multifaceted view of new research approaches and critical artistic practices and started with the keynote by Gesche Joost on “Smart wearable computing”. The following speakers presented the essential political and social dimensions of clothing in recent histories, such as colonial Spanish America, the

Sarong Revolution, and the Spanish Franco dictatorship. The conference was closed with a data-driven outlook by Martin Jess about “Defining the future research” on new trends in current research and also introduced the remarkable concept and practical research experiment led by Ulrike Beck about “Interweaving past and future: The ingenious principles by Xinjiang’s craftspeople in the first millennium BCE, eastern Central Asia and the Design Research Lab Experiment”. The experiment results were presented in a photo exhibition during the closing event at the Berlin Open Lab at the University of Arts Berlin.

A selection of the papers presented during the conference will be published in a joint volume as a permanent record of this insightful first conference in the DRESSED series. The next DRESSED conference will be held in June 2023.

*By Ulrike Beck and Martin Jess*

## 28th European Association of Archaeologists (EAA) Annual Meeting 2022

31 August to 3 September 2022, Budapest, Hungary

This year’s EAA finally took place in Budapest as the successor of the 2019 conference in Bern. It was thus a great pleasure to meet new and old colleagues in spite of the many worldwide obstacles for a peaceful and infection-free exchange of knowledge and research. Seen from a textile perspective, this conference was an important and successful demonstration of the impact, growth, and increasing relevance of textile research in the general archaeological discourse.

This time, the as always impressive programme listed no more than four specific textile-related sessions, and many individual textile-related presentations in others. Textile research is slowly penetrating most fields of research.

The sessions were:

- EAA Session #177 – Organic Materials in Tombs: The quiet protagonists. Organised by Demi Andrianou and Anne Kwaspen.
- EAA Session #195 – Silk: A catalyst for interconnection in the sixth to tenth centuries AD/CE. Organised by Alexandra Makin, Susanna Harris, Helena Březinová and Astrid Klein.
- EAA Session #232 – Dressing Europe: Mapping

and disseminating European textile heritage through digital resources. Organised by Catarina Costeira, Alina Iancu and Francisco Gomes.

- EAA Session #434 – Creation of European Identities: Food, textiles and metals in the Iron Age between Alps, Pannonia and Balkans. Organised by Margarita Gleba and Hrvoje Potrebica.

It is still uncertain if the results of these sessions will be published.

Further important news is that this year, thanks to the efforts of Margarita Gleba and Hana Lukesova, a new EAA community was unanimously approved right before the Budapest annual meeting. The community page is now live on the EAA website: [https://www.e-a-a.org/EAA/Navigation\\_Communities/Community\\_for\\_Textile\\_Archaeology\\_and\\_Conservation.aspx](https://www.e-a-a.org/EAA/Navigation_Communities/Community_for_Textile_Archaeology_and_Conservation.aspx)

The EAA Community for Textile Archaeology and Conservation aims to promote and integrate the knowledge of and provide the expertise in archaeological textile analysis and conservation to the wider EAA community by sharing best practices, creating forums for discussion, and establishing networks and collaborations.

All labels

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**List of sessions**

#	Title	view
177	Organic Materials in Tombs: The Quiet Protagonists	<a href="#">view</a>
195	Silk: A Catalyst for Interconnection in the Sixth to Tenth Centuries AD/CE [MERC]	<a href="#">view</a>
232	Dressing Europe: Mapping and Disseminating European Textile Heritage through Digital Resources	<a href="#">view</a>
434	Creation of European Identities – Food, Textiles and Metals in the Iron Age Between Alps, Pannonia and Balkans	<a href="#">view</a>

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Fig. 8: Textile-themed sessions at the EAA 2022 conference in Budapest, Hungary (Image: Screen-shot from the EAA homepage)

The EAA Community for Textile Archaeology and Conservation aims to break down research barriers by promoting the fundamental importance of textiles during at least the past 20,000 years of human evolution to the wider archaeological community



Fig. 9: Evening at the EAA conference in front of the Hungarian National Museum in Budapest (Image: Karina Grömer)

and demonstrating the secrets that little brown rags can reveal about the past when properly studied and conserved.

The detailed aims are:

- To create connections across archaeological fields to enable textile evidence to be fully integrated into interpretive narratives
- To promote the study and conservation of textiles across all periods and regions within the EAA and beyond
- To create forums for discussion of research directions, best practices, common documentation standards, and issues of importance to textile archaeologists and conservators
- To establish partnerships with specialists working in similar issues (other relevant EAA Communities, UNESCO, ICOMOS, ICOM-CC, E.C.C.O.)
- To be a resource for sharing expertise and best practices in textile archaeology and conservation to the EAA community, students, and researchers
- To raise the profile of textile archaeology and conservation within the EAA by organising and coordinating sessions related to textile archaeology and conservation at EAA Annual



- Meetings, particularly including sessions of general interest allowing for wide participation
- To promote the EAA among textile archaeologists and conservators and integrate them into the European archaeological community as a whole
  - To foster cross-European networks and collaborations
  - To promote activities to engage the general public with textile research
  - To contribute to open science through the sharing of data, tools, and methodologies

All EAA members can adhere to ComTex by logging into their EAA account on the community webpage. The call for papers for the next EAA Annual Meeting in Belfast in 2023 opens 15 December 2022 (<https://www.e-a-a.org/ea2023>). If you are planning a textile-related session, please tick the ComTex button, so it will count towards its activities. A community meeting will be organised during the meeting in Belfast. We hope to see many of you there.

*By Ulla Mannering*

## VIII Purpureae Vestes International Symposium: Tradition and Innovation in Textile Production in the Ancient Mediterranean World and Beyond

19 to 21 October 2022, Athens, Greece

The 8th edition of the international conference *Purpureae Vestes* was hosted at the Benaki Museum in Athens. The organising committee was made up of Christina Margariti, Stella Spantidaki and Alina Iancu and it was held in the framework of *EuroWeb – Europe through Textiles: Network for an integrated and interdisciplinary Humanities* and The Hellenic Centre for Research and Conservation of Archaeological Textiles (ARTEX).

It focused on how the study of tools, words, and techniques for textile production can reveal the tradition and changes throughout times and contacts with different cultures. It brought together archaeologists, philologists/linguists, historians, museum specialists, and scientists for a broad discussion on the recent study of Mediterranean textiles. The papers covered a wide geographical area from the Iberian Peninsula to the Near East and Egypt.

The conference covered three days and was divided into four main themes, distributed along ten sessions, each of four to five presentations. The themes highlighted different foci of study and approaches: textile studies, textile finds, textile tools, textile dyes, and textile terminology.

The conference opened with two sessions on textile

studies, chaired by Margarita Gleba and Agata Ulanowska, and spanned from the Neolithic textile production in the Aegean (Kalliope Sarri) to the new project on textiles from Nahal Omer on the Silk Road (Orit Shamir). A multifold approach was also offered, from archaeological findings to historical sources. The afternoon offered a session on recently excavated textile findings, chaired by Christina Margariti, and one on textile tools, chaired by Kalliope Sarri.

The second day was opened by a session on textile terminology, chaired by Stella Spantidaki, and continued with a session on textile tools, chaired by

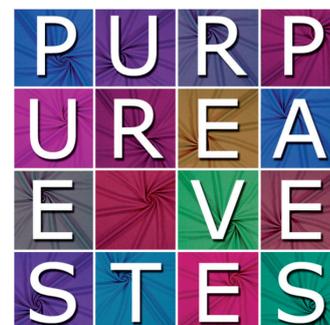


Fig. 10: The Purpureae Vestes logo



Fig. 11: Group photo of the participants of the VIII Purpureae Vestes in the courtyard of the Benaki Museum, Athens (Image: Alina Iancu)

Marco Galli. The afternoon offered a brief session on dyes, chaired by Christina Margariti, after which the participants were offered a guided tour to the Benaki Museum of Greek Culture. The museum houses a vast collection of archaeological findings and textiles, from Antiquity to modern times.

The final day started with a session on textile studies, chaired by Kalliope Sarri, and one on textile findings, chaired by Stella Spantidaki, followed by the poster session. The final session of the day consisted of a mix of textile and tool findings and was chaired by Alina Iancu.

The discussion after the presentations was lively and

transversal, despite the wide range of topics and approaches of the speakers. Among the themes which were discussed were the differentiation between loom weights and net weights and the distribution of tabby/twill textiles according to the new findings. The conference once more confirms the necessity for a space of discussion for textile experts working on different countries in the Mediterranean and offers a unique opportunity to join fields of studies traditionally, geographically, and chronologically so distant from one another.

*By Chiara Spinazzi-Lucchesi*

## Missing Persons: who were the typical Tudors?

23 to 25 October 2022, National Justice Museum, Nottingham, UK

The Tudor Tailor hosted in October an oft-postponed conference at the historic court room in Nottingham, which now serves as the UK's National Justice Museum. Its main theme was the integration of artefactual evidence – both archaeological and historical – with other sources of evidence for ordinary people's dress in the Early Modern era.

The conference organisers devised a novel way of presenting the arguments by inviting specialists representing the three main primary sources (objects,

iconography and archives) to speak as witnesses in a mock trial. A retired circuit judge, Andrew Hamilton, chaired the proceedings and 12 delegates found themselves promoted to seats on the jury on their arrival at the courtroom on Sunday 23 October 2022.

The Head of Research and Curator of Ordnance and Human Remains at the Mary Rose Trust, Alex Hildred, made the case for archaeological evidence. She outlined how evidence from the shipwreck speaks volumes about ordinary people's dress in



Fig. 12: The judge's eye view of the conference delegates in the historic courtroom with the counsels for the defence (Ninya Mikhaila – centre left) and prosecution (Jane Malcolm-Davies – centre right) (Image: Andrew Hamilton)

the first half of the 16th century. She focused on the many textile fragments and some complete garments that survived the 1545 catastrophe and showed how items had been reconstructed to illustrate life on board the ship. Ninya Mikhaila, acting as the counsel for the defence, questioned “the witness” about specific garments worn by soldiers and sailors. The counsel for the prosecution, Jane Malcolm-Davies, suggested that a snapshot of these men at the time of the shipwreck was not necessarily indicative of the dress of the population as a whole.

Other speakers included Tarnya Cooper, Curatorial and Collections Director, National Trust, who discussed portraiture, and Maria Hayward, Professor of Early Modern History at the University of Southampton, who explained how the various acts of apparel in

force at the time were eloquent documentary sources. Another advocate for archival sources was Pat Poppy, independent scholar and early modern clothing blogger, whose work with wills and inventories showed how they can provide relevant terminology for fragmentary evidence of garments.

Another novel aspect of the conference was a live garment “autopsy” performed by Susan North, Curator of Fashion at the V&A Museum, London. She undertook a forensic-style interrogation of a newly-discovered 16th century garment, which she had never seen before. She demonstrated how an historical approach to garment analysis follows the same methodology as that used in archaeological enquiry. She assessed the characteristics of the textile before moving to the construction of the garment. The counsel for the defence pressed Susan for an identification of the object, which she declared was a farthingale sleeve support. The counsel for the prosecution challenged the evidence for this being typical wear for people below the wealthy. This was countered by pictorial and documentary evidence showing that by the last decade of the 16th century and the first decade of the 17th century, such extravagant sleeves were being worn by the middle classes and even maidservants.

Hilary Davidson, chair of the masters in *Fashion and Textile Studies: History, Theory, Museum Practice* at the Fashion Institute of Technology, New York, brought the event to a close with a presentation which drew on The Tudor Tailor's model for good practice in the reconstruction of textiles and dress and her own work in reconstructing garments for research purposes. She referred to the “three-legged stool” of pictorial, documentary and artefactual evidence



Fig. 13: Nottingham's historic courtroom at the National Justice Museum was an excellent venue for this atypical conference on “Missing Persons: who were the typical Tudors?” (Image: Jodie Cox)

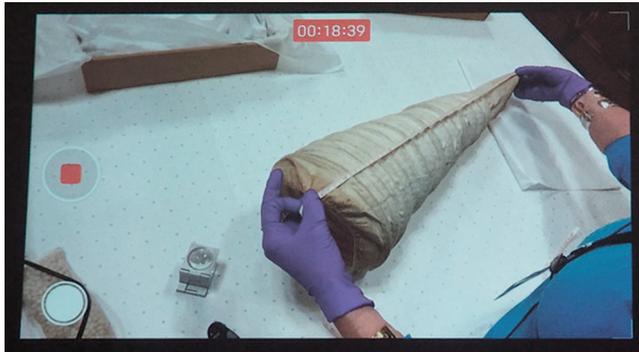


Fig. 14: Delegates watched Susan North's live "autopsy" of the previously unpublished farthingale sleeve support (dated circa 1600 CE) up-close on screen in the courtroom (Image: Jodie Cox)

which provides a firm foundation for scholarly reconstructions. The judge instructed the jury to consider whether the evidence for ordinary people's dress was adequate and, after much heated debate, they returned a verdict of case proven. They also emphasised the need for ongoing research as new evidence (including previously unknown artefacts) comes to light demanding a reassessment of what was already known or hypothesised about the dress of people for which there is relatively little credible information.

The event's unusual format extended to the evening

gala held at a Tudor mansion, Holme Pierrepont Hall. Amber Butchart, fashion historian and television presenter, gave an entertaining presentation about her work helping the police in criminal investigations by identifying clothing and interpreting who would wear it. She added to one of the day's main theme in discussing her methodology and providing illustrative examples.

The *Missing Persons* conference continued with activities in and around Nottingham on Monday 24 and Tuesday 25 October with tours around the textile district of the city, a visit to an historic lacemaking workshop and archive, a trip around the underground caves (which once housed a tannery), and time to explore the *Missing Persons* exhibition of reconstructed garments featured in Jane and Ninya's new book *The Typical Tudor: reconstructing everyday 16th century dress*. There was also an opportunity for conference delegates to examine the farthingale sleeve support and its silk satin oversleeve, and a visit to the Framework Knitters Museum in Ruddington, where original knitting machinery is still in working order.

There is a plan for many of the talks and presentations to be available online. Subscribe to The Tudor Tailor's newsletter on the website ([www.tudortailor.com](http://www.tudortailor.com)) to receive updates about this.

By Jane Malcolm-Davies

## Current Research in Textile Archaeology along the Nile

5 to 6 December 2022, Centre for Textile Research, University of Copenhagen, Denmark

The Current Research in Textile Archaeology along the Nile workshop was organised within the frame of the Marie Skłodowska-Curie research project EgYarn, focused on New Kingdom textile production.

The first workshop of this kind was organised by the TAES network in 2019. This second workshop opened the doors to not only archaeologists, but also scholars working with iconographic and textual sources. The aim



was to establish a new dialogue between archaeology, philology, and textile research in order to maximise the research potential of this area.

The workshop kicked off on the Monday with academic sessions. It was opened by two talks on iconographic sources while the rest of the morning focused on archaeological findings of textiles and tools. The afternoon was organised in two sessions, one devoted to textiles through the lens of textual sources and the second to fibres and their processing. In total, the 12 talks offered a wide range of topics on a very large chronological and geographical scale, spanning from Middle Kingdom Egypt to 18th century Sudan.



Fig. 15: Snapshot of the Conference “Current Research in Textile Archaeology along the Nile”: Left: Participants learning to decortify flax in the hands-on session. Right: Textiles from Egypt (Images: Chiara Spinazzi-Lucchesi)

It also ranged from technical and analysis-based presentations to contextual and collections-based material. The talks were streamed online, where 145 people from all over the world registered for the event and engaged in the discussion.

A splendid evening lecture on the embroidery from the tomb of Tutankhamon was presented by Gillian Vogelsang-Eastwood, Director of the Textile Research Centre in Leiden. The thrust of the paper was twofold: it demonstrated the various techniques of embroidery and decoration present in the tomb, and aspects of the use and meaning of the textiles, coming closer to the person who wore them.

The second day of the workshop was organised as a hands-on approach, to test the method of processing flax that resulted from the EgYarn project’s experimental tests. The results of the experiment

conducted by two professional spinners and weavers, Marie Wallenberg and Elena Ciccarelli, were presented on the first day and the participants were asked to replicate the sequence of actions that seem to be more adherent to the ancient Egyptian iconographic and archaeological findings (decortification, splicing, plying). The aim was to see if it was possible to learn this method quickly and easily, both by untrained and fully trained spinners used to the classical method of flax processing.

The papers presented during the workshop will be published in a joint volume.

The event was made possible by the funding of the European Union’s Horizon 2020 research and innovation programme under the Marie Skłodowska Curie grant, agreement 890144.

*By Chiara Spinazzi-Lucchesi*

# Audrey Henshall

## 1927 – 14 December 2021

Audrey Shore Henshall MA OBE who died on 14 December 2021 aged 94 was a distinguished pioneer of textile archaeology in Britain. Her first published work, *Textiles and weaving appliances in prehistoric Britain* (Henshall 1950), began as a thesis written as a final-year archaeology student at Edinburgh University in 1949. The topic was suggested to her by Professor Stuart Piggott. It was a challenge but, having been born in Oldham in the heart of the Lancashire cotton industry, it was not unfamiliar territory. She received help from the legendary Grace Crowfoot, who had reported on some earlier archaeological finds of textiles in Britain, but whose main research was carried out in the Near East, and from her daughter Elisabeth Crowfoot, who followed in her mother's footsteps. There followed a series of synoptic papers by Audrey on early textiles found in Scotland (Henshall 1951–1952, 1954–1956), and reports on some outstanding finds like the 17th century costume from Dungiven in Ulster (Henshall 1961–1962) and a Roman gypsum burial in York (Henshall 1962), to name but a few.

Her practical involvement with textiles, however, gradually waned, and she is best known among prehistorians for her magisterial survey in six volumes (1963–2001) of the Neolithic chambered tombs (cairns) of Scotland – some 600 monuments which she measured and recorded personally in the field, a mammoth task before digital surveying instruments became available. Most of her working life was spent in Edinburgh, first as an Assistant Keeper in the National Museum of Antiquities and from 1970 as Assistant Secretary of the Society of Antiquaries of Scotland. She was a pivotal and very popular figure in Scottish archaeology: her achievements were recognised in 1992 by a *Festschrift* (*Vessels for the Ancestors: Essays in the Neolithic of Britain and Ireland*) and the award in 1993 of an honour, OBE (Order of the British Empire). On a personal level, my debt to Audrey is enormous.



Audrey Henshall (Image: R. Meldrum)

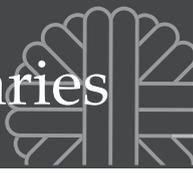
She was the only person in Britain with whom I could regularly “talk textiles” when I embarked on my doctoral research. When I was visiting her in Edinburgh on one occasion, she lent me for the night the copy of *The Warp-Weighted Loom* which Marta Hoffmann had just sent to her, hot off the press. Its content was electrifying! Later, she was persuaded to act as external examiner for my dissertation. We kept in touch, and in her reply to my sending her copies of the *Archaeological Textiles Review* in 2015 commented: “I am astonished at the width and breadth of textile studies at the present time. Also, so much of interest, especially the snippets on tablet-weave that was ever so dear to my heart.”

It is very sad that we have now lost our last link to the heroic age of archaeological textile research in Britain, some 70 years ago.

### Bibliography

- Henshall, A. S. (1950) *Textiles and weaving appliances in prehistoric Britain*. *Proceedings of the Prehistoric Society* NS 16, 130–162.
- Henshall, A. S. (1951–1952) *Early textiles found in Scotland, Part I homespuns*. *Proceedings of the Society of Antiquaries of Scotland* 86, 1–29.
- Henshall, A. S., Crowfoot, G. M. and Beckwith, J. (1954–56) *Early textiles found in Scotland, Part II medieval imports*. *Proceedings of the Society of Antiquaries of Scotland* 88, 22–39.
- Henshall, A. S. (1961–62) *The Dungiven costume*. *Ulster Journal of Archaeology* 24–25, 119–142.
- Henshall, A. S. (1962) *Cloths with burials in gypsum*. In *Royal Commission on Historical Monuments, An Inventory of the Historical monuments in the City of York: Volume I Eburacum: Roman York*. London: RCHM England, 108–109.
- Sharples, N. and Sheridan, A. (1992) *Vessels for the Ancestors: Essays on the Neolithic of Britain and Ireland in Honour of Audrey Henshall*. Edinburgh: Edinburgh University Press.

By John Peter Wild



# Annelies Goldmann, née Peters

## 20 December 1936 – 13 January 2022

Annelies was born in the Charlottenburg district of Berlin in 1936, and her childhood was marked by the Second World War. After the end of the war, her family found refuge in Neumünster, which was to become their second home. The history of divided Berlin never let go of her and shaped the rest of her life. Her future husband Klaus Goldmann was another refugee who had fled from Guben to Neumünster. They met on the train during their studies.

As a graduate economist, Annelies accompanied her husband, the prehistorian Klaus Goldmann, when he took up a position at the Museum of Prehistory and Early History in Berlin-Charlottenburg in 1971. The development and expansion of the Museum Village Düppel, of which Klaus Goldmann was appointed director in 1974, also became Annelies Goldmann's future field of work.

If one follows the biographical data of Annelies Goldmann, one quickly notices that she pursued and developed her interests with great enthusiasm despite certain social and family obligations.

In 1977, she began working as a volunteer at Museum Village Düppel and quickly became a recognised specialist in medieval weaving technologies and the processing of wool of ancient breeds of sheep. From June 1989 until her retirement, Annelies was permanently employed as a part-time employee of the Museum Village Düppel (later: Stiftung Stadtmuseum Berlin, Museum Village Düppel department).

Düppel provided Annelies with the optimal conditions to explore all aspects of the wool production process: sheep husbandry, the gathering or shearing of wool, further processing for spinning, thread production, dyeing, weaving with various

weaving implements, the finishing treatment of woven fabrics, and finally, the reconstruction of archaeological finds of garments.

For decades, she would provide ideas for new projects to the wool group within experimental archaeology, with a range of topics such as the reconstruction of the Reepsholt coat or the Vaal ribbon, the weaver's card, or the ancient Skudde sheep breed. Numerous publications reflect this dedication to research.

Her approach was both earnest and fun-loving, and she liked to test the results of her research in practice in cooperation with the wool group to obtain a comprehensive insight. The result of these projects were not only the finished fabrics and the publications, Annelies also gave numerous lectures, especially at the Northern European Symposia on Archaeological Textiles (NESAT). In this way, she contributed significantly to making the Museum Village Düppel more widely known. Both on a national and an international level, the wool group contributed to a better understanding of medieval wool processing

through working exhibitions, such as in Detmold, Oerlinghausen, or the Polish Museum Village of Biskupin.

The wool group of the museum village also participated in the travelling exhibition "Experimental Archaeology in Germany", which was shown for a long time all over Germany and beyond, and Annelies and other members of the group participated in several stations of the tour to demonstrate their techniques, to pass on their experience, and ultimately, to have fun and enjoy



Annelies Goldmann (Image: Eva-Maria Pfarr)



seeing foreign cities and regions together. Annelies always made sure to write down exactly what the wool group had done, and these protocol volumes have become a real treasure for new members who can learn from the history of the wool group and its projects.

It was important for her to stay in contact with textile archaeologists or people who worked directly on archaeological textile finds, such as Inga Hägg, with whom she conducted a weekend seminar dedicated to the textiles recovered from the harbour of Haithabu. Only few people were aware of her love of drawing and watercolours. An impressive result of this interest was her pictorial weaving, in which she transformed

her watercolours into woollen images.

In the end, the life of Annelies and Klaus came full circle again. After the unexpected death of their son in 2016 and the increasing health problems of her husband, the couple moved back to Neumünster in 2017, where a familiar circle of relatives and friends waited to receive them, including Klaus Tidow. But it was above all their daughter, Antje Goldmann, who created a loving and caring environment for them during their last years, in which Annelies could peacefully fall asleep on 13 January, 2022.

*By Johanna Banck-Burgess,  
Eva-Maria Pfarr, Antje Goldmann*



# Anne Reichert

## 10 June 1935 – 8 May 2022

With the passing of Anne Reichert, the scientific community has lost a personality who was recognised far beyond the borders of the German-speaking world as a proponent of archaeotechnology, or as she herself would have put it, an experimental archaeologist. She was a member of EXARC, the European association dedicated to the promotion of experimental archaeology, and of AEAS, the Swiss platform for experimental archaeology.

Her enduring legacy is marked by the way in which she shared her profound knowledge with interested children and adults – both laypersons and scientific colleagues – with equal enthusiasm.

Born in 1935 in the city of Königsberg, in the Neumark region of Prussia (formerly Germany, now Poland), her life was influenced by the harsh experiences of the war and post-war years. Her will to survive, and her indefatigability, modesty, and enthusiasm were later applied to the field of “living history” which she entered at the end of the 1980s. Her previous experience as a proofreader for a school book publisher and an editor for scientific books and periodicals would become a valuable asset when she wrote her own numerous publications.

In addition to working on reconstructions of prehistoric pottery or the production of birch pitch, Anne also developed a fascination with Neolithic textiles. She was always close to nature, and the harvesting and processing of natural resources were

a lifelong fascination and preoccupation for her. Anne really came into her own when conducting events such as the one held in 2008 in the Fischerhaus Wangen museum, where she taught the twining of wood bast and the freshly harvested bark of young twigs to children. Next to Emil Vogt, who laid the foundation for the research on Neolithic textiles with his 1937 book *Geflechte und Gewebe der Steinzeit*, and Antoinette Rast-

Eicher and her much-cited contribution *Bast before wool* (2015), it was Anne Reichert who directed scientific attention to the subject of wood bast as a raw material in prehistoric textile crafts. Beginning as an autodidact, she was tireless in her drive to understand and reconstruct the production methods used on archaeological finds of tree bast textiles. It hardly came as a surprise that numerous archaeological institutions such as the Landesamt für Denkmalpflege in Baden-Württemberg, in particular the Feuchtbodenarchäologie Hemmenhofen, or museums such as the Museum für Archäologie

und Ökologie Dithmarschen in Albersdorf sought her advice, her competence, or her collaboration.

Her exhibition *Bast, Binsen, Brennessel – textiles Material der Steinzeit* – which has become the stuff of legend – presented the processing of these textile raw materials, along with numerous reconstructions of archeological textile finds, to a wider public (<http://www.museum-albersdorf.de/bast/>).



Anne's participation in the THEFBO project, which was dedicated to the study of Neolithic textile crafts (sponsored by the BMBF 2018-2021) was a real asset to our joint endeavours. She is shown here during a meeting at the central archive of the Landesmuseum Baden Württemberg in Raststatt (2020) (Image: Johanna Banck-Burgess)

The exhibition went on tour through half of Europe, far beyond the confines of the German-speaking world, being shown in venues such as the ArcheoParc Schnals in South Tyrol under the title *Raffie, ortiche e giuncacee – Materiale tessile dell'età della pietra*, or in the Préhistosite de Ramioul, Flémalle in Belgium under the title *Liber, jonc et ortie – Fibres textiles de l'âge de la pierre / Bast, Biezen, Brandnetels – Textielmaterialen uit de steentijd*. The exhibition and the special events associated with it frequently turned out to be real visitor magnets which brought record levels of attendance to some of the museums that hosted it, such as the Heuneburg open air museum.

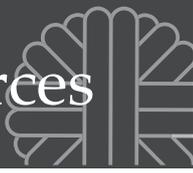
Anne's real gift of imparting knowledge made her a popular guest at workshops, seminars, or lectures hosted by universities such as the Freie Universität in Berlin or the open-air museum of Sagnlandet in Lejre, Denmark, where she passed on her knowledge in workshops in 2007. In a course of studies titled *Konservierung und Restaurierung von archäologischen, ethnologischen und kunsthandwerklichen Objekten* at the Staatliche Akademie der Bildenden Künste in Stuttgart, Anne found an enthusiastic response when she shared her rich experience with the students to whom she taught the techniques of twining lime bast in a workshop titled *Neolithische Geflechte*.

While academic archaeology would often be very restrained in commenting on textile production techniques due to the scarcity of sources, Anne would rely on her practical experience, an approach which

was not welcomed in all quarters. Nevertheless, she never relented in her tireless struggle to increase our knowledge of how humans fashioned their textiles in the Stone Age. A fine example of her work is provided by her reconstruction of the find of a twined fabric from Seekirch-Achwiesen (Sa 90 Q 99/147/ D-144) in the shape of a truncated cone. To this end, she had worked with Annemarie Feldtkeller throughout the years 2000/2001, discussing, testing, and rejecting numerous possible aspects of the production process until they finally arrived at a solution which came as close to the original as possible.

The impressive bibliography of Anne's works is a testimony to her lifelong active dedication to the field of living history. Only a few of her colleagues can claim to have achieved a comparable success in sharing their knowledge in such a lasting and generous manner. Anne Reichert died on 8 May 2022 in Ettligen (Baden-Württemberg, Germany). Her extensive collection of textile reconstructions, research protocols, and materials has been entrusted to the Pestenacker Stone Age Village (a UNESCO world heritage site), an institution administered by the Landsberg am Lech district.

*By Johanna Banck-Burgess, Sabine Karg,  
Helmut Schlichtherle, Wolfram Schier,  
Renate Ebersbach*



# Recent publications

***Ancient Textile Production from an Interdisciplinary Approach: Humanities and Natural Sciences Interwoven for our Understanding of Textiles* edited by Agata Ulanowska, Karina Grömer, Ina Vanden Berghe, Magdalena Öhrmann (2022). Springer**

The diverse developments in textile research of the last decade, along with the increased recognition of the importance of textile studies in adjacent fields, now merit a dedicated, full-length publication entitled “Ancient Textile Production from an Interdisciplinary Perspective: Humanities and Natural Sciences Interwoven for our Understanding of Textiles”. With this volume, the authors and the editors wish to illustrate the current impact of textile archaeology on the scholarly perception of the past (not limited to archaeology alone). The volume presents new insights into the consumption, meaning, use and re-use of textiles and dyes, all of which are topics of growing importance in textile research. As indicated by the title, we demonstrate the continued importance of interdisciplinarity by showcasing several “interwoven” approaches to environmental and archaeological remains, textual and iconographic sources, archaeological experiments and ethnographic data, from a large area covering Europe and the Mediterranean, Near East, Africa and Asia. The chronological span is deliberately wide, including materials dating from c. 6th millennium BCE to c. mid-14th century CE.

The volume is organised in four parts that aim to reflect the main areas of textile research in 2020. After the two introductory chapters (Part I: About this Volume and Textile Research in 2020), follow two chapters referring to dyes and dyeing technology in which analytical and material-based studies are linked to contextual sources (Part II: Interdisciplinarity of Colour: Dye Analyses and Dyeing Technologies). The six chapters of Part III: Interdisciplinary Approaches to Textile Tools discuss textiles and textile production starting from the analyses of tools, whether functional or as representative of technological developments or user identity. Archaeological and cultural

contexts as well as textile traditions are the main topics of the six chapters in Part IV: Traditions and Contexts: Fibres, Fabrics, Techniques, Uses and Meanings. The two final chapters in Part V: Digital Tools refer to the use of digital tools in textile research, presenting two different case studies.

ISBN: 978303092170-5

Price: 130€

<https://link.springer.com/book/10.1007/978-3-030-92170-5>

***Explorers, first collectors and traders of textiles from Egypt of the 1st Millennium AD* by Antoine De Moor, Cécilia Fluck and Petra Linscheid (2021). Proceedings of the 11th conference of the research group “Textiles from the Nile Valley”. Hannibal Books**

A scientific publication on the history of excavating and collecting Egyptian textiles.

Its dry climate means that Egypt boasts an exceptionally rich heritage of preserved ancient textiles. Since 1996, the international research group Textiles from the Nile Valley has been studying these Roman, Byzantine and early-Islamic textile artefacts, many of which have found their way into European and North American museum collections.

The research group, consisting of curators, archaeologists, textile conservators and scientists, organises a biennial conference at Katoen Natie Headquarters in Antwerp, and publishes a series of unique books on the importance of Egyptian textiles.

This latest volume brings together the findings from the eleventh conference, which was held from 25 to 27 October 2019. The focus is on the history of textile excavating and collecting, which goes back to the late nineteenth century.

The book contains eighteen text contributions describing recent fieldwork, conservation treatments and scientific research worldwide, in collaboration with major universities and museums such as the Victoria & Albert Museum in London and the Hermitage in St. Petersburg.

ISBN: 9464366079

Price: 60€

<https://hannibalbooks.be/en/explorers-first-collectors-and-traders-of-textiles-from-egypt-of-the-1st-millennium-ad>

***Exploring Ancient Textiles: Pushing the Boundaries of Established Methodologies* by Alistair Dickey, Margarita Gleba, Sarah Hitchens and Gabriella Longhitano (2022). Ancient Textiles Series (Volume 40). Oxbow books**

Over the past 30 years, research on archaeological textiles has developed into an important field of scientific study. It has greatly benefitted from interdisciplinary approaches, which combine the application of advanced technological knowledge to ethnographic, textual, and experimental investigations. In exploring textiles and textile processing (such as production and exchange) in ancient societies, archaeologists with different types and quality of data have shared their knowledge, thus contributing to well-established methodology. In this book, the papers highlight how researchers have been challenged to adapt or modify these traditional and more recently developed analytical methods to enable extraction of comparable data from often recalcitrant assemblages. Furthermore, they have applied new perspectives and approaches to extend the focus on less investigated aspects and artefacts. The chapters embrace a broad geographical and chronological area, ranging from South America and Europe to Africa, and from the 11th millennium BCE to the 1st millennium CE. Methodological considerations are explored through the medium of three different themes focusing on tools, textiles and fibres, and culture and identity. This volume constitutes a reflection on the status of current methodology and its applicability within the wider textile field. Moreover, it drives forward the methodological debates around textile research to generate new and stimulating conversations about the future of textile archaeology.

ISBN: 9781789257250

Price: £36

<https://www.oxbowbooks.com/oxbow/exploring-ancient-textiles.html>

***Historical Textiles and Their Characterization* by Iva Rezić (2022). Cambridge Scholars Publishing**

This book utilises current scientific advances to better understand the principles of degradation of historical textile materials (including ancient mummies, dresses, jewellery, and musical instruments) and their characterisation. Moreover, it highlights the

importance of multidisciplinary procedures as a part of complex tasks when only a relatively low amount of materials are available for analysis. In such cases, only sensitive, selective, and reliable analytical procedures, such as microscopy, spectroscopy, and chromatography, can be applied in the characterisation of precious materials.

As this book explores current scientific advances to better understand the principles of materials characterisation, it is of broad general interest to the general public, but also to the chemical, anthropological and conservation-restoration communities. Moreover, it also offers particular support to a global audience interested in the preservation of historical materials.

ISBN: 1527577112

Price: £61.99

<https://www.cambridgescholars.com/product/9781527577114>

***Only the Clothes on Her Back: Clothing and the Hidden History of Power in the Nineteenth-Century United States* by Laura F. Edwards (2022). Oxford University Press**

What can dresses, bedlinens, waistcoats, pantaloons, shoes, and kerchiefs tell us about the legal status of the least powerful members of American society? In the hands of eminent historian Laura F. Edwards, these textiles tell a revealing story of ordinary people and how they made use of their material goods' economic and legal value in the period between the Revolution and the Civil War. *Only the Clothes on Her Back* uncovers practices, commonly known then, but now long forgotten, which made textiles – clothing, cloth, bedding, and accessories, such as shoes and hats – a unique form of property that people without rights could own and exchange. The value of textiles depended on law, and it was law that turned these goods into a secure form of property for marginalised people, who not only used these textiles as currency, credit, and capital, but also as entree into the new republic's economy and governing institutions. Edwards grounds the laws relating to textiles in engaging stories from the lives of everyday Americans. Wives wove linen and kept the proceeds, enslaved people traded coats and shoes, and poor people invested in fabrics, which they carefully preserved in trunks. Edwards shows that these stories are about far more than cloth and clothing; they reshape our understanding of law and the economy in America. Based on painstaking archival research from fifteen states, *Only the Clothes on Her Back* reconstructs this hidden history of power, tracing it from the governing



order of the early republic in which textiles' legal principles flourished to the textiles' legal downfall in the mid-nineteenth century when they were crowded out by the rising power of rights.

ISBN: 9780197568576

Price: £26.99

<https://global.oup.com/academic/product/only-the-clothes-on-her-back-9780197568576?q=textiles&lang=en&ccc=at>

***Textiles and clothing along the Silk Roads* by Zhao Feng and Marie-Louise Nosch (2022). UNESCO and China National Silk Museum**

With the power to spark dialogue and understanding, the shared heritage of humankind is a vital tool for building trust and respect. A better knowledge of the mutual influences and legacies among people and cultures along the Silk Roads is essential for reinforcing intercultural dialogue and sustainable peace and development in a world marked by mistrust, tension, and conflict. Textiles and clothing are indispensable parts of our lives, with around 1 in every 8 workers employed in the industry globally. Historically, textiles and clothing have also been vectors of mutual exchange and influence between cultures. Despite this, their significant role in connecting us is sometimes overlooked. This volume of the Thematic Collection of Cultural Exchanges along the Silk Roads takes us around the world, from Java to West Africa, Scandinavia to the Philippines. It charts a fascinating history, from the ways in which patterns and dyes were elements of cultural imitation, hybridisation, and exchange, to how particular motifs and symbols were adopted across cultures and used as means to influence.

ISBN: 9789231005398

Free download: <https://unesdoc.unesco.org/ark:/48223/pf0000382993>.

***Textiles of Medieval Iberia – Cloth and Clothing in a Multi-Cultural Context* by Gale R. Owen-Crocker, María Barrigón, Nahum Ben-Yehuda and Joana Sequeira (2022). Boydell and Brewer**

An examination of the fabrics, garments, and cloth of the Iberian Middle Ages, bringing out in particular the international context. The Medieval Iberian Peninsula, encompassing various territories which make up present-day Spain and Portugal, was an ethnic and religious melting pot, comprising Christian, Jewish and Muslim communities, each contributing to a

vibrant textile economy. They were also defined and distinguished by the material culture of clothing and dress, partly dictated by religious and cultural tradition, partly imposed by rulers anxious to avoid cross-ethnic relationships considered undesirable. Nevertheless, textiles, especially magnificent Islamic silks, crossed these barriers. The essays in this volume offer the first full analysis of Iberian textiles from the period, drawing on both material remains and historical documents, supported by evidence from contemporary artwork. Chapters cover surviving textiles, many of them magnificent silks; textile industries and trade; court dress and its use as a language of power and patronage; the vast market in utilitarian textiles for lower-status clothing and furnishings; and Muslim and Jewish dress. It also considers Arabic and Jewish texts as sources of information on textiles and the Arabic garment-names which crossed into Spanish. Particular emphasis is given to the different ethnicities of Iberia and their influences on the use and trade of garments (both precious and commonplace) and textiles.

ISBN: 1783277017

Price: £75.00

[https://boydellandbrewer.com/9781783277018/textiles-of-medieval-iberia/?fbclid=IwAR1yQr609\\_jjtIRAICpre5jmeTLmdX9Wr\\_CS2HEASm3ZDbUmlDRc4M4CN5s](https://boydellandbrewer.com/9781783277018/textiles-of-medieval-iberia/?fbclid=IwAR1yQr609_jjtIRAICpre5jmeTLmdX9Wr_CS2HEASm3ZDbUmlDRc4M4CN5s)

***Textiles in Motion: Dress for Dance in the Ancient World* by Audrey Gouy (2022). Ancient Textiles Series (Volume 41). Oxbow books**

Dress is at the core of dance. It adorns dancers, defines various roles, and forms symbolic expressions that, for example, either bind people together or opposes them. It is a communicative tool that gives crucial information for understanding the dance as well as the culture and the sociological effects of a group of people. As such, dress transcends how it is seen visually to address what is being communicated. Nonetheless, studies in ancient dance have rarely taken clothing into consideration.

This volume provides new perspectives and insights on ancient dances and their ancient textiles. Comprehension of ancient dance benefits from investigations undertaken through the lens of dress, and research on ancient dress is understood through its relation to body movement and performative rituals, thus reinforcing the progressive integration of an anthropological and sociological dimension into historical analysis of ancient textiles. For the first time, the two-way transfer of knowledge between

dance studies and costume studies is connected via an innovative approach. Among the issues that are specifically addressed are the movement design of dress for dance, its sensory experience, gender and identity, re-enactment, and reception.

The chronological range of the book is focused on the ancient world (3rd millennium BCE to 5th century CE), with a broad geographical definition in order to promote a comparative, interdisciplinary approach and cross-cultural dialogue.

ISBN: 9781789257984

Price: £40

<https://www.oxbowbooks.com/oxbow/textiles-in-motion.html>

***The Typical Tudor: reconstructing everyday 16th century clothing* by Jane Malcolm-Davies and Ninya Mikhaila (2022). Fat Goose Press**

*The Typical Tudor* breaks new ground with a thorough survey of evidence for ordinary people's dress in the 16th century. It diligently cross-references three categories of evidence: extant archaeological and historical items; images such as paintings, effigies and woodcuts; and descriptions from contemporary documents. A statistically rigorous analysis of 57,000 items of dress drawn from wills, inventories, probate accounts and household expenses identifies the most popular garments with trends in textiles and colours and interprets them in the context of the acts of apparel and royal proclamations on clothes as they applied to those below knights in Tudor society. The evidence shows that, contrary to popular beliefs at the time and of later historians, most people observed the regulations. Little-known images from museums, churches and archives serve to illustrate a range of garments in detail while more familiar pictorial sources are presented as evidence for construction techniques.

The book features sewing patterns and knitting instructions for more than 40 garments and headwear which are accessible to a wide range of makers. Detailed drawings and diagrams show styles appropriate to ordinary people. The specially commissioned photographs of reconstructions illustrate how the garments contribute to accurate clothing ensembles for specific date ranges.

Historians and archaeologists, designers and costumiers, educators and reenactors will find *The Typical Tudor* a robust and essential guide for a range of reconstruction projects from scholarly studies to festival events. It offers 216 pages with colour

illustrations throughout.

*The Typical Tudor* demonstrates an innovative interdisciplinary approach to dress research by combining a statistical survey, art historical and archaeological science methods, and craft expertise. It builds on the authors' previous works *The Tudor Tailor* (2006) and *The Tudor Child* (2013) by interpreting a variety of sources with an academic understanding of the social context of dress and a practical understanding of historical tailoring.

ISBN 9780956267443

Price: £55

[www.tudortailor.com](http://www.tudortailor.com)

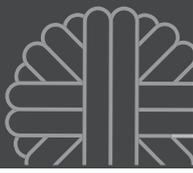
***Tracing Textile Production from the Viking Age to the Middle Ages: Tools, Textiles, Texts and Contexts* by Ingvild Øye (2022). Oxbow Books**

This book concerns textile production at the fringes of north-western Europe – areas in western Norway and the North Atlantic in the expanding, dynamic and transformative period from the early Viking Age into the Middle Ages. Textiles constitute one of the basic needs in human life – to protect and keep the body warm but also to show social status and affiliations. Textiles had a wide spectrum of use areas and qualities, fine and coarse in various contexts, and in the Viking Age not least related to the production of sails – all essential for the development and character of the period. So, what were the tools and textiles like, who made them, who used them and who exposed them? By tracing textile production from the remains of tools and textiles in varied landscapes and settings – Viking Age graves and in-situ workplaces from the whole period – and combining this with textual information, many layers of information are exposed about technology and qualities as well as gender, gender roles, social relations, power, and networks. By combining tools, textiles, and texts in various settings, this book aims to contextualise dispersed archaeological finds of tools and textiles to uncover patterns across larger areas and in a long-term perspective of half a millennium. Related to the overall societal changes from the early Viking Age raids, colonisation to centralisation to urbanisation in the Middle Ages, the tools and textiles reveal diversity, as well as stability and change.

ISBN: 9781789257779

Price: £48

<https://www.oxbowbooks.com/oxbow/tracing-textile-production-from-the-viking-age-to-the-middle-ages.html>



## PhDs

In March 2020, **Katarzyna Lubos** was awarded a PhD at the University of Bonn, Germany, for her dissertation *Aus der Reserve gelockt: Untersuchungen zu Technik und Funktion der reserve-gefärbten Gewebe spätantiker bis frühbyzantinischer Zeit* (Breaking through one's reserve: Analyses of the technique and function of reserve-dyed textiles of Late Antiquity and the Early Byzantine period). The publication is scheduled for this year and will be published by *Jahrbuch für Antike und Christentum*.

In June 2022, **Laura Cristina Viñas Caron** was awarded a PhD for her dissertation *Historical parchment as a biomolecular record of sheep husbandry practices in the Iberian Peninsula* supervised by Matthew James Collins and Eva Andersson Strand at the Globe Institute, University of Copenhagen. Her research explored aspects of the domestication and evolution of sheep from the Iberian Peninsula in medieval and post-medieval times in relation to wool production. To do so, different methods, including genomics and proteomics, were applied to a largely unexplored material: the skin of sheep converted into parchment, the main writing material used before the advent of paper.

The different lines of analysis can all help understand the process of sheep management and the relative strengths and limitations of using parchment compared with archaeological remains.

In May 2022, **Alistair Dickey** was awarded a PhD by the University of Liverpool, United Kingdom, for his dissertation entitled *Cloth culture in Early Egypt: Textile techniques, production and uses from the Neolithic to Early Dynastic period*. This collaborative award between Liverpool University and Bolton Museum was funded by the UK Arts and Humanities Research Council. Alistair was supervised by Professors Ian Shaw and Lin Foxhall, with his thesis examined by professors Douglas Baird and Marie-Louise Nosch. The research diachronically explores two main themes pertaining to Neolithic to Early Dynastic Egyptian (mid-5th millennium to 2686 BCE) woven cloth: thread technology and weave quality. The results from this study have shown that early Egyptian thread technology across all the sites studied used the technique of splicing for thread production, with two forms being recognised: continuous and end-to-end. Statistical analyses showed a strong correlation diachronically between thread density and thread diameter, i.e. the higher the thread count, the finer the thread diameter. This is exemplified by the quality of woven cloth found in tombs of the 1st Dynasty (approximately 3000 to 2890 BCE) period. This research is planned to be published in the future.



# Award

## Gad Rausing Prize 2022 from The Royal Swedish Academy of Letters, History and Antiquities for Marie-Louise Bech Nosch

The Gad Rausing prize for outstanding research in the humanities in 2022 is awarded to Marie-Louise Bech Nosch, Professor of History at the University of Copenhagen, for groundbreaking research in ancient history. Her research into textile material history has led to a completely new and flourishing field of research. The prize sum is SEK 1,500,000.

“It is a great personal honour to receive the Gad Rausing prize for my research in textile history. But I want all the archaeologists, philologists, conservators, art historians and historians with whom I collaborate to share the credit as well. Almost all of my research is done in collaboration with other researchers. We are a large group of international researchers who together have raised textile research”, says Marie-Louise Bech Nosch.

Through a theoretical, methodological and interdisciplinary innovative approach, Marie-Louise Bech Nosch has fundamentally changed the knowledge of textile production in the past. With a combination of object- and text-based analyses, Nosch has established herself as an internationally recognised expert in Aegean prehistory in general and as a world-leading expert in Linear B in particular.

Marie-Louise Bech Nosch’s research has led to insights and results that are truly outstanding and lastingly significant. Her work has contributed to making the Centre for Textile Research in Copenhagen a leading centre for archaeological and historical textile research. As a teacher and leader, she has inspired, nurtured and helped many young researchers.

“Marie-Louise Bech Nosch’s skillful analyses show how the production of cloth, which was a woman’s job, inspired and shaped the words and conceptual

devices that were developed in completely different areas of society in ancient Greece”, says Maria Ågren, Professor of History at Uppsala University and chair in the Nordic Rausing Committee, which appoints the prize winners.

In her PhD thesis, presented at the University of Salzburg in 2000, Marie-Louise Bech Nosch dealt with the organisation of work within the Mycenaean textile industry. During the years 2009 to 2017, she then initiated and led three major international research programs with a focus on textile history. At the same time, she played a decisive role in the establishment of the Danish Research Council’s excellence initiative Center for Textile Research, whose leader she was during the period 2005 to 2016. In 2017, she was appointed full professor of ancient history at the SAXO Institute, University of Copenhagen.



The Gad Rausing Prize 2022 from The Royal Swedish Academy of Letters, History and Antiquities for Marie-Louise Bech Nosch (Image: Felicia Margineanu)



# General Information

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## Guidelines to Authors

The *Archaeological Textiles Review* aims to provide a source of information relating to all aspects of archaeological textiles. Material from both prehistoric and historic periods and from all parts of the world are covered in the ATR's range of interests.

1. Contributions are accepted in English.
2. Contributions may include articles or project reports as finished works or accounts of research in progress. These may cover any research or activities related to archaeological textiles from recent excavations or in museums and galleries. Projects may encompass technology and analysis, experimental archaeology, documentation, exhibition, conservation and storage.
3. News contributions may include announcements and reviews of exhibitions, seminars, conferences, special courses and lectures, or queries concerning the study of archaeological textiles. Bibliographical information on new books, announcements about awards, and completed PhDs are also welcome.
4. The authors' guidelines can be found at [www.atnfriends.com](http://www.atnfriends.com). Please check the current guidelines as they are updated regularly.
5. All submissions are to be made in electronic text file format (preferably Microsoft Word) and are to be sent electronically.
6. Illustrations should be electronic (digital images or scanned copies at 600 dpi resolution or higher). Preferred format is TIFF (maximum size is 17.4 x 21.6 cm). Illustrations should be sent as separate files and not embedded in text. Colour images are welcome. Only illustrations with cleared copyrights, permission for internet publication, and full credit information as required by copyright holders can be used.
7. All contributions are double-blind peer-reviewed by invited specialists.
8. The editors reserve the right to suggest and make appropriate alterations in the wording of manuscripts sent for publication.

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