Nº 63

ARCHAEOLOGICAL TEXTILES REVIEW

2021 issue

Archaeological Textiles Review

ATR is published by the Friends of ATN, and hosted by the Centre for Textile Research in Copenhagen.

Cover: Charlotte Rimstad
Reconstructed tablet-woven band from Hallstatt in Austria (Image: Silvia Ungerechts)

Layout: Karina Grömer and Kayleigh Saunderson,
Natural History Museum Vienna

Print: Grafisk, University of Copenhagen

To purchase a printed copy of the latest *Archaeological Textiles Review*, please visit: https://www.webshophum-en.ku.dk/shop/archaeological-textiles-664s1.html
Information about institutional subscriptions is also available here.

Visit www.atnfriends.com to learn more about the organisation.

ISSN 2245-7135

Contents

Projects

Conferences

Editorial

Dear Reader,

Another year in the shadow of the pandemic has passed. 2021 has been a challenging year for many. We had hoped that the pandemic would now be under control but we will probably have to adjust ourselves to an academic world in which we share more data online and meet up in person on fewer occasions. Therefore, it is with great satisfaction that the editorial team can now place the current issue directly online on the *Archaeological Textiles Newsletter* homepage. It is still possible to order a printed copy from the webshop at the University of Copenhagen in Denmark (www.webshophum-en.ku.dk/shop/archaeological-textiles-664s1.html) but authors will no longer receive a printed copy.

Important changes have occurred in the editorial group in 2021. Eva Andersson Strand who has been part of the ATR editorial team since 2008, has resigned from this task and we thank her for her long and devoted participation. She will still keep her place on the board of the Friends of ATN/ATR society. Three new editors have joined the team: Mary Harlow from the UK, Elsa Yvanez from Denmark and Kayleigh Sanderson from Austria. Together we have developed an efficient editorial process which we hope authors and readers appreciate. At the same time, we are constantly working on optimising workflow procedures, guidelines for authors (now downloadable from the homepage) and contact with the authors.

It is very important that authors follow these guidelines before submitting articles and project reports. In future, we will decline non-compliant articles owing to the heavy workload on the editorial group. Please also write in formal academic English, using the correct scientific terms. If English is not your first language, please consult a skilled English speaker before submitting. The editorial team will make a final language edit but we do not have resources to make extensive corrections or to rewrite articles or reports.

Throughout the past year, ATR has received a constant flow of contributions, and we are open to receiving more articles and project reports, especially from authors who are not familiar with or used to publishing in the journal. We therefore encourage authors to share their knowledge through the *Archaeological Textiles Review*. We are an editorial board which loves textiles, preferably those found in archaeological contexts, but also encourages themes of more general value to textile experts. We now accept articles up to 10,000 words, (including abstract, references, captions, acknowledgements) and four to ten images with captions, and project reports up to 3,000 words with three to five images with captions. Articles are double-blind peer reviewed and project reports are reviewed by the editorial group. Please keep updated at our homepage https://www.atnfriends.com, where we also post news.

This year's issue contains a range of articles and project reports from different periods, with the Scandinavian Viking Age particularly well represented in both articles and project reports. There are rather fewer conference reviews than usual due to the pandemic

Fig. 1: The ATR editorial team (clockwise from top left): Kayleigh Saunderson, Elsa Yvanez, Jane Malcolm-Davies, Mary Harlow, Karina Grömer and Ulla Mannering

Full Name	Email	Street and number	Postal code	City	Country	Affiliation (optional)	Textile interests (optional)

Friends of ATN/ATR society: Template for the membership application

but we welcome more reports about online events (including ones held in 2021). Altogether there are nine articles, and eight project descriptions. Enjoy reading this issue and please spread the word about it. ATR is now a true open-source journal, free to download, and this is only possible with the work and help of many volunteers and enthusiastic hands and minds. Remember – the deadline for every issue is 1 May each year (with conference reports welcome until 1 October or later by arrangement).

Friends of ATN/ATR society

As all dedicated ATR followers will probably have noticed, the Friends of ATN/ATR society (which is the legal institution behind the newsletter/review) has not managed to hold an annual general meeting since 2017. Unfortunately, the planned meeting for this year, which was to take place during the NESAT XIV conference in Finland, was also cancelled, as the event only took place online. In order to update the society statutes to the new online working conditions and the fact that ATR no longer has a membership group defined by the subscription to the review, the ATN/ATR board suggests making minor changes to the statutes. These will be put to the vote at the next AGM in 2022. The changes and the date of the AGM will be announced on the homepage of the society in good time.

Membership of the Friends of the Archaeological Textiles Newsletter/Review society is according to the statutes of August 2007 given to the subscribers to ATN and ATR. Institutional subscribers are not given membership. Since 2020, ATN/ATR has been an open-access journal. Access to it is no longer restricted to the membership and anyone interested in archaeological textile research can join the society.

To apply for a personal membership (which is free until decisions about the annual fee for 2022 is made at the next AGM), please fill in the following template and return it to ulla.mannering@natmus.dk.

The membership will be valid from the day the applicant receives a confirmation from the ATN/ATR board. The membership will be valid until written notice is received by the ATN/ATR board resigning membership, and as long as the membership obligations, including paying the annual fee (as and when applicable) are followed by the member.

Access to the online AGM will only be sent out to members registered according to the above-mentioned procedure. Suggestions for the AGM's agenda may be sent to the editors before 1 February 2022. If no further suggestions are received, the agenda will be as follows:

- Election of a chair, if somebody so wishes
- The report of the board for the period since the previous annual general meeting
- Presentation and approval of the revised account of 31 December 2021
- Minor changes to the statutes, and decisions concerning membership and subscription
- Election of four members of the board and one deputy member for the current financial year (January to December 2022)
- Election of an auditor and one deputy auditor for the current financial year
- Any other business

For the statutes of the society, including the voting procedure, please consult the statutes section on https://www.atnfriends.com.

The Editors

Tracy Martens

Textile fibres from the Caleta Vitor Archaeological Complex, northern Chile

Abstract
This article examines fibre procurement, fibre technologies and type preferences at northern Chile's Caleta Vitor archaeological complex – a coastal site with archaeological deposits representing more than 10,000 years of occupation. Data obtained from textile analysis, stable isotopes, and historical documents provided evidence of a marine subsistence economy heavily reliant on composite fibre implements, highlighting the early predominance of plant fibres, along with camelid fibres and the introduction of *Gossypium barbadense* (cotton) in the Formative Period. The study also provides evidence of a previously unknown local camelid fibre source, challenging the long-held hypothesis that camelid fibre at low altitude sites is a proxy for trade with high altitude populations

Key words: Archaeological textiles, perishable artefacts, Chile, marine subsistence, stable isotope analysis

Introduction

During the Late Pleistocene (approximately 13,000 BP), people arrived on Chile's hyper-arid northern coast with an established marine-focused economy dependent on fishing gear, including hooks, lines, lures, and points. While the bone, stone and timber components of some composite tools have been examined in detail, fibre components have received little attention. A more complex textile tradition that developed in the region during the Formative Period (4,000 BP to 1,500 BP) has been identified at nearby sites (Azapa 70). However, the geographical extent of that technological tradition and detailed chronologies for it are scant. This bias persists despite the Atacama desert's conditions conducive to the preservation of perishable artefacts. The study reported here aims to provide a detailed analysis of these under-researched fibre technologies, clarify divergent models of fibre technology and material choices, identify culturally specific textile traditions, and identify provenance for fibre materials from the Caleta Vitor archaeological complex on Chile's far northern coast.

Background

Chinchorro fibre processing technologies included twining, cordage (vegetal and animal fibre) and net production. These expertly executed techniques can be broadly described as simple because they do not require specialised tools. Notwithstanding such simplicity, these fibre technologies made life in the harsh Atacama possible by facilitating the extraction of marine resources that provided an estimated 80% of dietary protein (Roberts et al. 2013). While it is generally accepted that the Chinchorro people exploited locally available raw materials in both craft and subsistence economies, there is a divergence of opinion regarding when different raw materials were in use. Some researchers suggest that cotton and vegetal fibre dominated the Archaic Period (13,000 BP to 4,000 BP) whereas others suggest camelid and vegetal fibre were the earliest available materials, with the former typically identified as non-local.

These divergent opinions have socio-political and economic implications. *Gossypium barbadense* (cotton) is indigenous to northern Peru and southern Ecuador.

Processed cotton is not documented in southern Peru until 4,150 Cal BP (Beresford-Jones et al. 2017) which is still several thousand years earlier than suggested for northern Chile. These complications require a reconsideration of the established distribution of native cotton on the west coast of South America or consider the possibility that long-distance trade routes were in place during the early Holocene. The alternative view implies that camelid fibre along with vegetal fibres were in use during the early Holocene. This notion has been criticised because of a lack of camelids in modern northern Chilean coastal areas and little knowledge of prehispanic camelid grazing areas. This question extends through to the Late Period (600 BP to 500 BP), when Spanish invaders irreparably disrupted traditional herding practices, leading to the conclusion that camelid husbandry was solely a highland activity and that the presence of camelid fibre at coastal sites is a proxy for highland trade or long-distance hunting.

Through the analysis of more complex fibre structures from Caleta Vitor, the research aimed to establish local participation in the local textile tradition featuring balanced interlacing, warp faced fabrics, warp stripes and weft faced elaborations (approximately 3,000 BP) (Ulloa 1981a; 1981b; Cassman 1997). This tradition is believed to have spanned much of the Chinchorro's cultural area - the coastal region between the Rio Loa and the Azapa Valley. However, more detailed regional studies outside the Azapa Valley are needed to confirm the existence of this tradition across that area.

On a larger scale, this research seeks to clarify external influences on the local fibre industry. This applies particularly to the Late Period as Inka artefacts at Caleta Vitor were sparse compared to sites in the nearby Azapa/Lluta valley. The Inka are thought to have administered the north of Chile through *tambos* in the Arica highlands with little direct interest in the

Fig. 1: The unku with a camelid fibre weft and a cotton warp: a – folded in half; and b – laid flat, with the neck opening at the centre (Image: Courtesy of Paola Salgado)

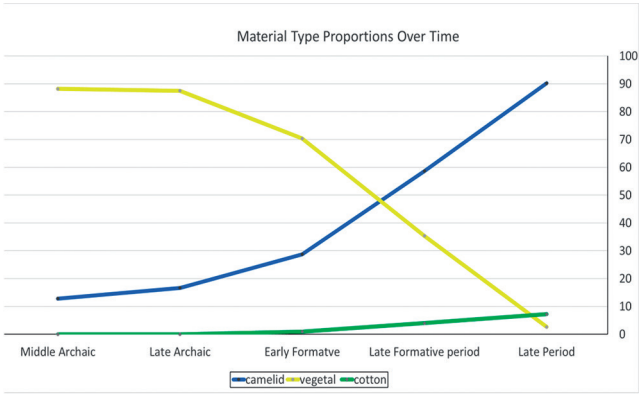


Fig. 2: Material type proportions over time (Image: Tracy Martens)

area owing to its small and dispersed population, lack of highly organised craft production, and limited potential for intensive maize agriculture or camelid husbandry. This paradigm was challenged by the discovery of an Inka *unku* (fig. 1) at the site, a fine, tapestry woven, camelid fibre tunic and powerful symbol of Inka administrative influence.

Methodology

More than 1,000 fibre artefacts were identified and recorded from five prescribed zones comprising middens, occupation areas, burials and rock art (Carter 2016). Artefacts were dated to the Middle through Late Archaic (6,000 BP to 4,000 BP), Formative (4,000 BP to 1,500 BP) and Late Period (600 BP to 500 BP), with no fibre items representing the Middle Horizon or Late Intermediate Period. Fibre structures were initially described and identified at the Instituto de Alta Investigación de Arqueología y Paleoambiente (Universidad de Tarapacá), in accordance with conventions established by Emery (1980). Microscopic analysis and 13C/12C and 15N/14N ratios were analysed at the Stable Isotope Laboratory of the Research School of Biology (Australian National University) on a Micromass Isochrom Continuous Flow Isotope Ratio Monitoring Mass Spectrometer coupled to an Elemental Analyzer.

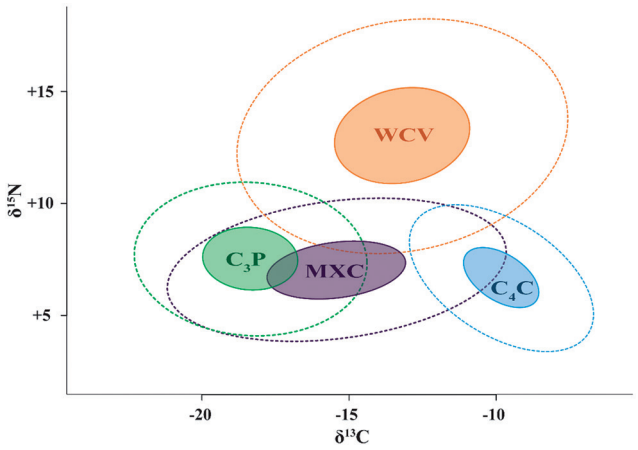


Fig. 3: Estimated isotope niche (SEAc) from the distribution of carbon and nitrogen values of referential archaeological camelid groups (Szpak et al. 2016) for the western Andean slope. Dashed ellipses - basic standard ellipses (SEA) (Image: Gayo et al. 2020)

Results and discussion

While no fibre items were recovered from the earliest occupation layers, indirect evidence of fibre processing technology in the Early Archaic was identified. A fine shell bead (less than 5 mm) and a multitude of remains of net-caught fish species indicate cordage production. Middle Archaic (7,500 BP to 6,000 BP) layers produced twisted, spun, plied and Z-direction twined fibre artefacts made of vegetal fibre and later of camelid fibre. The overwhelming majority of artefacts were vegetal fibre, probably composed of locally available sedges (*Schoenoplectus* spp.) (fig. 2). Cotton artefacts were not recovered from the Archaic layers (13,000 BP to 4,000 BP). During the Early Formative Period (4,000 BP to 2,500 BP), there was a decline in vegetal fibre and an increase in camelid fibre. A highly degraded fragment of cotton yarn, dated to approximately 3,360 cal BP, was found in a unit with unprocessed cotton in excellent condition (Martens et al. 2019). Further research is required to determine if the degraded condition of the yarn is a result of pre- or post- depositional factors.

At Caleta Vitor, the Early Formative Period (4,000 BP to 1,500 BP) is marked by significant changes such as the appearance of ceramics, new burial practices, the decline of the Chinchorro culture, and the first appearance of camelid droppings without any evidence for camelid butchering or consumption on site (Carter 2016). Despite the introduction of new technologies and materials, fibre processing technologies remained relatively unchanged until the Late Formative Period when loom woven textiles appear. This coincided with a marked change in raw materials; camelid fibre became the most common material, vegetal fibre fell out of favour and cotton was present but rare (Martens et al. 2019). The increasing trend towards camelid fibre usage and decreasing reliance on vegetal fibres continued through the Late Period when camelid fibre became the most common fibre by a significant margin (fig. 2). Vegetal fibre yarns never achieved the same uniformity (spin and ply direction, dimensions and angle and tightness of twist) as camelid fibre processing. This change may

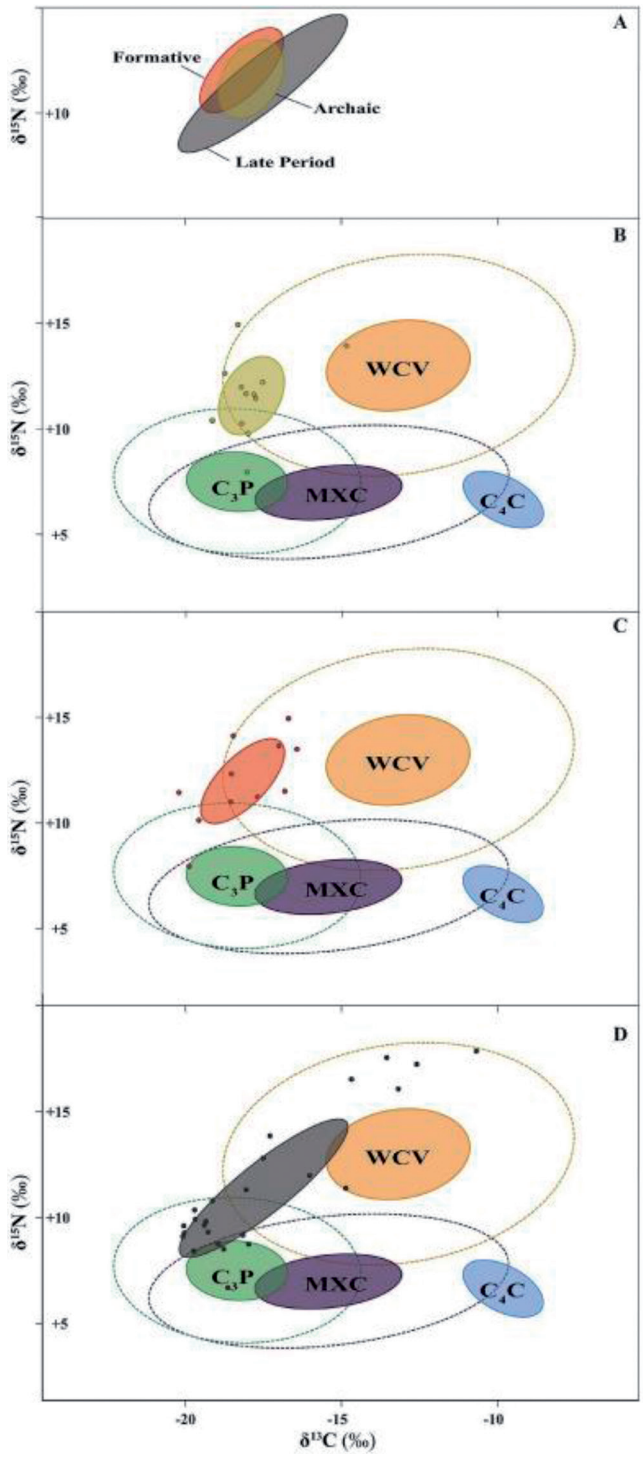


Fig. 4: Estimated isotope niche (SEAc) from the distribution of carbon and nitrogen values of referential camelid groups and Archaic (B), Formative (C) and Late Period (D) populations. Dashed cyan and purple lines: standard ellipses (SEA) for archaeological camelids populations raised in highlands and low-elevation C3/C4 crop-fields (Image: Gayo et al. 2020)

reflect the physical characteristics of particular vegetal fibres that exhibit a predilection of twist direction called the fibrillar orientation (Bergfjord and Holst 2010) rather than differential treatment of the two materials. Confirming this supposition will require experimentation.

The style and technical attributes of textile fragments from the site's Late Formative Period (2,500 BP to 1,500 BP) deposits compare favourably with attributes typical of the broader textile tradition that stretched between the Azapa to Loa River valleys, where the Chinchorro tradition had previously dominated (Ulloa 1981b). Caleta Vitor's participation in this regional tradition is significant as there are just a handful of confirmed sites outside the Azapa Valley. Whilst no fibre items from Middle Horizon or Late Intermediate Period units were recovered, these technologies continued through the Late Period and were probably also used during unrepresented periods.

The unku

The unexpected identification of an Inka *unku* suggests a more formal relationship with the Inka empire that included direct administration than was previously recognised (fig. 1). Symbolically, *unku* were gifted to local leaders to convey the direct power of the Sapa Inka and ultimately, played an important role in the expansion of the empire by vesting legitimacy in local administrators. The unprecedented discovery is significant to the developing understanding of Inka activity on the northern Chilean coast, a region previously believed peripheral to Inka interest. Because typical prerequisites of Inka involvement are absent at the site, the presence of the *unku* along with increased volumes of discarded pottery, evidence of increased marine resource extraction, population increase and camelid droppings at the site probably represent state involvement and represent a new set of proxies for Inka interaction on the northern Chilean coast (Martens 2019).

Camelid fibre acquisition

For the contextualisation of 48 camelid fibre samples from the Archaic Period, Formative Period and Late Period artefacts, established isotopic signatures were used in order to detect camelid grazing regimes from the western Andean slope (Szpak et al. 2016). The regimes include mixed irrigated cultigens (MXC), comprising irrigated cultigens grown in the lowlands, wild coastal vegetation (WCV), comprising wild plants from fog oases at mid and low altitudes (extreme hyperarid plus marine influence), cultivated C4 crops (C4C) and irrigated maize crops, and high-elevation

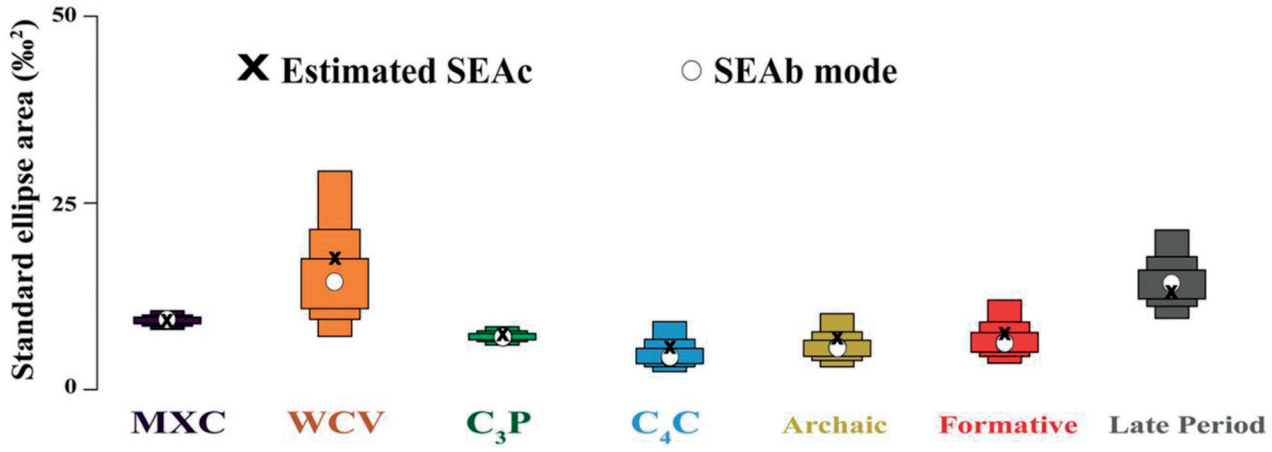


Fig. 5: Posterior Bayesian estimates for Standard Ellipse areas for archaeological referential groups and Caleta Vitor assemblages showing the SEAb mode and corresponding 50%, 95% and 99% credible intervals of posterior distributions of 10,000 simulations (Image: Gayo et al. 2020)

C3 pastures (C3P) composed of wild plants from high-elevation environments (*puna* and/or *bofedales*) (fig. 3). Based on the generally accepted archaeological paradigm that camelid fibres are a highland resource, the samples from all three periods were expected to reflect C3 rich diets typical of the high Andean steppe as represented by the C3P regime. However, the results indicate a diet reflecting wild coastal vegetation.

Statistically, all three time periods are indistinguishable, overlapping with both C3P and WCV regimes (fig. 4). There is considerably more overlap with WCV, indicating feeding on coastal lomas vegetation with the possibility that some animals were fed on high-altitude resources before being moved to the lowlands and fed WCV. Alternatively, the overlap with C3P could represent variability within the WCV regime (intra-regime variability) as there is little overlap with the core C3P niche, indicating this high-altitude niche is not strongly represented in the samples (fig. 4). The Late Period group niche is wider but overlaps with the other time period groups, indicating that they exploited similar dietary niches (fig. 5). Differential variation could represent differences in dietary niche, sample size variation and δ15N variation between one depleted individual and five very enriched individuals (Gayo et al. 2020).

While the Late Period niche is clearly wider than other time periods (indicating a more varied diet, as with the WCV regime), the Archaic and Formative Periods are equivalent and narrower (indicative of a less diverse diet) than the reference groups. The overlaps clearly indicate that camelid populations from all three represented time periods occupied equivalent isotope (trophic) niches likely from low-altitude WCV resources found in fog oases or lomas formations (Gayo et al. 2020). Contrary to previously established models for camelid fibre procurement, the 48 camelid fibre samples showed that they were available from low/mid-altitude sources rather than a proxy for highland contact, Inka dominion or long-distance trade. This is a significant challenge to established trade models because camelid fibre has been a proxy for Inka/ highland contact and trade at coastal sites for decades.

Conclusions

People arrived at Caleta Vitor with knowledge of plant processing and yarn production and quickly developed or adopted animal fibre processing. Locally available plant fibre slowly gave way to camelid fibre which became overwhelmingly dominant by the Late Period. Surprisingly, the population was either unable or unwilling to adopt cotton as a major fibre source, unlike coastal populations to the north, in Peru where cotton processing precedes ceramic production. Fibre implements such as nets, lines and cords were essential to the marine subsistence economy of the site. More complex technologies developed or were adopted over the time periods analysed. However, the people of Caleta Vitor continued to utilise simple and effective textile and yarn production techniques, evident in the earliest layers. New technologies including the backstrap loom were introduced in the Formative Period, that precipitated the development of a local textile tradition. This was characterised by warp-faced structures among other techniques. Finally, when

combined, increases in population, resource use and changes in material culture as well as the discovery of an *Inka unku* and isotopic evidence for camelid fibre procurement outside the highlands strongly suggest that further research is needed to clarify highland/coastal trade and political relations in the region.

Acknowledgment
I would like to thank my supervisor Judith Cameron, the Instituto de Alta Investigación of the Universidad de Tarapacá, C. Santoro, D. Valenzuela, E. Jolie, E. Gayo and T. Lynch for their valuable comments and contributions to my PhD. This research was supported by an Australian Government Research
Training Program Scholarship and the Chilean National Science Foundation Project 1150763 led by Claudio Latorre.

Bibliography

Beresford-Jones, D., Pullen, A., Chauca, G., Cadwallader, L., García, M., Salvatierra, I., Whaley, O., Vásquez, V., Arce, S., Lane, K. and French, C. (2017) Refining the Maritime Foundations of Andean Civilization: How Plant Fiber Technology Drove Social Complexity During the Preceramic Period. *Journal of Archaeological Method and Theory 25*(2), 393–425. https://doi.org/10.1007/s10816-017-9341-3

Bergfjord, C. and Holst, B. (2010) A procedure for identifying textile bast fibres using microscopy, *Ultramicroscopy* 110, 9, 1192–1197.

Cassman, V. (1997) *A Reconsideration of Prehistoric Ethnicity and Status in Northern Chile: The Textile Evidence*. PhD dissertation. Tempe: Department of Archaeology, Arizona State University.

Emery, I. (1980) *The Primary Structures of Fabrics*. Washington: Thames and Hudson.

Gayo, E. M., Martens, T., Stuart-Williams, H., Fenner, J., Santoro, C. M., Carter, C. and Cameron, J. (2020) Procurement of camelid fiber in the hyperarid Atacama Desert coast: Insights from stable isotopes. *Quaternary International* 548, 71–83.

Martens, T. (2019) *Fiber Technology from the Caleta Vitor Archaeological Complex, northern Chile*. PhD Thesis. Canberra: Archaeology, Department of Culture, History and Language, Australian National University.

Martens, T., Correa-Lau, J., Santoro, C. M., Carter, C. and Cameron, J. (2021) An Inka Unku from Caleta Vitor Bay, Northern Chile. *Latin American Antiquity* 32(1), 201–208.

Roberts, A., Donald, P., Petruzzelli, B., Carter, C., Westaway, M., Santoro, C., Swift, J., Maddern, T., Jacobsen, G., Bertuch, F. and Rothhammer, F. (2013) Retention of hunter-gatherer economies among maritime foragers from Caleta Vitor, northern Chile, during the late Holocene: Evidence from stable carbon and nitrogen isotopic analysis of skeletal remains. *Journal of Archaeological Science* 40(5), 2360–2372.

Szpak, P., Chicoine, D., Millaire, J-F., White, C. D., Parry, R. and Longstaffe, F. J. (2016) Early Horizon camelid management practices in the Nepeña Valley, north-central coast of Peru. *Environmental Archaeology 21*, 230–245.

Ulloa, L. (1981a) Estilos decorativos y formas textiles de poblaciones agromarítimas en el extremo norte de Chile. *Chungara, Revista de Antropología Chilena* 8, 109–136.

Ulloa, L. (1981b) Evolución de la industria textil prehispánica en la zona de Arica. *Chungara, Revista de Antropología Chilena* 8, 97–108.

Author:
martens.tracy@gmail.com

Quentin Richard

Problems with Greek clothing terminology

Abstract
The Greek vocabulary of clothing and textile production is rich and varied. It contains hundreds of words that have survived in literary texts or in epigraphic resources. Ancient lexicographers attempted to compile these terms but the meaning of many of them has disappeared, only a few can be identified with certainty in visual representations. The clothing nomenclature used today was mainly established by German academics in the 19th century and has become widely adopted. However, modern studies show that some of these interpretations could be questioned. In this situation, what words should be used to designate Greek garments represented on artworks? There are different propositions: continue to use Greek terms conventionally or try to establish alternative nomenclature. In this paper it is argued that the use of modern generic terms could minimise problems of interpretation in the study of Greek clothing

Key words: Greek clothing, terminology, historiography, nomenclature, terracotta figurines, *peplos*, *chiton*, *ependytes*

Introduction
"There is no part of Antiquities more curious and useful than that which treats of the habits; and none also more obscure. We are equally at a loss to find out the shape of a great many habits mentioned by Greek and Latin authors, and to discover by what terms they called other habits which monuments shew us the form of, without their name" (Montfaucon 1724, 3; Lee 2015, 11). Even 300 years after this statement by Bernard de Montfaucon and despite research by many modern authors, problems in the comprehension and interpretation of Greek garments persist. Our knowledge of ancient clothing is based on literary and epigraphic evidence and on iconography. Which terms did the ancient Greeks use to name the variety of clothes in their wardrobes and how should they be understood? Reconciling the terms with artistic representations is one of the main difficulties in the study of ancient Greek dress. Even if ancient Greek terms used by modern scholars were also used by the ancient Greeks themselves, it has been suggested that some of them have been wrongly interpreted by modern authors. The study of multiple sources of various kinds is crucial, since it allows the collection of a large number of terms linked to textiles. However, the meanings of the majority of these words have disappeared over time and are now hard to understand. There are garments known from the iconographical sources, whose ancient names are unknown, and there are terms in ancient Greek texts whose characteristics are unknown (Papadopoulou and Roche 2017, 77). How should ancient Greek terms be used if their exact meaning is not secure?
Some scholars have attempted to interpret various Greek words and propose a coherent terminology. Terminology appeared as an independent and discreet discipline in the 20th century thanks to the works of Wüster (1968) and connected to the study of linguistics (Depecker 2002, 7; Roche 2012, 2626). According to Roche, the goal of terminology is "to eliminate ambiguity from technical languages by means of standardisation" (Roche 2012, 2626). This approach could be useful for other disciplines such as art history. The vagueness of terminology in costume studies "is perhaps one of the causes of communication difficulties between researchers" (Delaporte 1981, 12; translation by the author). Indeed, ancient Greek terms are not clearly defined in descriptions of artworks,

material or archaeological artefacts and this can lead to misunderstandings.
After outlining the problems of comprehension with the most common ancient Greek terms used in descriptions in art history or archaeological studies, the goal of this paper is to show that they should be used with caution or replaced with generic terms when describing works of art.

Terms attested in epigraphic and literary sources
Epigraphy is an important source for the study of Greek terminology. In many sanctuaries of the Greek world, it is attested that garments were dedicated to the gods and goddesses as costly offerings. According to Brøns, garments were in most cases worn by women before being offered to the gods (Brøns 2015, 70). The sacred property of the divinities was kept in treasuries and registered in temple inventories on stone for administrative purposes (Linders 1988, 37-40; Grand-Clément 2014, 4). These inventories have been found extensively in the Greek world: for example, at Tanagra (Brøns 2015, 45–50; Brøns 2016, 37) or Delos (Prêtre 2018) over a period from the fifth century BCE to the second century CE (Scott 2011, 240; Brøns 2015, 44). Although the textiles have disappeared, the terms for them have been preserved.
The inventories from the sanctuary of Artemis Brauronia on the Athenian Acropolis are among the central documents for the study of Greek clothing: a total of six *stelae* from 349/348 BCE to 336/335 BCE. Cleland has demonstrated that many terms are used without specific descriptions (Cleland 2005). Although it is not known what these garments looked like, it is certain that they were present in Athens in the fourth century BCE. Some words refer to aspects of the clothing: there is occasionally information concerning the colour, the decoration or the state of the textile. Some are in rags, and they may have been damaged through use by the dedicant or in the sanctuary (Brøns 2015, 47–50).
These epigraphic documents are complemented by preserved literary texts. Homeric texts in particular provide several descriptions of Greek garments. Prior to the sixth century BCE, attestations in Greek texts are sporadic (Lee 2015, 5) but drama, philosophy and further genres of the Classical Period provide various designations for clothing. The poet Losfeld compiled a list of 360 words connected to garments or textile production in ancient Greek texts (Losfeld 1991, 327–339). However, some of them are unexplained or unclear. Although Losfeld's work has been criticised by several authors (Holtzmann 1995, 515; Morizot 1999, 115–117; Lee 2015, 17), it nevertheless shows the extent and variety of Greek terminology relating to clothing in the literary sources.
From the first centuries of our era onwards, lexicographers compiled terms found in ancient texts and established a rich vocabulary. The most important of these is Julius Pollux who, in the second century CE, provides short sections of clothing terminology in his *Onomasticon*. Hesychius of Alexandria is also a noteworthy author, whose work dates to the fifth century CE. He compiled one of the richest lexicons and provided some words from poetry and non-Attic dialects in his *Lexicon*. These terms have largely fallen out of use but expand the Greek terminology (Llewellyn-Jones 2010, 34). Some terms may have been used only in a specific region. Ancient lexicographers do not provide an exhaustive terminology nor a detailed description of individual items of clothing and these texts were written several centuries after the Hellenistic period.
It is difficult to establish how the meanings of terms vary according to time periods and regions. It is possible that some words had a limited lifespan, appearing in Greek vocabulary before disappearing, going out of style or being used in a different way. "We must consider that ancient clothing terminology was open to a wide degree of flexibility and … dress terms might have been changeable" (Llewellyn-Jones 2010, 24). In fact, the meaning of some words could have evolved significantly from Homeric texts to the time of the lexicographers in the first centuries of our era. Many interpretations could thus be correct only for a limited time period. Eustathius of Thessalonica claims that the same garment was called *chitoniskos* (χιτωνίσκος) by some and *ependytes* (ἐπενδύτης) by others (*Eustathius of Thessalonica, Comm. ad Iliadem* 18.595, p. 1166, line 51; Miller 1997, 176). The denomination *ependytes* is not attested before the Hellenistic period whereas *chitoniskos* is listed several times in the Brauron catalogues (Miller 1997, 176). Both terms may refer to the same garment for which the name has evolved over time.
Spantidaki argues that ancient Greek is characterised by a semantic richness, incomparable to modern European languages (Spantidaki 2016, 97). A single word could have different meanings with subtle nuances. A common word used to describe clothing decoration is *poikilos* (ποικίλος), attested in both epigraphic and literary sources. This is a polysemous adjective, employed in highly different contexts. Spantidaki defines it "as adorned with colours" and links it to the Stoa Poikile, a porch erected in the fifth century BCE on the Agora of Athens and decorated by the painters Micon of Athens and Polygnotos of Thasos

(Spantidaki 2016, 102). However, Grand-Clément points out that ancient authors used *poikilos* not only to describe colourful fabrics, but also to refer to a snake's skin, the feathers of birds or the shrewd skill of Odysseus (*Homer, Odyssey*, 3.163; Grand-Clément 2015, 406–407). In the last case, it means a manifold degree of competence. Plato is the first author to use this word in a negative sense, by comparing a poikilos coat to the political anarchy of Athens (Plato, *Republic*, 8.557c–558c; Villacèque 2010; Grand-Clément 2011, 257).

A translator should therefore interpret a word according to its context. When the text is not explicit or fragmentary, this could lead to errors in comprehension and translation. In her study of the perception of colours in archaic times, Grand-Clément alludes to the same difficulty: "The terms can therefore only be understood in relation to each other, they are integrated into a complex and mobile network, made up of associations and oppositions" (Grand-Clément 2011, 82; translation by the author). Thus, a term should be understood in a larger context. It is therefore difficult to interpret a word when the surviving text is largely incomplete.

Criticism of interpretations

The renewed interest for ancient literature in the renaissance brought the discovery of clothing terms. Lazare de Baïf was one of the first to be interested in Greek clothing terminology. In *De re vestiaria libellus*, he proposes a compendium of Greek and Latin clothing terms and establishes a parallel with dress in his own time period (Baïf 1535; Lee 2003, 124; Lee 2015, 11). His work is mainly based on texts by lexicographers and Latin authors. In the early 18th century, Bernard de Montfaucon was also a pioneer in the study of Greek garments. Lee notes that Johann Joachim Winckelmann, who studied ancient art, contributed surprisingly little to the study of Greek clothing (Lee 2015, 11). However, the real starting point for the investigation of Greek terminology came in the 19th century with the work of German academics. Several scholars proposed definitions for Greek words but their conclusions were often criticised. There were few certainties and the majority of the interpretations proposed were widely discussed. The following is a short overview of the main terms used in Greek clothing terminology and the associated problems.

Peplos

The one we believe we know best" (Lee 2003, 118) is the term *peplos* (πέπλος), which was identified early. In modern studies, it is understood as a large wool tunic (Bieber 1928, 17; Ridgway 1984, 30–31) worn by men and women. It was folded lengthwise, and the sides could be open or partially sewn. The upper part is also folded and held with dress fasteners. This term, for example, is used to describe the garment of Attic and Boeotian terracotta figurines in the Classical Period

Fig. 1: Boetia, Statuette of a woman, c. 450 BCE (Image: Art Institute Chicago, 2014.969)

(fig. 1), which is called *peplophoros* (Poulsen 1937, 48–59; Uhlenbrock 2016, 5). The Boeotian statuette held in the Art Institute of Chicago (United States) shows well preserved polychromy with red and yellow paint. Indeed, this indicates that dyeing was widely practised in the Greek world (Grand-Clément 2011, 164–173; Spantidaki 2016, 86–90).

The *peplos* was identified for the first time by the French humanist Claude Saumaise, but he limits the word to the sacred garment of Athena and other goddesses (Saumaise 1656; Lee 1999, 15; Lee 2003, 125). The study of Wolfgang Helbig represented a turning point. He suggested that in Homeric texts, the *peplos* is worn only by women and goddesses while the *chiton* is worn only by men. He thought that the *chiton*, and therefore the *peplos*, had Phoenician origins (Helbig 1884, 115–128; Lee 1999, 32–33; Lee 2003, 125). Franz Studniczka argued against this and proposed an Indo-European origin for the word *peplos*. He identified the same etymological root (**plo-* in *peplos*) and in the Latin words *palla* and *pallium* (Studniczka 1886, 15–16; Lee 2003, 132–136). Conforming to a passage in Herodotus' *Histories* (5.87–88), Studniczka interpreted Dorian fashion to refer to the *peplos*. This interpretation was widely adopted by scholars. Gabriel Leroux proposed a wider interpretation: he applied the term *peplos* to any garment pinned to the shoulder or folded (Leroux 1907, 385; Lee 2003, 134–135). According to Lee, by the Classical Period the *peplos* was no longer used in everyday life but was linked to ritual practices and the mythological world (Lee 1999, 357). This could explain why this term is uncommon in the Brauron catalogues. Indeed, Brøns has demonstrated that garments dedicated to Artemis Brauronia were the same as those worn in everyday life (Brøns 2015, 74).

Marinatos, in his study of Homeric clothing, disputed Studniczka's opinion and rejected the vision of the *peplos* as the main dress of women. He also proposed a broader meaning: the term could be used to designate a veil, but also any piece of textile (Marinatos 1967, 42–43). Abrahams had already argued that the Greek world used large quadrangular fabrics for clothing but also, for example, as covers or sheets (Abrahams 1908, 17; Lee 1999, 353). Homer provides an example of a *peplos* used as a cover on chariots (*Homer*, *Iliad* 5.193–195). It may seem that there was no fundamental difference between a garment and a woven cloth displayed on a wall as a tapestry (Jeammet 2003, 27; Von Hofsten 2011, 9). Riis compared this notion to the travel story of the ethnologist Carl Gunnar Feiberg who saw one of his assistants in Iran use her veil as a coat and as a sheet (Riis 1993, 160). Therefore, the term *peplos* is often only used for describing a specific garment in modern scholarship whereas ancient authors seem to have used it for various pieces of clothing.

Chiton

The chiton (χιτών) is, in modern studies, also often interpreted as a tunic. The main difference from the peplos is the material: the chiton is made of linen rather than wool, and it is sewn at the sides. The linen fibre allows for a fine pleated fabric which created decorative effects: for example, fragmentary terracotta oenochoe attributed to Euthymides Potter (fig. 2) shows garments understood as a *chiton* because of its many pleats.

According to Geddes, the *chiton* was unwieldy and did not permit movement. It is thus not a garment suitable for work, but rather for leisure (Geddes 1987, 311). The oriental origins of this garment are widely accepted in modern scholarship and some scholars point out the Semitic origins of the word (Abrahams 1908, 19; Bieber 1928, 19; Riis 1993, 153; Lee 2015, 107). The poet Sappho is the first writer to describe a *chiton* worn by a woman (*Sappho, fragment 103*). Many authors use a passage of Herodotus' *Histories,* cited earlier, to explain the abandonment of the *peplos* for the benefit of the *chiton* in the middle of the sixth century BCE (Evans 1893, 27; Leroux 1907, 383; Abrahams 1908, 57; Bieber 1934, 19; Pekridou-Gorecki 1989, 72; Riis 1993, 153; Lee 2015, 107). However, some scholars have criticised this interpretation. Evans was the first to express reservations concerning the historical truth of this passage (Evans 1893, 28), a view shared by Schmaltz and Morizot (Schmaltz 1998, 9; Morizot 2001, 17). Dewald argued strongly that Herodotus' story is probably inspired by misogynist tales popular in Athens (Dewald 1981, 98).

Ependytes

The term *ependytes* is less common than the previous two, both in ancient literary and epigraphic sources, but it is used by some authors to describe garments depicted on works of art. Miller argued that this garment is better known in iconography than in texts (Miller 1997, 170). It is understood as a short linen or wool tunic worn over another tunic. This garment was surely an oriental import into Greece (Miller 1989, 327–329; Miller 1997, 170–171). Hauser understood this piece of clothing as a sleeveless tunic and insists that it is a slim fitting garment (Hauser 1905, 33–34). Thiersch had suggested a specific link with theatre and cults, but Miller showed that this interpretation is erroneous (Miller 1989, 314). The

Fig. 2: Fragment of a terracotta oenochoe, attributed to Euthymides Potter, c. 520 BCE, Attic (Image: The Metropolitan Museum of Art, 1983.11.1)

word is regularly used in several descriptions in *Corpus Vasorum Antiquorum* (for example, CVA Deutschland, Band 87, München Antikensammlung, 108–109; CVA USA, Fascicule 32, The J. Paul Getty Museum, 32) or to describe the costume of Athena on Panathenaic amphorae (Bentz and Eschbach 2001). However, it is not always used to characterise a garment worn close to the body but sometimes as a large wool or linen tunic. On the Panathenaic amphora by Eucharides Painter in the Metropolitan Museum of Art, the garment understood as an *ependytes* is decorated with a chequered pattern and worn over a pleated tunic. The uses of the term *ependytes* to describe garments depicted on Greek vases are often fanciful. There are still difficulties in understanding this term: it is not certain if it was ever worn over a tunic or if it was worn close to the body. Therefore, it is used differently by different authors, which can lead to misunderstandings.

Words describing parts of garments: *kolpos* and *apoptygma*

As with the terms for pieces of clothing, the words describing parts of garments are also widely discussed. One is the *apoptygma* (ἀπόπτυγμα) which has been understood to describe the upper part of the garment folded over on the chest. Böhlau was the first one to propose this interpretation after studying the *Hekatompedon* inscriptions (Böhlau 1884, 5–17; Lee 2004, 222). The idea was picked up by Studniczka and subsequently widely disseminated despite the objection of Heuzey (Heuzey 1922, 157). Burr Thompson showed that this perception is based on an error of translation and argued that *apoptygma* was used for the unfolded area of the garment for which no other category was obvious. She remarked that "archaeologists are making a scientific term of a vague one" (Burr Thompson 1944, 198). The same remarks could be applied to the name *kolpos* (κόλπος), identified by the classical philologist, archaeologist and ancient historian Karl Otfried Müller as either an excess length of textile hanging folded or a girdle (Müller 1820; Lee 2004, 221). This interpretation was criticised by

Studniczka who thought that this term referred to the body and not to the clothing (Studniczka 1886, 101). Leroux supports this idea and argues that the word *kolpos* designates the chest in Homeric texts (Leroux 1907, 383).

As Lee states "the *kolpos* and *apoptygma* are products of 19th and early 20th century scholarship, not ancient Greek nomenclature" (Lee 2004, 224). This remark is crucial in the study of Greek terminology because it stresses that interpretations of ancient Greek words could be, at least for some terms, a creation of modern scholars, without any relationship to the way ancient authors used them.

The interpretation of some terms is still debated, and in some cases, they derive from errors by modern authors. Few interpretations can claim to be certain, and it cannot be ruled out that future studies will challenge further interpretations. The terminology used by modern scholars is probably not what was used in the ancient world. In 1989, Pekridou-Gorecki spoke of a "scientific wasteland" (Pekridou-Gorecki 1989, 80; Fendt 2017, 129), but she was optimistic and thought that it could become a "flourishing terrain" with further work.

Which nomenclature could be used for Greek clothing?

In the light of the above and the rich discussion in current scholarship, the question must be asked: which nomenclature should be used to describe representations of Greek clothing on artworks? Early scholars were well aware of this problem. Baïf established comparisons between Greek garments and the clothing of his time with the aim of making his texts more understandable and accessible to his contemporaries. Montfaucon was quite careful and did not use Greek terms systematically to describe ancient works of art. Instead, he used generic terms such as tunic or mantle (Lee 2003, 126–127).

Different kinds of terminological conventions are possible for the study of Greek representations. The first option is to keep using Greek words although they may be wrongly identified and to use them as conventional terms. The question of Greek clothing terminology has come to the fore in recent studies, notably in the important works of Lee. She noted that "although it may be impossible, or undesirable, to create a new system of dress terminology, it is important to note that many words for ancient Greek garments have been erroneously identified" (Lee 2004, 221). She thought the use of terms such as *kolpos* and *apoptygma* should be retained. Pekridou-Gorecki argued along the same lines, and, after posing questions concerning the term *peplos*, she proposed retaining its use despite these problems (Pekridou-Gorecki 1989, 80; Fendt 2017, 129). The advantage of this approach is that it does not provoke a break with studies since the 19th century, but it must then be clearly indicated that the words are a modern scholarly convention. A disadvantage is that this system gives the false impression that Greek vocabulary is limited. Only three or four terms are used today to name a multitude of visual representations. Ancient historians and classical archaeologists tend to call any coat they identify in ancient works of art *himation,* whereas ancient authors used a very broad range of words: for example, Aristophanes successively employs four terms that could denote a coat of different forms in the *Assemblywomen* (*Aristophanes*, *Assemblywomen*, 318–322; Harlow 2017, 156): *himation* (ἱμάτιον), *hemidiploidon* (ἡμιδιπλοίδιο), *krokotidion* (κροκωτίδιον)

Fig. 3: Panathenaic amphora, attributed to the Eucharides Painter, c. 490 BCE, Attic (The Metropolitan Museum of Art, 56.171.3)

and *egkukklon* (ἔγκυκλον*)*. Although the characteristics of each garment were perfectly understandable for an Athenian in the fifth century BCE, it is now hard to distinguish these words clearly.

This nomenclature is widespread in modern studies but not universally adopted. Some scholars have proposed another nomenclature for the study of Greek clothing. In his work upon the veiled woman of ancient Greece, Llewellyn-Jones discussed artworks presenting veils that are difficult to designate with a Greek word. He was confronted with a major problem: it was hard to clearly define terms that are rarely used, such as *kredemnon* (κρήδεπνον) or *kaluptre* (καλυπτρή). Therefore, he proposed using some Arabic terms for specific veil types such as *shaal*, *maghmuq* or *litham* in order to comment on Greek veils. He admitted that this solution "might not be the most satisfactory answer, but at least it is expedient" because it avoided interpretation or translation errors (Llewellyn-Jones 2010, 35). By trying to solve terminology problems, this proposal creates new issues because it leads to the introduction of other terms in Arabic which also need definition.

Recently, Papadopoulou and Roche have devoted themselves to the problem and proposed the creation of an ontoterminology of ancient Greek garments. They propose combining the terminology with the ontology or conceptualisation. Using digital resources, they created notes on 250 terms that will be translated into English, French and Modern Greek. This approach takes into account a linguistic and conceptual dimension and distinguishes the term from its concept (Papadopoulou and Roche 2017). There are differences between the traditional discipline of terminology and the more novel approach of ontoterminology. Indeed, the latter allows two kinds of definitions for a term: the first explains the concept and the second the linguistic usage (Roche 2012, 2628).

A fourth solution to nomenclature could avoid misunderstandings in the description of Greek garments depicted in works of art. Féret showed that describing the garments is one of the major difficulties in the study of Greek terracotta figurines. This challenge is not limited to Hellenistic artworks. Consequently, she asked whether it is necessary to use the Greek and Latin terms (Féret 2018, 143) and chose to use modern terms in her study. This approach is interesting and could be applied to other studies in Greek art history which also deal with representations of garments.

When the meaning of a Greek term is not perfectly defined and understood by everyone, it can be problematic to use it in discussions of works of art. Therefore, it seems preferable to put aside all the Greek words usually employed and to use generic modern terms that are clearly defined and more neutral when describing a work of art: for example, by using tunic instead of *peplos* or *chiton* to describe any long or short garment belted at the waist and held at the shoulders by pins or fibulae. In certain cases, the fabric of the garment could be identified: a wool tunic generates large pleats as seen on Attic or Boeotian terracotta figurines from the fifth century BCE whereas linen tunics fall in fine pleats as on the fragment of a terracotta oenochoe, attributed to Euthymides Potter mentioned above. But it is necessary to be very careful in identifying the material represented in the artworks. In the same way, the term coat (or cloak) could be used instead of *himation* to characterise a heavy garment worn over one or both shoulders and usually over a tunic.

These generic terms could be easily adopted in the major scholarly languages such as English, French, German and Italian. They avoid all the preconceptions surrounding Greek terms. Even if the descriptions are longer with modern terms because paraphrases replace a single ancient Greek word, they will prevent misunderstandings between scholars. They would require more precision when describing an artwork and avoid the use of anachronistic terms.

Ancient Greek terms could be retained in exceptional cases when the context of a garment leaves no doubt. It is impossible to define a precise number of textual or epigraphic references needed to check if an ancient Greek term is correctly understood by modern authors. The use of an ancient Greek term in a description must be considered on a case-by-case basis: is it well attested at the time and in the context studied? For example, numerous ancient authors affirm that the fabric dedicated to Athena during the Panathenaic festival in Athens was called *peplos*, so this term can be used in this precise context.

Zanola has already pointed out the issue of diachronic terminology for the 18th century in Europe (Zanola 2014). Both clothing and language change over time but modern scholarship always uses the same terms from the beginning of the Archaic to the end of the Hellenistic periods. Homer used the term *chiton* to describe men's tunics, but it is possible that centuries later, the meaning of the word had changed and that the garment described by Homer had disappeared. Using the same ancient Greek terms with no regard to chronology is problematic. It is possible that the same term could have a different meaning depending on the period. Riis was among the first to point out that clothing nomenclature should not be based

only on philological studies (Riis 1993, 154) but he suggests no alternative. There should not be a strict dichotomy between epigraphy and art history, and this article does not propose to put aside philological studies. In the study of epigraphic sources, it might be beneficial to use the Greek terms since they are often impossible to translate into English or other modern languages.

Using these thoughts in other eras

Problems of comprehension in clothing terminology are not restricted to Ancient Greece. The question of clothing terminology is global, and scholars of different disciplines are facing the same problems. Boloti deplored the lack of a widely accepted terminology for Aegean prehistoric dress items (Boloti 2017, 371). Some authors have noted similar problems in the textile terminology of Ancient Egypt (Collombert 2002, 44–45) or in the Oriental world (Quillien 2017; Michel and Nosch 2010).

Terminology is also problematic in cultures where textual evidence is mostly lacking or even unattested. For the study of the Etruscan Dress, Bonfante chose to use ancient Greek and Latin terms to describe a piece of clothing. This can be questioned because she used ancient Greek terms for several garments that do not have a Greek origin (Bonfante 1975, 101–103). The use of ancient Greek terms is already complex for studies in the Greek world and using them for another culture is even more problematic. There are similar problems in the study of central European (Grömer 2016, 409–427) and Scandinavian clothing: for example, as with the use of the term *kaftan* (Mannering 2017, 149–177).

A universal approach cannot be accepted, but authors can draw inspiration from other disciplines in the establishment of a consistent clothing terminology.

Conclusion

This article points out that the interpretations of Greek clothing terms have been criticised by scholars. The interpretation of modern scholars may be different from that used in ancient Greece. This problem is an impediment for studies of ancient clothing and scholars have therefore proposed alternative nomenclatures. Some argue for the use of Greek terms, but only conventionally. Using generic terms such as tunic or mantle is not the only solution, but it permits clear descriptions and avoids misunderstandings.

This study is limited to the main and the more common Greek words, but similar arguments could be made regarding other terms such as *paruphe* (παρυφή) or *zone* (ζώνη). Terms for textile production or textile tools also merit further scholarly attention. Scholars had initially perceived the term *poikilos* as referring to embroidery, but Wace in particular showed that this interpretation is false (Wace 1948, 53; Patera 2012; Spantidaki 2016, 102); the appropriate term is polysemous (see above). The establishment of a regular clothing terminology is crucial in the study of Greek garments but also, and especially, in the study of ancient art history in order to describe the appearance of the many garments depicted in the various works of art.

Acknowledgments

I would like to thank Brigitte Bourgeois, Louis Détrez and Violaine Jeammet for their supervision of my master's thesis: *Les motifs vestimentaires des figurines en terre cuite béotiennes et attiques aux époques archaïque et classique*, Ecole du Louvre (Richard 2020) on which this paper is based. In addition, thanks are due to Violaine Jeammet for reading and making valuable comments on the first draft of this article. I am also grateful to the reviewers for their relevant remarks and corrections.

Bibliography

Abrahams, E. (1908) *Greek dress: a study of the costumes worn in ancient Greece, from pre-Hellenic times to the Hellenistic age*. London: J. Murray.

Baïf, L. de (1535) *De re vestiaria libellus, ex Bayio excerptus: addita vulgaris linguae interpretatione, in adulescetuloru gratiam atq[ue] utilitatem*. Paris.

Bentz, M. and Eschbach, N. (eds) (2001) *Panathenaïka: Symposion zu den Panathenäischen Preisamphoren, Rauischholzhausen 25.11.-29.11.1998*. Mainz: Ph. Von Zabern.

Bieber, M. (1928) *Griechische Kleidung*. Berlin: W. de Gruyter.

Bieber, M. (1934) *Entwicklungsgeschichte der griechischen Tracht: von der vorgriechischen Zeit bis zur römischen Kaiserzeit*. Berlin: Gebr. Mann.

Boloti, T. (2017) Offering of cloth and/or clothing to the sanctuaries: A case of ritual continuity from the 2nd to the 1st millennium BCE in the Aegean. In C. Brøns and M-L. Nosch (eds), *Textiles and cult in the ancient Mediterranean*. Oxford: Oxbow Books, 3–16.

Bonfante, L. (1975) *Etruscan Dress*. Baltimore: John Hopkins University Press.

Böhlau, J. (1884) *Quaestiones de re vestiarea Graecorum*, Weimar.

Brøns, C. (2015) Textiles and Temple Inventories. Detecting an Invisible Votive Tradition in Greek Sanctuaries in the Second Half of the First Millennium BC. In J. Fejfer, M. Moltesen and A. Rathje (eds), *Tradition. Transmission of Culture in the Ancient World.* Acta Hyporborea 14. Copenhagen: Museum Tusculanum Press, 43–83.

Brøns, C. (2016) *Gods and garments: Textiles in Greek Sanctuaries in the 7th to the 1st Centuries BC.* Oxford: Oxbow Books.

Burr Thompson, D. (1944) The Golden Nikai Reconsidered. *Hesperia* 13(3), 173–209.

Cleland, L. (2005) *The Brauron clothing catalogues: text, analysis, glossary and translation*. Oxford: J. and E. Hedges.

Collombert, P. (2002) Les termes de textile dans l'Egypte Ancienne. In M. Durand and F. Saragoza (eds), *Egypte, la trame de l'histoire : Textiles pharaoniques, coptes et islamiques : [exposition, Rouen, Musée départemental des antiquités, 19 octobre 2002-20 janvier 2003 ; Roanne, Musée des Beaux-Arts et d'Archéologie Joseph Dechelette, 20 février 2003-1er juin 2003 ; Paris, Institut du monde arabe, mi-juin à mi-septembre 2004]*. Paris: Somogy, 44–45.

Delaporte, Y. (1981) Pour une anthropologie du vêtement. In M. de Fontanès and Y. Delaporte (eds), *Vêtement et sociétés: actes des journées de rencontre des 2 et 3 mars 1979*. Paris: Laboratoire d'ethnologie du Muséum national d'histoire naturelle, 3–13.

Depecker, L. (2002) *Entre signe et concept : éléments de terminologie générale.* Paris: Presses Sorbonne nouvelle.

Dewald, C. (1981) Women and culture in Herodotus' Histories. In H. Foley (ed), *Reflections of women in Antiquity.* New York: Gordon and Breach science publishers, 91–126.

Evans, M. M. (1893) *Chapters on Greek Dress*. London: Macmillan and Co.

Fendt, A. (2017) Peplos, Chiton, Himation und mehr. Das Kleid der griechischen Frau. In E. Baumgartner, A. Fendt, F. S. Knauß and E. K. Wittich (eds), *Divine X Design, Das Kleid der Antike. [Eine Ausstellung der staatlichen Antikensammlungen und Glyptothek München in Zusammenarbeit mit der AMD Akademie Mode & Design von 5. April bis 8. Oktober 2017].* Munich: Nünnerich-Asmus Verlag, 128–139.

Féret, S. (2018) *Statuettes en terre cuite de l'époque hellénistique en Italie : productions et variations*. PhD Dissertation, Université Paris 1 Panthéon-Sorbonne.

Geddes, A. G. (1987) Rags and Riches: The Costume of Athenian Men in the Fifth Century. *Classical Quarterly* 37/2, 307–331.

Grand-Clément, A. (2011) *La fabrique des couleurs: histoire du paysage sensible des Grecs anciens*. Paris: De Boccard.

Grand-Clément, A. (2014) *L'étoffe des dieux. Les consécrations de vêtements dans le monde grec: autour du culte attique d'Artémis Brauronia*.

Grand-Clément, A. (2015) Poikilia. In P. Destree and P. Murray (eds), *A Companion to Ancient Aesthetics*. Chichester: Wiley Blackwell, 406–421.

Grömer, K. (2016) *The Art of Prehistoric Textile Making. The development of craft traditions and clothing in Central Europe*. Vienna: Natural History Museum Vienna.

Harlow, M. (2017) Literary Representations. In M. Harlow (ed), *A cultural history of dress and fashion in antiquity*. London et al.: Bloomsbury Publishing, 155–166.

Hauser, F. (1905) Nausikaa. *Jahreshefte des Österreichischen Archäologischen Institutes in Wien* 8, 18–41.

Helbig, W. (1884) *Das homerische Epos aus den Denkmälern erläutert*. Leipzig: B.G. Teubner.

Heuzey, L. (1922) *Histoire du costume antique: d'après des études sur le modèle vivant*. Paris: Libraire ancienne Honoré Champion.

Holtzmann, B. (1995) Georges Losfeld, L'art grec et le vêtement. *Topoi* 5/2, 515.

Jeammet, V. (2003) Le costume grec à travers les figurines en terre cuite. Reflet d'une société démocratique. In F. Chausson and H. Inglebert (eds), *Costume et société dans l'Antiquité et le haut Moyen Age*. Paris: Picard, 25–35.

Lee, M. (1999) *The myth of the classical Peplos*. PhD Dissertation, Bryn Mawr College.

Lee, M. (2003) The Ancient Greek *Peplos* and the 'Dorian Question'. In A. A. Donohue and M. D. Fullerton (eds), *Ancient art and its historiography*. Cambridge: Cambridge University Press, 118–147.

Lee, M. (2004) Problems in Greek Dress Terminology: Kolpos and Apoptygma. *Zeitschrift für Papyrologie und Epigraphik* 150, 221–224.

Lee, M. (2015) *Body, Dress, and Identity in Ancient Greece*. Cambridge: Cambridge University Press.

Leroux, G. (1907) Péplos. In C. Daremberg, E. Pottier and E. Saglio (eds), *Dictionnaire des Antiquités grecques et romaines d'après les textes et les monuments contenant l'explication des termes qui se rapportent aux mœurs, aux institutions, à la religion, aux arts, aux sciences, au costume, au mobilier, à la guerre, à la marine, aux métiers, aux monnaies, poids et mesures, ETC. : et en général à la vie publique et privée des anciens. Tome quatrième. Première partie, (N - Q).* Paris: Libraire Hachette et Cie, 382–384.

Linders, T. (1988) The purpose of Inventories. A Close Reading of the Delian Inventories of the Independence. In D. Knoepfer (ed), *Comptes et inventaires dans la cité grecque. Actes du colloque international d'épigraphie, Neuchâtel 23-26 septembre 1986 en l'honneur de Jacques Tréheux*, Neuchâtel, 37–47.

Llewellyn-Jones, L. (2010) *Aphrodite's tortoise: the veiled woman of ancient Greece*. Swansea: Classical Press of Wales.

Losfeld, G. (1991) *Essai sur le costume grec*. Paris: de Boccard.

Mannering, U. (2017) *Iconic Costumes. Scandinavian Late Iron Age Costume Iconography.* Oxford: Oxbow Books.

Marinatos, S. (1967) *Kleidung, Haar- und Barttracht*. Göttingen: Vanderhoeck et Ruprecht.

Michel, C. and Nosch, M-L. (2010) *Textile terminologies in the*

ancient Near East and Mediterranean from the third to the first millennia BC. Oxford: Oxbow books.
Miller, M. (1989) The Ependytes in Classical Athens. *Hesperia* 58(3), 313–329.
Miller, M. (1997) *Athens and Persia in the fifth century BC: a study in cultural receptivity*. Cambridge: Cambridge University Press.
Montfaucon, B. (1724) *Supplément au livre de L'antiquité expliquée et représentée en figures. Tome troisième qui comprend les habits et usages de la vie*. Paris.
Morizot, Y. (1999) Losfeld G., L'art grec et la draperie pure. *Revue des Études Anciennes* 103, 620–621.
Morizot, Y. (2001) Le vêtement grec dans sa matérialité, découvertes et recherches récentes. *Histoire de l'art* 48, 11–22.
Müller, K. O. (1820) *Minervae Poliadis sacra et aedem in arce Athenarum.* Göttingen.
Patera, M. (2012) Problèmes de La Terminologie Grecque Du Vêtement : Recherche Sur La Broderie. In I. Tzachili and E. Zimi (eds), *Textiles and Dress in Greece and the Roman East: A Technological and Social Approach.* Athens: Ta Pragmata, 117–130.
Papadopoulou, M. and Roche, C. (2017) Ontoterminology of Ancient Greek Garments. In C. Roche (ed), *Terminologie & ontologie : théories et applications : actes de la conférence TOTh 2017, Chambéry, 8 & 9 juin 2017*. Chambéry: Université Savoie Mont Blanc, 73–94.
Pekridou-Gorecki, A. (1989) *Mode im antiken Griechenland: Textile Fertigung und Kleidung*. Munich: Beck.
Poulsen, V. (1937) *Der strenge Stil: Studien zur Geschichte der griechischen Plastik 480-450*. Copenhagen: Levin & Munksgaard.
Prêtre, C. (2018) Vêtements sacrés et tissus profanes. Les textiles dans les inventaires de Délos. *Bulletin de correspondance hellénique* 142(2), 545–65.
Quillien, L. (2017) Tools and Crafts, the Terminology of Textile Manufacturing in 1st-Millennium BC Babylonia. In S. Gaspa, C. Michel and M-L Nosch (eds), *Textile Terminologies from the Orient to the Mediterranean and Europe, 1000 BC to 1000 AD*. Lincoln: Zea Books, 91–106.
Richard, Q. (2020) *Les motifs vestimentaires des figurines en terre cuite béotiennes et attiques aux époques archaïque et classique.* Master's Thesis, Ecole du Louvre.
Ridgway, B. S. (1984) The Fashion of the Elgin Kore. *The J. Paul Getty Museum Journal* 12, 29–58.
Riis, P. J. (1993) Ancient Types of Garments: Prolegomena to the Study of Greek and Roman Clothing. *Acta Archaeologica* 64, 149–182.
Roche, C. (2012) Ontoterminology: How to unify terminology and ontology into a single paradigm. In N. Calzolari (ed), *Eighth International Conference on Language Resources and Evaluation: May 23–25, 2012, Istanbul Luotfi Kirdar Convention & Exhibition Centre: conference abstracts*. Paris: European Language Resources Association, 2626–2630.
Saumaise, C. (1656) *Tertulliani Liber de Pallio*. Leiden.
Schmaltz, B. (1998) Peplos und Chiton – Frühe griechische Tracht und ihre Darstellungskonventionen. *Jahrbuch des Deutschen Archäologischen Instituts* 113, 1–48.
Scott, M. (2011) Displaying Lists of what is (not) on Display: The Uses of Inventories in Greek Sanctuaries. In M. Haysom and J. Wallensten (eds), *Current Approaches to Religion in Ancient Greece. Papers presented at a symposium at the Swedish Institute at Athens, 17–19 April 2008*. Stockholm: Svenska Institutet i Athen, 239–252.
Spantidaki, S. (2016) *Textile production in Classical Athens*. Oxford: Oxbow Books.
Studniczka, F. (1886) *Beiträge zur Geschichte der altgriechischen Tracht.* Vienna.
Uhlenbrock, J. (2016) Research Perspectives in Coroplastic Studies: The Distribution, Trade, Diffusion, and Market Value of Greek Figurative Terracottas. *Les Carnets de l'ACoSt. Association for Coroplastic Studies* 15, https://doi.org/10.4000/acost.926.
Villacèque, N. (2010) De La Bigarrure En Politique (Platon République 8.557C4–61e7). *Journal of Hellenic Studies* 130, 137–152.
Von Hofsten, S. (2011) Weaving as a means of preserving the collective memory in archaic and classical Greece. In H. Whittaker (ed), *In Memoriam: Commemoration, Communal Memory and Gender Values in the Ancient Graeco-Roman World*. Newcastle upon Tyne: Cambridge Scholars Publishing, 5–23.
Wace, A. J. B. (1948) Weaving or Embroidery? *American Journal of Archaeology* 52(1), 51–55.
Wüster, E. (1968) *The Machine Tool – An interlingual Dictionary of Basic Concepts*. London: Technical Press.
Zanola, M.T. (2014) *Arts et métiers au XVIIIè siècle. Études de terminologie diachronique*. Paris: L'Harmattan.

Author:
quentin.richard0@orange.fr

Anne Kwaspen

Nubian textile features:
wool fragments from Hisn al-Bab and a tunic from Fag el-Gamus, Egypt

Abstract
Excavations carried out by the Cairo Branch of the Austrian Archaeological Institute since 2012 at the site of Hisn al-Bab, a military settlement 10 km south of Aswan in Egypt, revealed an abundance of textile fragments dating from the late sixth to early seventh centuries CE. A study group of 80 textiles was selected of which 60 wool examples were analysed and compared with wool textiles from Lower Nubia and Egypt. Research into the typical features of Nubian textiles also led to the discovery of what may be an exceptional Nubian wool tunic unearthed at the cemetery of Fag el-Gamus at Fayum in Egypt.

Keywords: Egypt, Nubia, wool, tunic, weft twining

Introduction
The Marie Sklodowska Curie research project 'TUNICS' investigated the impact of cultural cross-fertilisation between the diverse populations in Egypt in the Early Medieval period (sixth to tenth centuries CE) through a comparative study of the clothing worn in that period**.** This research is foremost an object-based study of tunics and other garments from various settings: several museum collections as well as the cemetery of Fag el-Gamus (Fayum) and the excavation of Hisn al-Bab on the Egyptian-Nubian border.
Permission was granted to study the textile finds of the military settlement Hisn al-Bab in March 2019. In particular, the wool fragments from this border settlement appeared to be relevant material for this research project, and a comparative study was conducted between these finds and wool textiles excavated in Egypt and Lower Nubia (in modern Egypt and Sudan) from the same period. The technical features of the wool fragments from Hisn al-Bab mainly correspond to the features of Nubian wool textiles. Similarities have also been identified with one exceptional tunic find from a burial of the cemetery of Fag el-Gamus, Fayum.

Textiles from Hisn al-Bab
The site of Hisn al-Bab, a military settlement on a rocky slope and plateau on the east bank of the Nile, is situated at the south end of the first Nile cataract near Philae, 10 km south of Aswan. There were no constant boundaries in this area during the first millennium CE, as the occupation of the border area by different populations changed often. The archaeological site consists of two fortresses (Gascoigne and Rose 2014; Rose 2012). Research into the history and the occupation of the military post is still ongoing. It is assumed that the earlier fort is probably of late Roman date, and that the use of this fortress came to an end during the seventh century CE. After a period of abandonment, a new fort was built in the ninth century, partly over the earlier structures.
Excavations carried out by the Cairo Branch of the

Austrian Archaeological Institute (ÖAI) since 2012 under the leadership of Pamela Rose have focused on the earlier fortress. An abundance of textile fragments from ten different areas within this fortress have been recovered. Pottery finds (unpublished research by Gillian Pyke, Yale University, USA) and coins (unpublished research by Hans-Christoph Noeske, University of Frankfurt, Germany) from the same areas indicate that these textiles date to the late sixth or early seventh centuries CE.

From the thousands of textile finds, 80 textiles were selected for technical analyses of the weaving structures. These were mainly small fragments from ten different areas in the fortress. The selection was made in the context of the intended comparative research. No complete textiles were found in Hisn al-Bab. The larger fragments and those with visible technical features (other than tabby weave) were chosen for further investigation. As a result, this research does not provide a systematic overview of all the textiles excavated on the site but it does discuss a number of striking technical features apparent in the study group under examination. A systematic survey of the Hisn al-Bab textiles is currently being conducted by Amandine Mérat (independent Egyptologist and textile specialist).

Linen, which was a basic material in Egypt during the Byzantine and Early Medieval period, was found only to a limited extent in Hisn al-Bab. This probably indicates that these linen fabrics were not usually worn or used in the settlement. Linen is mainly found in tapestry fragments not as a yarn for the ground weave of garments or utility textiles.

Cotton finds are also scarce in the late sixth century CE at Hisn al-Bab. Both S-spun and Z-spun cotton yarns are present including a head covering made from likely reused cotton textile scraps with threads spun in both directions (inventory number 906-M-0082AK). A great deal of discussion regarding the spin direction of cotton is still ongoing. In Nubia, the spin direction was mainly S whereas in Egypt both S-spun and Z-spun cotton have been found. One of the assumptions is that Z-spun cotton (as with Z-spun wool) is of foreign origin (Bouchaud et al. 2019). This could mean that the cotton yarns at Hisn al-Bab may have a mixed origin, both local and imported.

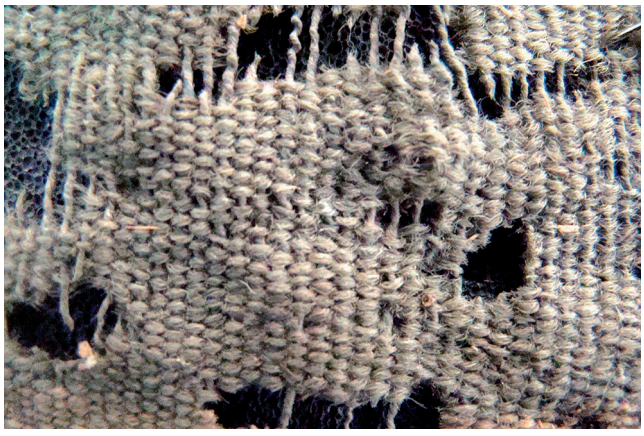


Fig. 1: Detail of 550-1750-0079AK showing the difference in the spinning of the warp and the weft. The warp yarn has a very high twist degree while the weft is rather loosely spun (Image: Anne Kwaspen)

The most important textile fibre used at Hisn al-Bab was wool (Mérat 2021). Among the selected 80 textiles, 60 are wool. The term wool is used here to include fibre from other animals as well as sheep. The material and technical weaving features of these are described and parallels from Nubia and Egypt discussed. The frequency of fibre use in the textiles of Hisn al-Bab reported is consistent with the findings of previous textile studies focusing on Lower Nubia in the sixth and seventh centuries CE, including the region between Gamai and Faras (Bergman 1975) and Ballana and Qustul (Mayer-Thurman and Williams 1979). These studies reported that mainly wool textiles were found during the periods referred to as the "X-Group" and the "Early Christian". The fact that the textiles in Hisn al-Bab are mainly made of wool may be the first indication that they are of Nubian origin.

Wool fibres and yarns

The short study period of ten days and the prohibition on exporting samples from Egypt made scientific analyses of the wool fibre impracticable. However, the range of colours (from off-white to dark brown) corresponds to undyed natural wool colours. The use of camelid fibres in Late Antique Egyptian textiles has not yet been thoroughly investigated. However, several textile finds from Nubian medieval sites indicate that camelid fibres were likely used (Bergman 1975, 10; Fiedler 1979, 49–51; Yvanez et al. 2021, 36–40), making dromedary camels a probable fibre source in Hisn al-Bab alongside sheep and goats (Mérat 2021).

In general, the wool fibres found at Hisn al-Bab are S-spun. It is striking that many of the textiles show a difference in the spinning of the warp and the weft (fig. 1). The warp yarns tend to have a very high twist, sometimes even an over-twist, while the weft is spun rather loosely. A yarn spun with a high twist degree is typical of the warp needed for weaving on a warp-weighted loom in order to sustain the weight and tension created by the loom weights (pers. com. Demant 2021). The warp-weighted loom was commonly in use in Nubia in the Meroitic period

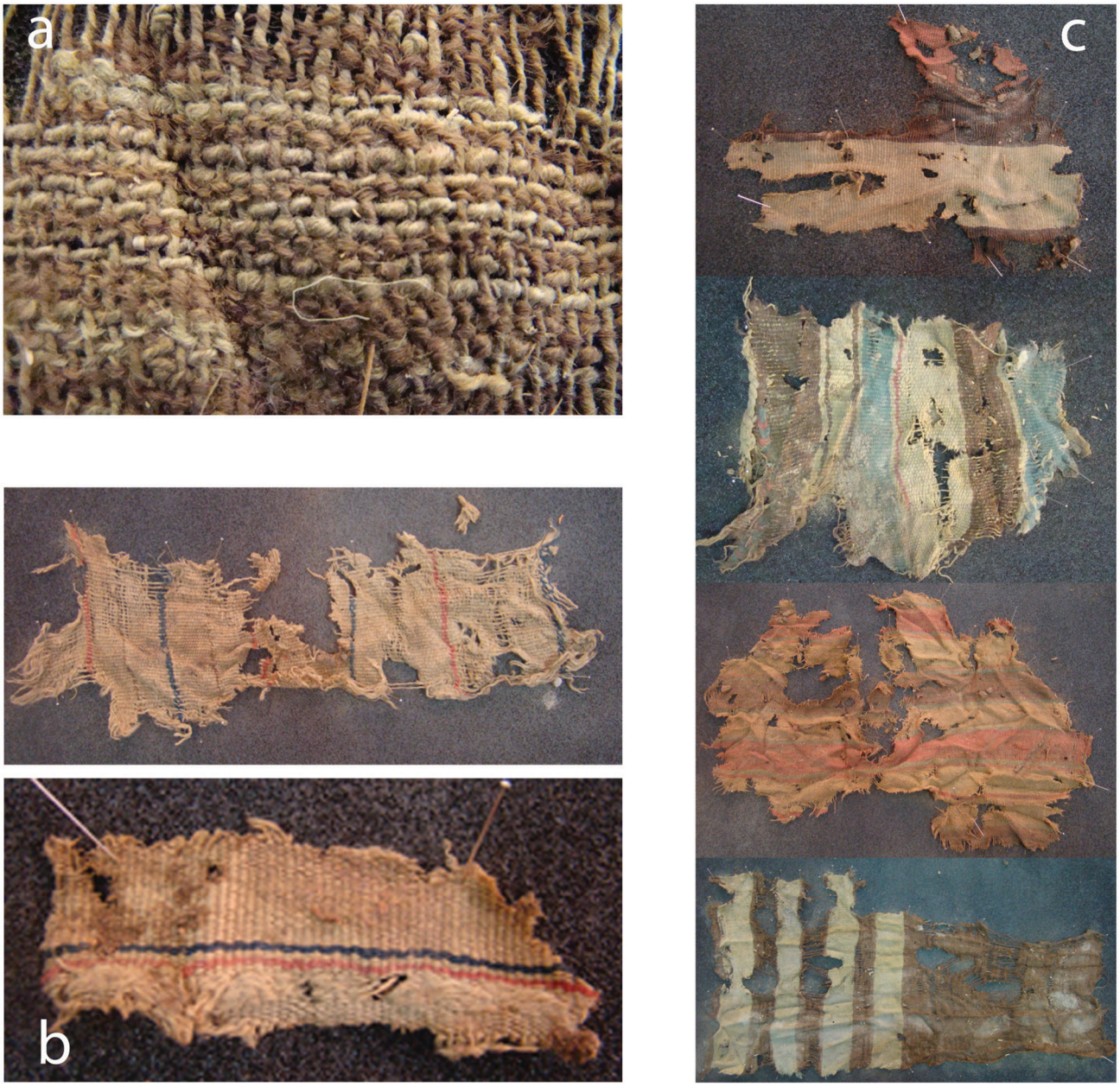


Fig. 2: a – Detail of 877-0699-0060AK with a striped pattern of alternating wefts in light and dark brown; b – fragments 794-0894-0042AK and 938-0898-0024AK with fine coloured stripes; and c – fragments 728-0898-0027AK, 877-0699-0061AK, 2014-0036AK and 732-0898-0034AK with wide stripes (Image: Anne Kwaspen)

(Wild and Wild 2014, 76) but less often in later periods. The use of high twist warp yarn may still be indicative of this tradition.

Besides textiles woven with single spun wool warps, fragments were also found with warp yarns plied S2Z (that is, two S-spun yarns plied together in the Z direction). The use of plied yarns for the warp is mainly known from Egyptian linen tapestry weaves and from supplementary weft brocaded (*broché*) wool bands which were both produced for application on tunics. The three examples found at Hisn al-Bab in this study are monochrome or striped tabby weaves. The samples are too small to determine their function.

Ground weave

The wool fabrics from Hisn al-Bab showed extensive use of undyed, naturally coloured wool. Among the 60 fabrics only four have a dyed warp. Another four

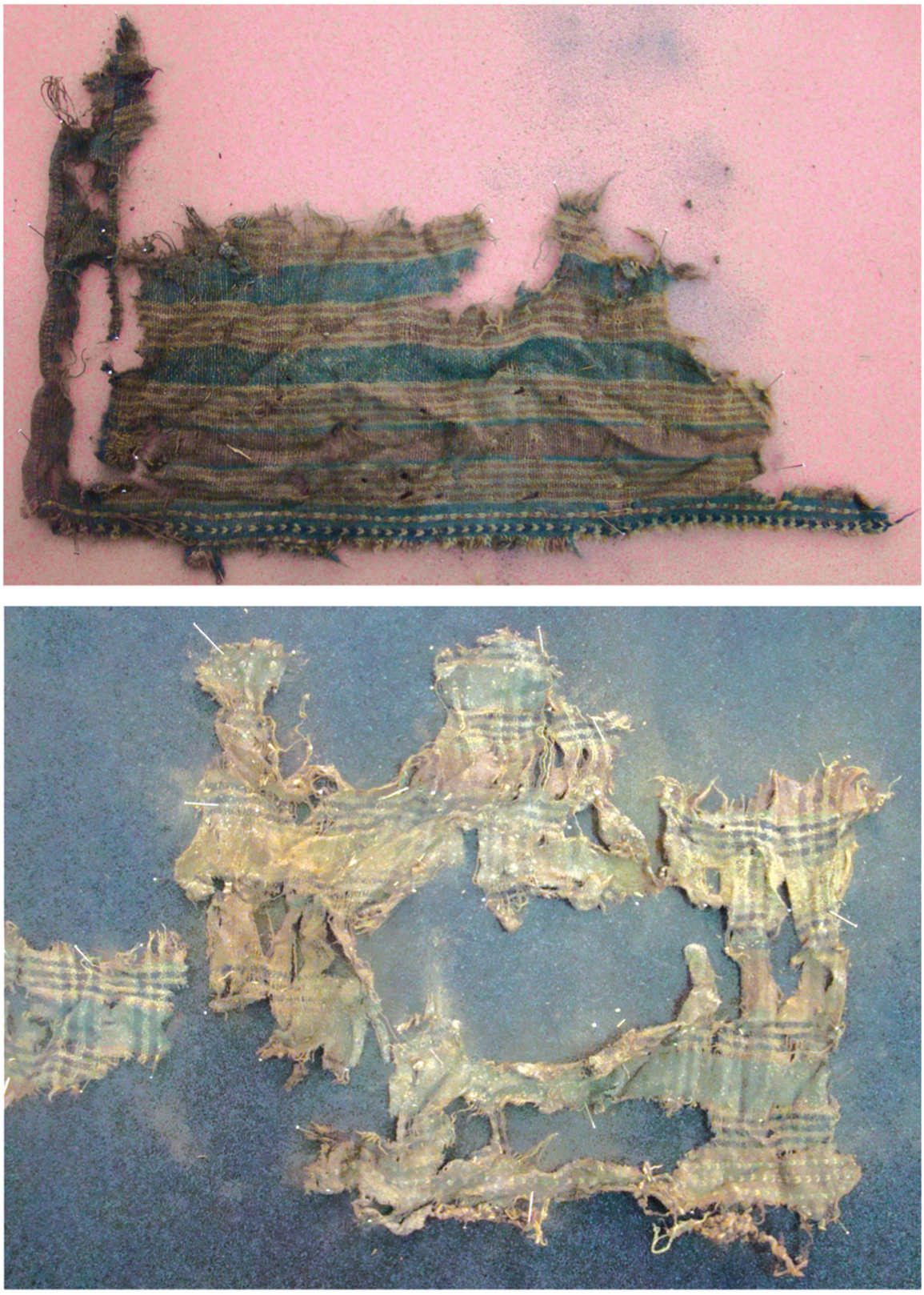


Fig. 3: a – Fragment 722-0898-0014AK in plaid weave in weft-faced tabby; and b – fragment of a plaid weave 1045-0699-0058AK (Image: Anne Kwaspen)

fabrics have a striped warp in which undyed wool is alternated with red, yellow, and blue warps.
The main weaving structure for the wool fragments is tabby weave. The majority are in weft-faced tabby, with the weft covering the warp and an average density of six to ten warps per cm and 16 to 27 wefts per cm. There are also weft-predominant tabbies with more weft than warp yarns per cm but with the warp still visible. Only four of the fragments have a balanced weave: two of these are open structured weaves made with very fine wool yarns. By way of comparison, it is noteworthy that Egyptian wool fabrics are also commonly weft-faced tabbies, yet there are only two fragments that are very similar to the typical wool cloths from Egypt with a warp density of eight to nine yarns per cm and a weft density of 38 and 50 yarns per cm. A large number of the Hisn al-Bab wool fabrics differ from Egyptian wool weaves because of the degree of difference in the spin of the warp and weft. Owing to the loosely spun weft, these fabrics are thinner and more flexible than the usual wool finds from Egypt.
One example has bands in balanced weave, alternating with bands in weft-faced tabby. In another example, the weft predominant structure alternates with half basket weave, where two weft threads are worked together.
Another more exceptional structure among the textile finds of Hisn al-Bab is a yellow wool with a looped weave. It is a pile weave with a row of wrapped pile (Verhecken-Lammens 2009, 134) every 2 cm. The wefts between the pile rows are executed with paired threads.
Although many of the recovered wool textile fragments are monochrome, their fragmentary nature makes it difficult to conclude that they also come from a cloth which is monochrome throughout. The striped wool fabrics are the most common finds. They appear to have full-width (weft) stripes in each case. There are different patterns of stripes including cloth with an alternating stripe pattern per two picks in light and dark brown natural-coloured wool (fig. 2a); cloth with narrow stripes which are only a few weft picks high (fig. 2b); and cloth with patterns with wide coloured stripes (fig. 2c). Some larger fragments have clear evidence that the stripes are only at the starting/finishing ends of the fabric whereas other examples have a striped pattern throughout. Most of these striped textiles have the natural-coloured wool as the basic colour. The colours that occur most frequently are red and blue but yellow, pink, and a lilac-ish purple were also found, as well as a colour, which after deterioration, can be described as light grey.
There are some notable weaves, which at first glance look like striped weaves, where the warp is threaded in different colours, making them plaid weaves (fig. 3a). Because these fabrics have a weft-faced tabby structure, the colour variation in the warp is almost imperceptible. However, it would have been visible in the starting/finishing borders, which are no longer preserved. In addition, there are three plaid fabrics with a balanced or weft-predominant tabby structure, in which the intersecting colour combinations are visible (fig. 3b).

The edges

The starting and finishing borders

The assumption that the fabrics with a very tightly spun warp were woven on a warp-weighted loom suggests that many starting borders would be found among the textiles. Ingrid Bergman described eight main types of starting borders on the textiles during the Scandinavian Joint Expedition to Sudanese Nubia (Bergman 1975, 28–31). However, there are only two starting borders in this Hisn al-Bab study group, even though this was an important criterion for selection. This could be an indication that the fabrics are woven on two-beam looms rather than the warp-weighted loom. One fabric has a light brown warp and weft and a starting border in blue S4Z-plied wool yarn in which a countered twining was first made followed by another row with single twining (fig. 4). The other example was difficult to analyse because only one centimetre of the starting border was preserved. It comes from one of the plaid fabrics. Its starting border is executed in either tablet weaving or band weaving; the fragment is too small to determine the technique with certainty.
Finishing borders can be found more frequently in

Fig. 4: Detail of 795-1120-0084AK with a twined starting border in blue S4Z-plied wool yarn (Image: Anne Kwaspen)

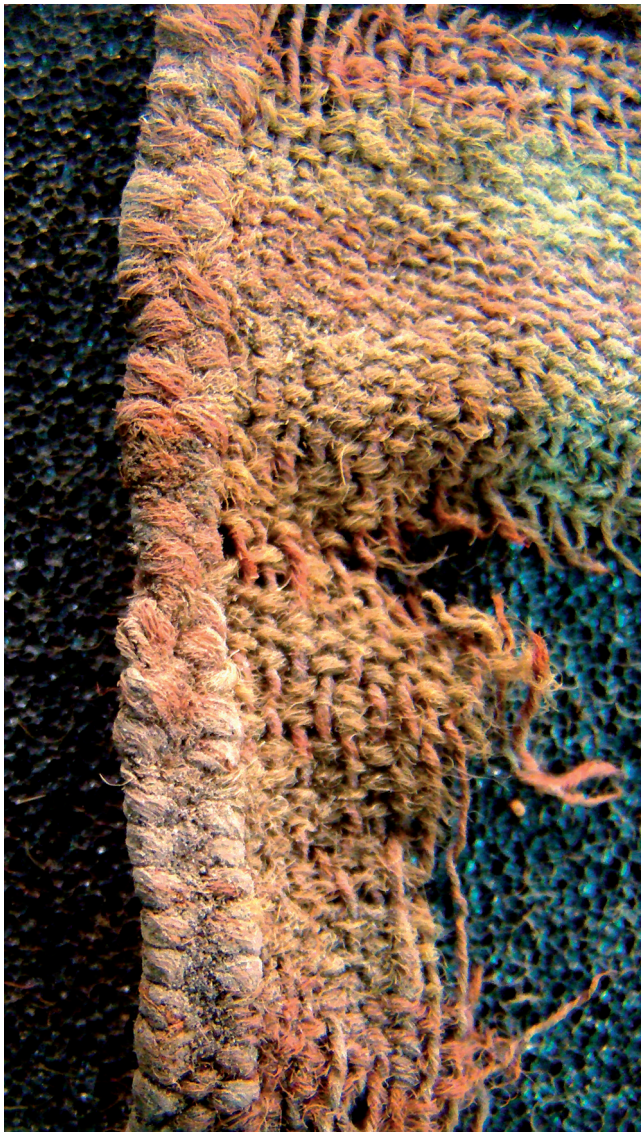


Fig. 5: Detail of 730-0898-0032AK with a reinforced selvedge (Image: Anne Kwaspen)

the textile finds of Hisn al-Bab. In the study group, there are nine fabrics with the most typical finishing border in which the warp yarns are processed in a twined cord that runs along the fabric edge (Kwaspen 2020, 25; Bergman 1975, 32–33). One fabric has a more complex border combining twining and braiding.

The selvedges

The preserved longitudinal edges of the wool fabrics show that all are reinforced selvedges. As a basis for reinforcement, some units of combined warp yarns have been created. Most commonly, these are two or three units of two to five yarns together, used as outer warps on both sides of the weave. In addition, most

Fig. 6: Detail of 722-0898-0014AK with selvedge (Image: Anne Kwaspen)

cloths also have a reinforcement of the selvedge made in the weft direction. This was done in two ways. A first method used the weft of the ground weave to make extra turns in the selvedge section. In the second method, an extra weft yarn is added that only makes turns in the selvedge section. This can result in a thicker and stiffer border, in some cases highlighted even further by the construction of a polychrome design. This decoration has so far only been identified in these Hisn al-Bab textiles (fig. 5).

The longitudinal edge of one fragment deserves more attention (fig. 6). In this fragment, two warp units have been created 3 cm from the side, each consisting of two yarns together. The regular weft ends wrap around these warp units in the dovetailing technique. The outer 3 cm are then woven in blue wool up to the outer edge which is formed by three warp units of three yarns together. On these warp units, the blue weft ends in a triangular shape in the dovetailing technique to connect again with another weft colour. The outer edge is woven in red with the opposite dovetailing. Uniquely, the stripe pattern does not extend to the edge of this fabric because of the way the broad blue border is formed.

The seams

There are very few seams on the textiles from Hisn al-Bab. Most relate to patches for repairs rather than the construction of clothing. This lack of seams is more evidence that these textiles are probably of Nubian

Fig. 7: Details of 877-0699-0061AK, 722-0898-0013AK, 927-0600/0621-0055AK, 927-0600/621-0054AK, 730-0898-0033AK, 730-0898-0032AK, 707-0895-0022AK, 718-0898-0018AK and 707-0895-0023AK - all textiles with (countered) weft twining near the finishing border (Image: Anne Kwaspen)

origin. Nubian clothing usually consisted of one-piece cloth tunics with openings for the head or rectangular or triangular cloths that were draped around the body, such as loincloths and the so-called mantles (Bergman 1975; Mayer-Thurman and Williams 1979). Different types of seams occur as run and fell seams, overlap seams, and flat seams. Two textiles have two fragments joined at selvedges, where the selvedges are placed next to each other and sewn together with top stitch. This method is known from the shoulder seams of Roman wool tunics which are constructed from two rectangular fabric pieces (Sheffer and Granger-Taylor 1989).

Decorative weaving techniques

For this study, nine fragments with tapestry were selected. All these tapestry fragments are woven with a wool warp (with an average thread count of nine to 11 warps per cm). Wool is also used for the weft (with an average thread count of 42 to 60 wefts per cm). Therefore, it can be assumed that all these tapestries were woven directly as ornamentation in the ground weaves, since textiles woven separately for appliqué were extremely rarely made on a single wool warp. Most of the fragments are so small that little information is available to understand their figuration or to compare them with other tapestry weaves from Egypt and Nubia. In three cases, the tapestry is combined with a flying thread brocading technique executed with wool yarn.

One very specific type of decorative element stands out among the Hisn al-Bab textiles: lines of countered weft twining often found close to the finishing borders of the weave (fig. 7). Countered weft twining is a well-known feature in Egyptian wool tunics from the late Roman period onwards. Its function is to reinforce the weak points under stress in the woven-to-shape tunics such as the corners of the woven-in neck slits and the armpit point where the sleeve merges into the front and back parts. Countered twining is often used to insert or eliminate extra warp threads into the weave. However, the appearance of countered twining in

the Hisn al-Bab wool textiles appears to have had a primarily decorative rather than strengthening function. Its placement near the start and finishing borders is a remarkable feature. The countered weft twining on these textiles is often executed in two alternating colours, made with two S2Z or S3Z plied yarns. The structure is weft twining 2-2, 3-3 or 4-4, which means that every yarn always goes over and under the same number of warps, creating V-shaped figures with one V starting where the previous V stops. The twining yarns can be naturally coloured, red, blue or yellow. Only one textile (inventory number 720-0898-0039AK) was found with a single weft twining. It is naturally coloured monochrome and executed with two yarns but these go irregularly over and under the warp yarns.

The decorative use of weft twining has already been published with the countered twining chiefly discussed as part of the starting borders (Bergman 1975, 25–28; Mayer-Thurman and Williams 1979, 39–41). The weft twining at a short distance from the end borders (as is strikingly common in the textiles from Hisn al-Bab) is not mentioned even though it is clear from these publications that the stripes in weft twining are typical for wool cloth in Lower Nubia.

Although the decorative use of countered weft twining next to the end borders is not a recognised feature in Egypt, an instructive small fragment was unearthed in Berenike (inventory number BE97 099; pers. com. Wild 2021). In this blue wool fragment, counter twining was introduced a few wefts behind the finishing border in white and red wool, making it very similar to the Hisn al-Bab fragments but with the significant difference that this textile is executed with a coloured warp.

A Nubian tunic found in the Fayum (inventory number 1992-SW-39.13)

The identification of the countered twining decorative stripes as a typical feature for Nubian textiles has led to the discovery of what may be an exceptional Nubian tunic unearthed at the cemetery of Fag el-Gamus (Fayum). It is now in the study collection of archaeological textiles at Brigham Young University (BYU) in Utah (USA). Fag el-Gamus is located 90 km south of Cairo, in the desert just east of Fayum. BYU holds the concession for the cemetery, which was in use from the Ptolemaic period until the Early Medieval period (Muhlestein et al. 2020). The author was in the excavation team from 2018 and was in Utah to study the textiles in storage in 2020 as part of the TUNICS project. During investigation of the textiles in an exceptionally rich burial with Kristin South, a large fragment of a wool tunic (inventory number 1992-SW-39.13) was identified as completely different from the typical woven-to-shape tunics that are frequently found in Fag el-Gamus.

Fig. 8: A fragment of tunic 1992-SW-39-13 from Fag el-Gamus (Image: Anne Kwaspen)

The preserved part (46 cm x 46 cm) consists of a fragmentary rectangular piece running from the side edge to approximately centre front of the tunic with a half preserved woven-in slit as a neck opening at centre front (fig. 8). The tunic is what is called a sleeveless woven-to-shape tunic, which is a very common type of garment in Egypt. These tunics are woven from side edge to side edge, then turned 90° to be worn. In the finished tunic, the warp runs horizontally. The selvedges are located on the hems at the front and back. A first striking feature of this tunic is that it is extremely short. The full weave width is only 46 cm, making the front and back each only 23 cm long. No sewing marks were found on the selvedges, which are strengthened with two warp units, making it unlikely that any pieces would have been sewn on to make the tunic longer.

Technical features

The ground weave of this garment is composed of a naturally coloured S-spun wool warp with a count of 10 yarns per cm and a naturally coloured S-spun weft with a count of 32 to 35 yarns per cm. The weave structure is therefore a weft-faced tabby. The starting border is preserved: it is countered twining which

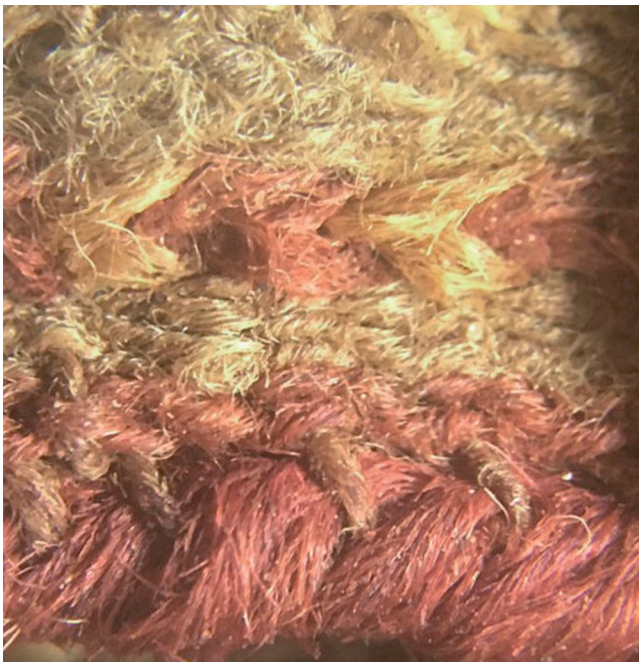


Fig. 9: Detail of the starting border and countered weft twining of tunic 1992-SW-39-13 from Fag el-Gamus (Image: Kristin South)

always goes over two and under two warp yarns made with red S3Z-plied wool yarn. This is followed by three wefts in red wool and then seven wefts of naturally coloured wool (fig. 9). Subsequently, a row of countered twining was introduced over the entire width of the cloth. This twining also goes over two and under two warp yarns and is made of alternating yellow S2Z-plied wool and red S3Z-plied wool yarn. It is this bicoloured twining near the starting border that strongly resembles the textile finds from Hisn al-Bab.

There are other remarkable features including the *clavi*, the vertical stripes that run along the neck opening from the front over the shoulders to the back. In this tunic, the *clavi* are executed in a vertical stripe pattern with six purple-brown stripes, each with a bicoloured countered twining down its centre (fig. 10), five of which are made with a combination of red and white wool, and one in red with yellow wool. Comparsion with a corpus of more than 400 Egyptian tunics suggests that this type of *clavus* is unique among Egyptian finds but is echoed in the Nubian textile tradition.

What is also rather remarkable is the placement of the circular ornamental elements, the *orbiculi*. There are no *orbiculi* placed at the height of the shoulder line, as often occurs on Egyptian tunics, but two are preserved (and probably four on the entire tunic) in the corners of the tunic. These *orbiculi* are woven in purple wool and decorated with geometric figures in flying thread brocade technique, executed with naturally coloured wool as are the flying thread brocaded fragments from Hisn al-Bab. In addition, these *orbiculi* are very similar to examples on textiles found at the Nubian site of Qustul, in grave Q 136 (inventory number 85) and grave Q 236 (inventory number 107) (Mayer-Thurman and Williams 1979, 98 and 108).

Tapestry technique was employed to depict animal figures between the two *orbiculi* and between each *orbiculus* and the selvedges, probably representing crocodiles (fig. 11). These kinds of loose and connecting figurations between *orbiculi* is not seen on Egyptian tunics.

The neck opening is a woven-in slit with one unit of two warp yarns as selvedge. Over this selvedge a colourful decorative border is made in finger-weaving technique (Kwaspen 2017, 203–204) (fig. 10). This technique implies that twining threads are sewn with

Fig. 10: Detail of clavus and neck opening of tunic 1992-SW-39-13 from Fag el-Gamus (Image: Anne Kwaspen)

Fig. 11: Detail of tapestry on tunic 1992-SW-39-13 from Fag el-Gamus (Image: Anne Kwaspen)

Fig. 12: Fragment 1992-SW-39-23 from Fag el-Gamus (Image: Anne Kwaspen)

one red S2Z-plied wool yarn. The twining threads are all S3Z-plied wool yarns, with the following colour combination: yellow, red, blue, red, yellow, blue, and green.

Other textiles in burial 1992-SW-39

The tunic fragment was found in the burial of a young adult woman in a shaft 127 cm deep. In Fag el-Gamus, from the beginning of the era to at least the sixth century CE, it was customary to bury the deceased in a shaft into which further burials were superimposed over a long period. The burial 1992-SW-39 was found in very good condition. An exceptionally large number of textiles were recovered during unwrapping. The fragment of the tunic was placed on the pelvis and legs of the deceased. Because of this, it was interpreted by the excavators as an apron. It is not possible to deduce from the notes in the field books whether there could have been more fragments on the upper body.

In the same burial, three fragments of another cloth in naturally coloured wool (inventory number 1992-SW-39.23) with a countered twining stripe in alternating red and white wool located one centimetre from the finishing border were found (fig. 12). Long warp fringes finish the end edge. Narrow stripes in red and brown wool were woven into the structure as embellishment. From these characteristics, a Nubian origin for this textile could be hypothesised.

In addition to various linen wrapping sheets and ribbons, this burial also contained a pair of needlebound socks as well as a linen tunic with *clavi* and sleeve bands in purple wool and flying thread brocading in linen, which all frequently occur in Egyptian linen tunics. Ten hairnets were also found, both on the head of the deceased and placed elsewhere on the body (Kwaspen and South 2021).

Conclusion

Research into the political history of the border area between Egypt and Nubia is still ongoing. Analyses of technical features of the wool textile finds show that these textiles from Hisn al-bab correspond to finds of Nubian textiles from other settlements and cemeteries. This result may help in determining that Hisn al-bab was most likely a Nubian settlement at the time. However, it should be taken into account that most textiles were found in dump pits and that a minority of finds also resemble Egyptian textiles.

The most striking technical feature is the countered bicoloured weft twining near the end borders of the cloths. This is clearly a feature found in Nubian textiles and unusual in Egyptian textiles. It was therefore remarkable to find this use of weft twining on two textiles in a burial at Fag el-Gamus. Both the tunic and the other wool fragments suggest that these could be Nubian textiles. It is with great caution that this conclusion is proposed given the great distance between Lower Nubia and the Fayum and that other textiles found in the burial are more in line with the Egyptian clothing tradition. Nevertheless, these two textiles form interesting sources for further research on trade and migration, or on the movement of people and craft knowledge.

Acknowledgements

I would like to thank Pamela Rose and the ÖAI for the opportunity to study the collection of Hisn al-Bab. I also wish to express my thanks to Kristin South from the BYU Egypt excavation team for inspirational collaboration during our study of the Fag el-Gamus textiles. I also warmly thank Elsa Yvanez and

Magdalena M. Wozniak for introducing me to a great deal of information and literature on Nubian textiles. Finally, I thank John Peter Wild and Felicity Wild for searching their archives to find comparative material. This research has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Sklodowska Curie grant agreement 844179.

Bibliography

Bergman, I. (1975) *Late Nubian Textiles.* Scandinavian Joint Expedition to Sudanese Nubia 8. Stockholm: Esselte Studium.

Bouchaud, C., Yvanez, E. and Wild, J-P. (2019) Tightening the thread from seed to cloth. New enquiries in the archaeology of Old World cotton. A case for inter-disciplinarity. *Revue d'Ethnoécologie* 15. https://doi.org/10.4000/ethnoecologie.4501

Demant, I. (24 February 2021) Textile specialist Land of Legends in Lejre, Denmark – personal communication.

Fiedler, I. (1979) The fibers. In C.C. Mayer-Thurman and B. Williams (eds), *Ancient Textiles from Nubia: Meroitic, X-Group, and Christian Fabrics from Ballana and Qustul*. Chicago: Art Institute of Chicago, 49–51.

Gascoigne, A. L. and Rose, P. (2014) The forts of Hisn al-Bab and the first Cataract frontier from the 5th to 12th centuries AD. *Sudan and Nubia* 16, 88–95.

Kwaspen, A. (2017) Different finishing techniques of the neck slits on Late Antique tunics from Egypt. In A. De Moor, C. Fluck and P. Linscheid (eds), *Excavating, analysing, reconstructing. Textiles of the First Millennium AD from Egypt and neighbouring countries*. Tielt: Lannoo, 196-205.

Kwaspen, A. (2021) An exceptional way to join two textiles together: A textile fragment from Hisn al-Bab (Egypt). *Archaeological Textiles Review* 62, 24–26.

Kwaspen, A. and South, K. (2021) Sprang hairnets from the necropolis of Fag el-Gamus in the Fayum, Egypt. In F. Pritchard (ed.), *Crafting Textiles: Tablet Weaving, Sprang, Lace and Other Techniques from the Bronze Age to Early 17th Century*. Oxford: Oxbow books, 85–102.

Mayer-Thurman, C.C. and Williams, B. (1979) *Ancient textiles from Nubia: meroitic, X-group, and Christian fabrics from Ballana and Qustul*. Chicago: Art Institute of Chicago.

Mérat, A. (2021) The spring 2019 season at Hisn al-Bab: Care, study and general presentation of textile finds from Area 9 (6th-7th centuries) In A. De Moor, C. Fluck, P. Linscheid (eds), *Explorers, First Collectors and Traders of Textiles from Egypt of the First Millennium AD*. Veurne/Antwerp: Hannibal Books, 210–219.

Muhlestein, K., Jensen, B. and Pierce, K. V. L. (2020) *Excavations at the Seila Pyramid and Fag el-Gamous Cemetery.* Leiden: Brill.

Rose, P. (2012) Hisn al-Bab. A New Project of the Austrian Archaeological Institute/Cairo Branch. *Jahreshefte Des Österreichischen Archäologischen Institutes in Wien* 81, 127–136.

Sheffer, A. and Granger-Taylor, H. (1989) Textiles from Masada: a preliminary selection. In J. Aviram (ed), *Masada: The Yigael Yadin Excavations, 1963-1965: Final Reports*. Jerusalem: Israel Exploration Society, The Hebrew University of Jerusalem, 149–255.

Verhecken-Lammens, C. (2009) Linen Furnishing Fabrics with Pile in the Collection of Katoen Natie. In A. de Moor and C. Fluck (eds), *Clothing the house: furnishing textiles of the 1st millennium AD from Egypt and neighbouring countries: proceedings of the 5th conference of the research group "Textiles from the Nile Valley", Antwerp, 6-7 October 2007*. Tielt: Lanoo Publishers, 132–143.

Wild, J-P. (6 March 2021) Emeritus, University of Manchester, Manchester, UK – personal communication

Wild, J-P. and Wild, F. (2014) Qasr Ibrim: New perspectives on the changing textile cultures of Lower Nubia. In E.R. O'Connell (ed), *Egypt in the First Millennium AD: Perspectives from New Fieldwork*. Leuven: Peeters, 71–85.

Yvanez, E., Murillo, M-L., Francigny, V. and De Voogt, A. (2021) Cultural interconnections: textile craft and burial practices in Early Medieval Sudan. *Archaeological Textiles Review* 62, 32–44.

Author:
kwaspen.anne@hotmail.com

Julia Hopkin

Raincoats or riches?
Contextualising *vararfeldir* through multi-perspective experiments

Abstract
Fleece pile cloaks or *vararfeldir* feature regularly in early medieval (870 CE to 1200 CE) Icelandic textual sources as a staple of north Atlantic trade. Archaeological finds and reconstruction projects have provided numerous insights. However, few studies have investigated how *vararfeldir* were used, or why they were produced and traded so extensively when other materials were available. This project used controlled experiments to compare the properties of reconstructed *vararfeldir* with contemporary materials, while a public consultation provided alternative perspectives. The resulting data suggest that the demand for *vararfeldir* may have been driven by more complex forces than previously assumed, including specific practical needs, production advantages and subjective concepts. This provides broader insights into the perceptions and priorities of early medieval society and suggests numerous avenues for future investigation. The results highlight the potential for multiperspective, contextualised investigations to broaden understanding of textiles as societally-embedded technologies.

Keywords: Experimental, *vararfeldir*, pile, Iceland, early medieval, sensory, materiality

Introduction
The north Atlantic region, including modern-day Greenland, Iceland, Norway, the Faroe Islands and the British Isles, was dominated by extensive trade networks during the Early Medieval period (870 CE to 1200 CE), and Iceland was at the heart of the trade in wool textiles (Gelsinger 1981, 13; Dennis et al. 2000, 247; Priest-Dorman 2001, 8; Hayeur Smith 2015, 25–26). In addition to producing standardised wool fabric (*vaðmál*), Icelandic written sources give intriguing glimpses into the production and exchange of shaggy fleece pile cloaks (plural *vararfeldir*; singular *vararfeldr*) for consumers both locally and overseas, particularly in Norway and the British Isles. While research into archaeological finds has built up a detailed picture of how *vararfeldir* were constructed (Kløve Juuhl 2013; Hakonardottir et al. 2016, 180; Mader 2017; LaFleur 2017), very little is known about how they were used, making it difficult to understand why there was such demand for them, or what role they had in society beyond being a trade product.

This research investigated these questions using a variety of experimental methodologies in order to approach them in a more holistic, contextualised way than had previously been attempted. The results provide new insights into the complex experiences of the people who made and used *vararfeldir*, and how these unique textiles fitted into the wider landscape of material production, trade and usage in early medieval Iceland and the wider north Atlantic region.

Evidence
Written sources suggest that pile cloaks were produced in Iceland from the first settlement in the late ninth century until about 1200 CE (Guðjónsson 1962, 69). *Grágás*, the earliest surviving Icelandic legal text, valid between 1117 CE and 1271 CE (Hayeur Smith 2020, 57), includes a description of a market-standard *vararfeldr* meaning "trade cloak":

> *"In accordance with General Assembly regulation … a trade-cloak is worth two ounce-units, four*

thumb-ells long and two broad, thirteen tufts across the piece. If cloaks are of better quality than that, their value is subject to assessment" (Dennis et al. 2000, 207).

Based on this description, the typical *vararfeldr* has been interpreted as a rectangular garment, which was constructed by inserting additional material into the textile to form a pile structure (Guðjónsson 1962, 68; Priest-Dorman 2001, 8).

Following Guðjónsson's interpretation of the early Icelandic unit of measurement "thumb-ells" (*þumalálnir*), these measurements have been taken to describe a textile 204.8 cm long and 102.4 cm wide (1962, 68). The description suggests that these cloaks were standardised to some extent for the trade market but it is not clear how much variation there actually was. The reference to "better quality cloaks" clearly suggests variation within the tradition, but *Grágás* gives no indication as to how the versions differed or why some were preferred over others.

Several archaeological textile finds have features corresponding to this description (fig. 1). In particular, two twill weave wool fragments from Heynes in south-west Iceland, dated 900 CE to 1100 CE, have locks of unspun fleece woven into the textile, creating a shaggy, fur-like surface (Guðjónsson 1962, 66–69). Similar examples of fleece pile textile have been found elsewhere, most notably in several key sites along early medieval trade routes including Dublin (Ireland), York (United Kingdom), Birka (Sweden), and the Isle of Man (United Kingdom) (Crowfoot, 1966, 80–81; Pritchard 1992, 93–98; Walton 1989, 336; Priest-Dorman 2001, 13). The precise construction techniques observed in these finds vary, and it is difficult to know whether they represent Icelandic exports, as there were contemporary pile textile traditions elsewhere, most notably in Ireland (Wincott Heckett 1992, 160–161; Guðjónsson 1962, 70–71; Priest-Dorman 2001, 8; Pritchard 1992, 98). Due to this uncertainty, this research focused primarily on the Heynes fragments and the *Grágás* description, as they are most likely to represent the Icelandic production tradition.

The purpose of pile cloaks

Vararfeldir are primarily presented as trade items in written sources from the period. *Heimskringla* describes entire shipments exported to Norway (Sturluson et al. 2011, 129) and *Grágás* sets out their value within the 'commodity-money' system of the time relative to silver and other trade goods such as furs, livestock and *vaðmál* (Dennis et al. 2000, 247; Hayeur Smith 2020, 56). Perhaps most significantly, *Grágás* specifies

Fig. 1: Archaeological finds of pile fabric from the north Atlantic region, including Heynes (Iceland) shown in red with similar finds in blue (data compiled from Guðjónsson 1962, 65-69; Priest-Dorman 2001, 9-14; Walton 1989, 336; Crowfoot 1949, 25; Crowfoot, 1966, 25, 80-81; Pritchard 1992, 93-98; Walton 1989, 336) (Image: Julia Hopkin, after Google Maps)

that *vararfeldir* could be used by Icelanders to pay taxes in Norway: "males … shall pay land dues, six trade-cloaks and six ells of homespun or half a mark of silver … when men come to an anchorage or to shore-moorings" (Dennis et al. 2000, 211). Sagas such as *Heimskringla* are likely to be subject to literary exaggeration, and may not accurately reflect the extent to which *vararfeldir* were traded. However, these legal references suggest that *vararfeldir* were in sufficient demand in both Iceland and Norway to be exchanged with the expectation that they would retain their value. The recipient would either be able to use the item him or herself or have confidence that there was a market in which to exchange them. Several different terms were used for pile cloaks but *Grágás* repeatedly refers to them as *vararfeldr* ("trade cloaks") which suggests that this economic role was an important way in which these cloaks were perceived. However, these references give little indication of how the final consumers of *vararfeldir* used them, making it difficult to understand why they were so in demand.

There are a few descriptions in Icelandic sagas of *vararfeldir* being worn but it is often not clear exactly why they were worn or how they were intended to function. Norwegian king Óláfr Tryggvason is described as wearing one on top of his "bad weather clothes" following a sea voyage (Sturluson et al. 2011, 166), which suggests it provided protection against the weather. Icelandic characters in *Njáls saga* and *Grettis saga* (Anonymous and DaSent 1861, chapter 22; Anonymous and Hight 1914, chapter 35) wear them as impromptu disguises. In *Heimskringla*, King Haraldr

"Greycloak" seems to wear one simply for novelty value (Sturluson et al. 2011, 129). These descriptions do not point to a single consistent use for *vararfeldir*, and the rarity of these references, along with the likelihood of artistic licence being used in saga narratives, makes it difficult to know how accurately they represent the ways *vararfeldir* were used in reality.

Previous academic interest in *vararfeldir* has focused on their role in the early Icelandic economy (Gelsinger 1981, 13, 69; Ingimundarson 1992, 219; Durrenberger 1992, 42; Hayeur Smith 2015, 25–26) or analysis of the construction details seen in the archaeological evidence (Guðjónsson 1962; Walton 1989, 336; Pritchard 1992, 95; Priest-Dorman 2001). Numerous reconstruction projects have provided insights into their visual appearance (Kløve Juuhl 2013; Hakonardottir et al. 2016, 180; Mader 2017; LaFleur 2017) but they have produced only limited documentation of their production choices, experiences of the production process, and the physical properties of the finished products.

Several studies have also included suggestions as to how and why *vararfeldir* could have been used but these have been hypothetical. The dominant idea has been that they were used as protective clothing in cold or wet weather, often based on comparisons with the uses of pile fabric in other contexts (Guðjónsson 1962, 70; Barber 1992, 149–150; Hayeur Smith 2020, 112): for example, written references indicate that the wool pile garments popular in Ireland from the 15th to 17th centuries CE were considered particularly effective against wet weather (Wincott Heckett 1992, 163–164). Many pile textiles, including *vararfeldir*, have also been repeatedly compared with fur or sheepskin, often being described as "fake fur", suggesting that their popularity was based on conceptual associations with similar materials (Gelsinger 1981, 13; Barber 1992, 183; Priest-Dorman 2001; Owen-Crocker 2004, 182; 9; Ewing 2009, 153; Mannering 2017, 177). While many of these ideas are very appealing in theory, no previously published investigation has studied the functions of *vararfeldir* in depth, experimentally tested how they function in practice or placed their functionality into the wider context of the time.

The experimental approach

This research aimed to provide more concrete information about how *vararfeldir* functioned, to help suggest why people created, traded, and used them, and understand how they fitted into the wider context of the early medieval north Atlantic world. As the scope of the project was limited by the time and budget of a masters dissertation, it was intended as a preliminary study, to provide initial insights into the properties and possible uses of *vararfeldir*, generate ideas that could be studied further in the future, and explore methodologies that could be of value to other investigations.

The question of why people in the past acted in the way they did is an easy and common question to ask but, in practice, can be deeply challenging to answer. The concept of technological choice frames people's actions as a series of conscious or subconscious choices between different methods of dealing with their situation (Lemonnier 1993, 2; Sillar and Tite 2000, 3, 11). This concept provided a key framework for developing the methodology for this project.

Research into technological choice has indicated that while functional considerations often seem to be the most obvious factors driving people's decisions, in many cases other priorities, such as social or conceptual factors, can be just as or even more important than practical ones – to the point where some choices and behaviours are actually counterproductive in a functional sense (Lemonnier 1993, 2; Olofsson et al. 2015, 76; Sillar and Tite 2000, 9). On this basis, it was important to avoid restricting the investigation to purely functional considerations. In particular, factors such as phenomenology and materiality were highlighted as particularly valuable when investigating clothing, which is so intimately connected with the human body (Harris 2014, 37; Joyce 2005, 147–149) and instrumental in mediating between the body, the environment, and people's actions within it (Gilligan 2010, 68; Cartwright 2015, 53). Phenomenology refers to how people experience objects through their senses (Thomas 2006, 2; Harris 2008, 84–85). Materiality considers the social and conceptual ways in which people interact with objects (Harris 2008, 82; Graves-Brown 2000, 1).

This project combined several methodologies in order for the investigation to consider the wide variety of possible factors and the context in which these choices were made. Controlled tests of reconstructed materials produced quantifiable data on their physical properties and insights into their functionality. Observations on the sensory qualities of the materials and the experience of producing them were made, but it was also a priority to include a wider range of viewpoints. A public consultation was also carried out, involving 60 people, to provide alternative perspectives on the materials' sensory and conceptual qualities, and generate new suggestions for factors to investigate in the future. Harris' experiments have demonstrated the potential of recording modern perceptions of archaeological cloth types for

generating new ideas and highlighting ones that have been previously overlooked (Harris 2008; 2010; 2014), and her method of conducting handling sessions followed by questionnaires formed the basis for the methods used in this experiment.

Investigations into technological choices have also emphasised that all stages of the item's life cycle, including production, consumption, re-use and disposal, can affect people's choices (Sillar and Tite 2000, 3-4). As previous experiments with *vararfeldir* have focused on their production, this research centred around their use, and how people interacted with them as consumers. Some insights were gained into their production process but it would be valuable to investigate this in more detail, along with other stages of their use lives, such as reuse and disposal, in the future. As Icelandic textile finds in general show a high level of reuse (Hayeur Smith 2020, 59) and the Heynes fragments themselves show signs of being altered or reused (Guðjónsson 1962, 67), these later stages of use are of particular significance to the understanding of how *vararfeldir* circulated and were consumed as household commodities as well as in their role as trade goods.

Contextualising *vararfeldir*

A core element of this investigation was the awareness that *vararfeldir* were just one option in a range of materials available at the time, and it was essential to consider this wider technological landscape to understand them in their original context.

Numerous textile types were available in this period but fabrics with pile were in the minority (Hayeur Smith 2015, 25; Andersson Strand 2015, 18). In records of the Icelandic textile trade, *vararfeldir* always appear secondary to *vaðmál* (standardised wool fabric) in terms of the quantities traded and their ubiquity as a trade and currency item (Hayeur Smith 2015, 23; Hayeur Smith 2020, 57–58). The demand for *vararfeldir* cannot be fully understood without acknowledging the predominance of non-pile fabric.

There is also plenty of written and archaeological evidence for extensive trading in furs and skins in early medieval Europe, including wild species such as fox, squirrel, marten and ermine, as well as sheepskins and other domestic animal products (Ericson et al.,1988, 85; Dennis et al. 2000, 207). In both *Grágás* and *The Voyage of Ohthere,* furs are used to represent wealth (Dennis et al. 2000, 207, 209; Fell and Lund 1984, 19-21), while in *Gunnlaugs saga ormstungu,* a fur-lined cloak serves an important sociopolitical role as a royal gift to a loyal retainer (Anonymous and Attwood 2015, 19). Furs also feature heavily in the descriptions of

Fig. 2: The project samples: wool fabric (1); dense pile fabric (2); less dense pile fabric (3); sheepskin proxy (4); and rabbit fur (5). The woven and skin samples measured approximately 29 cm x 23.5 cm and 16 cm x 15 cm respectively (Image: Julia Hopkin)

Norse exchanges with other groups, such as the taxes levied on Saami leaders in *Egils saga* (Anonymous and Scudder 2001, 20) and exchanges with indigenous communities in North America in *Eiríks saga rauða* (Anonymous and Kunz 2001, 670). This suggests that the trade in furs had deeper significance than simple economic benefits. As with pile cloaks, it is not always clear what furs were used for but since many of their possible functions and those of *vaðmál* are similar to those suggested for *vararfeldir*, their coexistence in exchange networks makes it difficult to imagine why the latter were so popular, and even more important to investigate them in their shared context.

In order to examine *vararfeldir*'s role in relation to these other materials, this project carried out the same experiments on small-scale samples of two types of reconstructed *vararfeldr* fabric (samples 2 and 3) and samples representing some of the main alternative materials available at the time: plain wool fabric (sample 1), sheepskin (sample 4), and fur (sample

Sample	Material
1	Wool textile without pile
2	Wool textile with dense pile based on the Heynes finds
3	Wool textile with less dense pile based on the *Grágás* description
4	Icelandic sheepskin proxy (fat tanned sheepskin with Icelandic fleece)
5	Rabbit fur

Table 1: Overview of the samples created for the project

5) (table 1, fig. 2). This direct comparison aimed at identifying ways in which *vararfeldir* may have been exceptional, and thus provide potential reasons for selecting them over other materials.

Methodology

Creating the samples

The woven textile samples (samples 1 to 3) were created by the author using a reconstructed warp-weighted loom (fig. 3). The woven samples measured approximately 29 cm x 23.5 cm with some slight variation (up to 0.5 cm larger or smaller). The fabric for all the samples was a 2/2 twill based on Guðjónsson's description of the Heynes fragments (1962, 66–67). This source gives only a vague description that the warp threads are finer and more tightly spun than the weft threads. For this reason, yarns with a similar thread count to the original fragments (table 2) were chosen. The yarns (Ístex Einband for the warp and Ístex Léttlopi for the weft) are commercial single-ply yarns spun from Icelandic wool. Commercial yarn was used owing to the limited time frame of the project but it also ensured greater consistency between the samples than would have been possible with handspun yarn, as well as ensuring that they can be replicated in future projects. The same fabric was created for all the samples, and they were woven on the same warp to ensure consistency. Pile was inserted into samples 2 and 3 during the weaving process to represent the fragments from Heynes and the cloaks described in *Grágás*. Details that are not mentioned in *Grágás* were made according to the Heynes fragments. The material used to create the pile in the Heynes fragments has not been subjected to microscopic

Fig. 3: The small-scale warp-weighted loom used to weave the textile samples (Image: Julia Hopkin)

Piece	Weave	Yarn thickness		Yarn twist		Thread count (per 1 cm)	
		Warp	Weft	Warp	Weft	Warp	Weft
Heynes 1 Large piece (Guðjónsson 1962, 66-67)	2/2 twill	"Comparatively fine"	"Coarse but rather uneven"	"Tightly spun" Z Single	"Slightly spun" S Single	9	4
Heynes 2 Small piece (Guðjónsson 1962, 66-67)	2/2 twill	"Coarser than warp in large piece"	Not recorded	"Less tightly spun than warp in large piece" Z Single	"Slightly spun" S Single	7	5
Sample 1 Plain fabric	2/2 twill	12 wraps per cm (Ístex Einband)	6 wraps per cm (Ístex Léttlopi)	70-80° Z Single	70-80° Z Single	8.6	5.5
Sample 2 Dense pile						9.25	5
Sample 3 Less dense pile						9	5.75

Table 2: Details of the woven samples 1 to 3 compared with Guðjónsson's description of the Heynes fragments (Guðjónsson 1962, 66-67)

Fig. 4: Detail of sample 3 (less dense pile fabric based on *Grágás*) showing a lock of fleece inserted under four threads in one shed, and looped around the final thread (left side) to form the pile structure (Image: Julia Hopkin)

analysis but Guðjónsson described it as most similar to the *tog* (outer coat) of Icelandic fleece (1962, 66). To create the samples for this project, individual locks of wool were separated from an Icelandic fleece, and the *thel* (undercoat) pulled out by hand, leaving only the *tog*, while keeping the lock structure intact.

The pile insertion method followed Guðjónsson's diagram of the Heynes fragments (1962, 20). One shed was opened, and a fleece lock passed from right to left beneath four threads, then looped back around to pass underneath the fourth thread again (fig. 4). A second shed was then opened in addition to the first. The main weft was passed, and weaving continued as usual for the next three weft passes. The finished fabric looked very similar to the original finds, with the pile forming distinctive loops on the front of the fabric, and no sign of the pile showing on the back (Guðjónsson 1962, 66–67). In both samples the pile was inserted into every fourth row, following the Heynes fragments, as *Grágás* only mentions the spacing of the locks in one direction.

The key difference between the samples was the spacing of the pile locks within each row. The spacing based on the Heynes fragments (sample 2) resulted in a very dense pile (fig. 5a), whereas sample 3 was based on a calculation from the *Grágás* description and turned out to be much less dense (fig. 5b, table 3) – a difference also noted by Guðjónsson (1962, 69). The difference is clearly visible in the samples, which led to a hypothesis that the denser cloaks might have been the "better" cloaks described in *Grágás*, as they used more wool, and seemed like they would be more functionally effective and visually appealing.

Creating small-scale samples does not give precisely the same experience as creating a full-scale

Fig. 5: Detail of the pile textile samples showing the visible difference between: a -sample 2 with the higher density pile based on the Heynes fragments; and b - the lower density of the pile in sample 3 based on the description in *Grágás* (Images: Julia Hopkin)

Piece	Frequency of pile rows	Spacing of pile within row	Interval between pile insertions within row (cm)	Number of warps pile is passed under (in one shed)	Number of warps between pile locks (in one shed)	Total warps per lock (all four sheds)
Heynes fragments (Guðjónsson 1962, 66-67)	Every 4 rows	Irregular	Unknown	4-8	Unknown	20 (approx.)
Grágás description (Dennis et al. 2000, 207)	Unknown	Unknown	7.87	Unknown	Unknown	Unknown
Sample 2 (Heynes)	Every 4 rows	Regular	1-1.2	4	2	24
Sample 3 (*Grágás*)	Every 4 rows	Irregular	7.5	4-5	18	Irregular

Table 3: The pile spacing used in project samples 2 to 3 compared with Guðjónsson's description of the Heynes fragments and calculations made from the details in *Grágás* (Guðjónsson 1962, 66-67; Dennis et al. 2000, 207)

reconstruction. Using commercial yarns meant that it was not possible to investigate the production stages prior to weaving. Nevertheless, producing the samples provided insights into the production processes for the different materials, including the time required to weave each sample and prepare the fleece for the pile, the quantity of wool used, and the experience of producing them for a modern-day maker.

The fur and skin samples were intended to represent types available in the early medieval north Atlantic. However, exactly matching the species was challenging, due to the difficulty in sourcing these materials and the risk of them being damaged during the practical tests. As Icelandic sheepskin was difficult to source, a proxy was created by sewing a section of Icelandic fleece to commercially produced fat-tanned sheepskin (chamois), thus closely mimicking the structure of an actual skin, while using the same type of fleece as used for the pile. The skin samples were irregular shapes due to the nature of the skins. The rabbit skin sample was approximately 29 cm x 20 cm wid, and the sheepskin proxy approximately 16 cm x 15 cm wide.

Fine fur from small mammals was also difficult to obtain. Fox and ermine furs were loaned for the public handling sessions (see below) but it was not possible to obtain furs from these species that could be damaged during the experiments using water. Rabbit fur was used as a proxy, as it was much more easily available for the purposes of these experiments. Although rabbit is not native to the north Atlantic region and was not commonly available in the area during the Early Medieval period, rabbit fur has a similar structure to other small mammals, with thin skin and fine, dense fur. Repeating the practical experiments using a wider range of early medieval fur and skin types should be a priority for future experiments.

Fig. 6: The equipment used for testing the samples' insulation properties, showing sample 1 with a heat pack inside, the uninsulated heat pack used as a control, and the dual probe thermometer used to measure the temperature of both heat packs from outside the refrigerator (Image: Julia Hopkin)

Testing the physical properties

A series of controlled experiments investigated the materials' physical properties. The experiments investigated a selection of key properties focusing on the possibility that they could have been used in cold or wet weather. More rigorous testing was not possible with the small-scale samples and limited equipment available.

The samples were first tested for their insulation properties. Each sample was folded in half and the edges sewn closed. A heat pack with a thermometer attached to it was placed inside (fig. 6). These were placed in a refrigerator for an hour with an uninsulated heat pack (also with a thermometer attached) as a control. The temperature of both heat packs was measured at five-minute intervals, allowing the total heat loss over the course of the hour to be calculated. This was repeated with the samples dry and fully saturated with water. For those with pile or fur, this was also repeated with the pile facing inwards and outwards.

To investigate their water resistance, each sample was attached to a thin layer of sponge and mounted on a wooden frame at an approximately 45° angle with buckets set up to catch any water that ran off (fig. 7). Tap water was sprayed onto each sample in increasing quantities representing different weather conditions (table 4). Each time, the quantity of water that completely ran off the sample, that was absorbed into the material itself, and that passed through the material and soaked into the sponge behind it was measured.

Following suggestions during the public consultation (see below), an additional test was conducted to investigate how long the samples took to dry. After each application of water during the water resistance test, the samples were hung up, and their weights recorded at 20-minute intervals for one hour. After the final test, all the samples were completely immersed in a bucket of water and weighed at regular intervals until they were fully dry, allowing a comparison of the maximum time required for drying. This was calculated by weighing the sample, bucket and sponge after the water had been applied, and subtracting the weight of all three when dry.

Fig. 7: The equipment used for the water resistance experiment showing sample 3 attached to a layer of foam, mounted at approximately 45˚ on a wooden frame, with a bucket placed underneath to collect water which ran off the sample (Image: Julia Hopkin)

Stage	Water level	Application method	Approximate water quantity (ml)	Distance from sample (cm)	Real world conditions represented
1	Light spray	Spray bottle, 20 sprays on a light setting	10	40	Brief light rain, sea spray
2	Medium spray	Spray bottle, 50 sprays on a stronger setting	20-30	40	Brief medium rain, heavy splash
3	Heavy soaking	2x 5 second bursts from a watering can	100	10	Brief very heavy rain, drenching from a large wave
4	Full saturation	Immersed in a bucket of water	n/a	n/a	Full immersion in a large body of water

Table 4: The stages of water application used in the water resistance and drying experiments

Collecting alternative perspectives

It was possible to observe the sensory qualities of the materials while creating and preparing the samples. To quantify these observations and allow comparisons of these qualities at different stages of use, each sample was rated on a numbered scale for a range of sensory qualities. This was carried out both before and after the practical testing enabling a basic comparison of how they changed during use. Repeating this survey with more participants would provide a more comprehensive view of the materials' sensory qualities. The logistics of the public consultation meant it was not possible to use this approach on a larger scale in this project but it should be a priority for future investigations.

The public consultation took place during the Viking Market at Fotevikens Museum (Sweden) in June 2019, and included 60 participants, including experts in textile and tanning technologies, craftspeople, reenactors, and the visiting public. The participants represented a wide range of ages, genders, and cultural backgrounds. The participants handled the samples and were asked a series of structured questions about their sensory experiences and the factors that they would consider when deciding how to use the materials. The participants were all asked the same questions so that their answers could be compared and the frequency of key ideas measured. Many participants also contributed additional ideas and comments. These responses could not be quantified but provided valuable anecdotal insights into the complexities of real-world usage.

Findings and discussion

Physical properties

Analysing the data together revealed new insights into the functionality of these materials. One of the most striking results of the practical experiments was that the pile textile samples did not stand out as notably more effective than the other materials during either the insulation or water resistance tests. When the samples were dry, the pile textile samples were slightly better insulators than the plain fabric, but were less insulating than the sheepskin sample, and broadly similar to the fur sample (fig. 8). In the water resistance tests, the fur was consistently most effective at shedding water (fig. 9). Neither of the pile textiles allowed water to entirely penetrate through, as the plain fabric did when fully drenched. They soaked up water rather than shedding it, particularly when larger quantities of water were added. In terms of these most straightforward aspects of insulation and water protection, *vararfeldir* do not seem to have been the optimal material available. This makes it unlikely that the dry insulation or water resistance properties of *vararfeldir* would have been enough to generate demand on their own and suggests that other factors were responsible.

However, the pile textile samples stood out in other areas. In particular, the heat retention of the samples changed drastically when they were wet. The skin samples were noticeably less insulating wet than dry, with the rabbit fur becoming colder than the uninsulated heat pack, suggesting it was actively leaching warmth away from the heat source. In

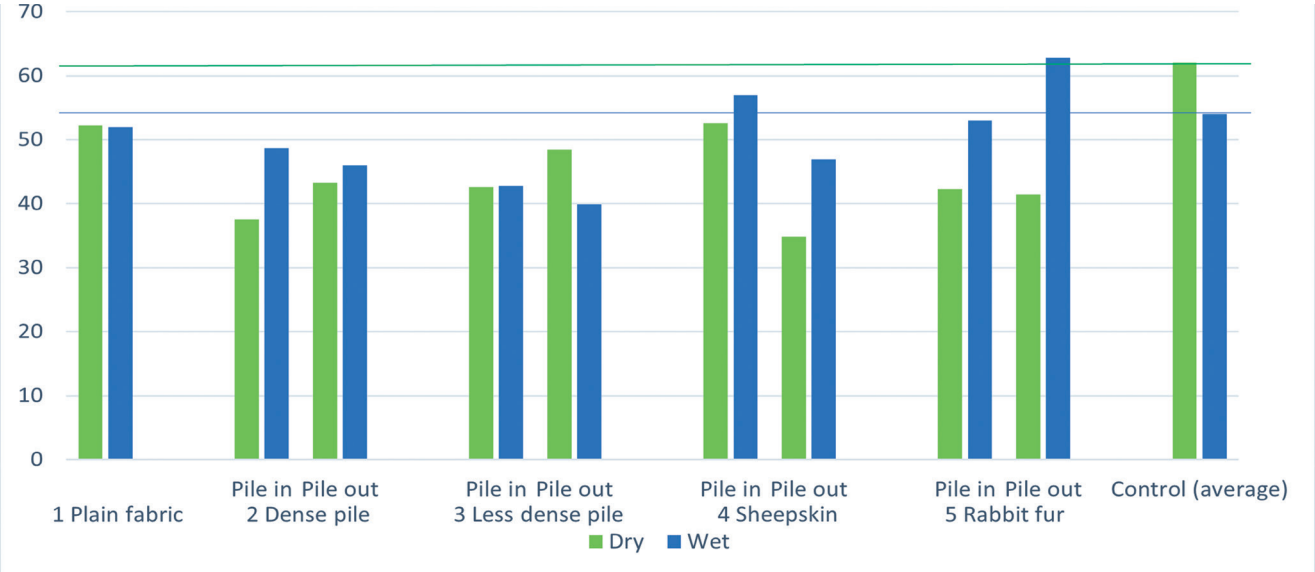


Fig. 8: Results from the insulation test showing the total heat loss (°C) from all the samples after one hour in a refrigerator (Image: Julia Hopkin)

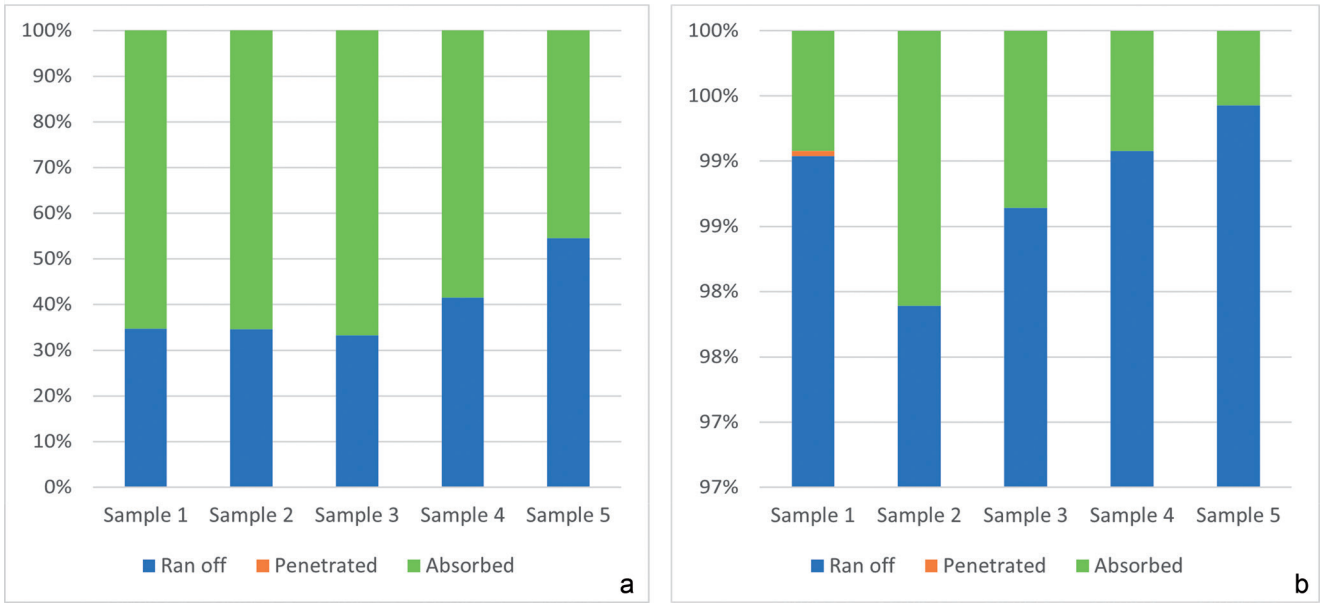


Fig. 9: Results from the water resistance tests showing the proportion of water which ran off, penetrated, and was absorbed by each sample following application of water using: a – medium spray; and b – heavy soaking. Note that different scales have been used for each (Images: Julia Hopkin)

comparison, the pile fabric samples were more consistent between wet and dry insulation, with the less dense pile fabric retaining the most heat overall when wet. Plain fabric was fairly consistent between wet and dry but retained less heat than the pile textile samples in both tests. It was also noticeable that in wet conditions the pile fabric samples were more effective insulators with the pile facing out, which may also have been a more suitable arrangement for resisting water. These advantages in cold, wet conditions are particularly notable in the context of Hayeur Smith's observation that pile fabrics are more frequently found in Greenlandic contexts than Icelandic ones, which could represent adaptations to colder climates (Hayeur Smith 2020, 112).

The drying experiments provided an added dimension to these observations. The fur consistently dried fastest after water was sprayed or poured onto the surface, as it was most effective at shedding water (fig. 10a). However, after full saturation, the fur was comparable

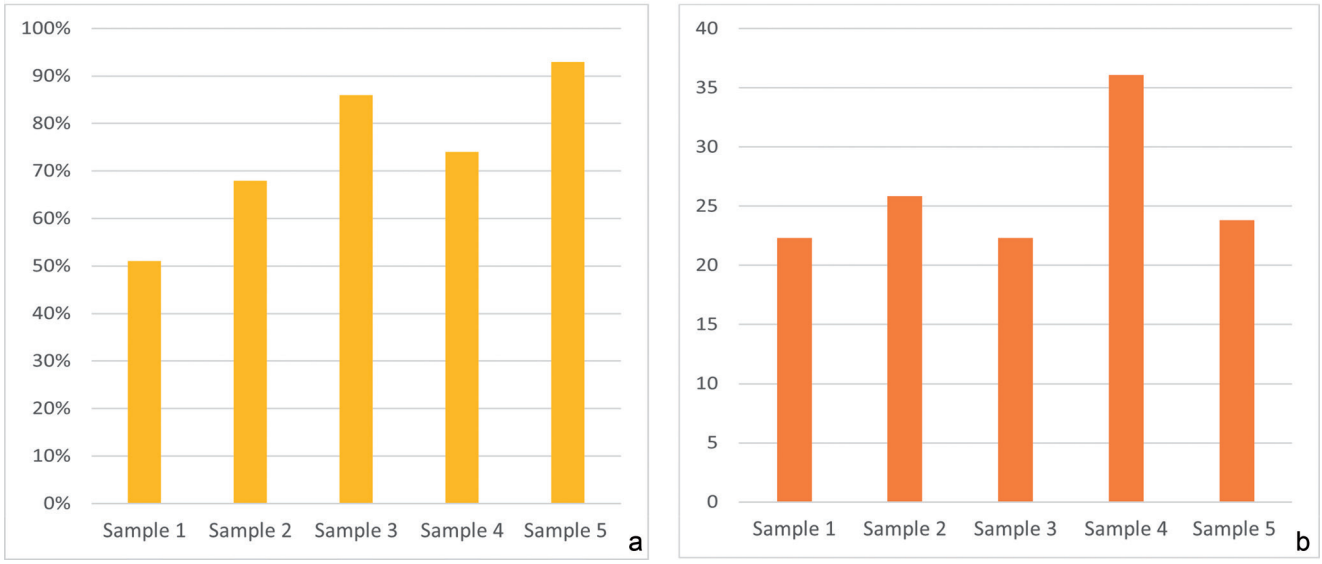


Fig. 10: Results from the drying tests showing: a - the percentage of water absorbed during the medium spray water application which had dried after an hour; and b - the maximum number of hours required for each sample to dry after full saturation(Images: Julia Hopkin)

Sample	Production process	Insulation		Water resistance	Drying (from full saturation)
		Dry	Wet		
1 Plain fabric	Fastest production	Least insulating	Less insulating than pile samples, similar to when dry	Moderate ability to shed water, but allowed water to penetrate during heavy soaking	Fastest at drying, equal to less dense pile
2 Dense pile	Weaving much slower than plain fabric, slowest pile preparation. More flexible process than fur	Moderately insulating, more insulating than less dense pile	Slightly less insulating than less dense pile	Least successful at shedding water but did not allow water to penetrate	Moderate drying speed, slower than rabbit fur
3 Less dense pile	Weaving slightly slower than dense pile, pile preparation much faster. More flexible process than fur	Moderately insulating, less insulating than dense pile	Most insulating	Moderately successful at shedding water	Fastest at drying, equal to plain fabric
4 Sheepskin	Speed not recorded, less flexible process	Most insulating	Slightly more insulating than rabbit fur but still poor insulation	More successful at shedding water than pile samples	Considerably slower than other materials
5 Rabbit fur	Speed not recorded, less flexible process	Moderately insulating	Least insulating and actively leaching heat	Most successful at shedding water	Moderate drying speed, faster than dense pile

Table 5: Summary of the physical properties of the samples according to the experiments with the best performing sample in each experiment in green and the worst performing in red

to the other samples (fig. 10b). The sheepskin took by far the longest to dry. Significantly, although the pile fabrics were expected to dry more slowly than the plain fabric, the less dense pile fabric was consistently more effective than plain fabric at drying surface water, and equally effective at drying from full saturation.

Comparing the materials' sensory qualities before and after water exposure revealed that both skin-based samples changed after water exposure, becoming stiffer with a rougher texture, and noisier when moving. These changes would make the skin-based materials much less suitable than the others in wear unless additional maintenance (such as resoftening) was carried out. However, the pile materials did not show any major sensory changes. This ability to dry more quickly and be wearable after water exposure without additional maintenance could have been a key advantage of pile textiles over skin materials. Notably, these results have a parallel in anecdotal evidence of 19th century Swedish and Finnish fishermen using rag or yarn-pile rugs rather than skins as blankets while sleeping in their boats, as they provided insulation and water protection without becoming stiff after drying (Nordic Homecraft 2013). This suggests that

these factors can be sufficient to influence real-world technological choices.

Following these tests, pile fabric does not seem to have been the single most insulating or water-resistant material available at the time. However, it appears to be more insulating than plain fabric. Its properties of insulating well while wet, drying quickly and not requiring additional maintenance after use in wet conditions set it apart from skin-based materials. Combining the results from these experiments (table 5) suggests that *vararfeldir* may indeed have been the most functionally effective choice for wearing as protective clothing in very wet conditions but for more complex reasons than previously assumed. This fits well with the description of Óláfr Tryggvason wearing a pile cloak during an ocean voyage (Sturluson et al. 2011, 166), while giving new perspectives on why people might have chosen to wear them in that context, and deeper insights into the experiences they might have had while doing so.

Pile density

Comparing the two different types of pile textile also provided new insights into the reference in *Grágás* that some cloaks were of "better quality" than others (Dennis et al. 2000, 207), and the hypothesis that this could have referred to cloaks with denser pile, such as the fragments uncovered at Heynes. Pile density did have a noticeable impact on the results in the practical experiments but, surprisingly, the denser pile fabric was not always more functionally effective than the less dense version. It was more insulating when dry and less insulating when wet, and it tended to absorb more water and become heavier than the less dense pile fabric, as well as drying a lot more slowly. It seems unlikely then, that denser pile cloaks would have been regarded as functionally better if their main purpose was use in wet conditions.

This could mean that this idea of "better" cloaks referred to less dense pile fabric, or cloaks with features that made them more functionally effective in other ways. It is possible that these differences in density represent specialised materials designed for specific purposes. However, it is also possible that "better" simply did not refer to functionality. Denser cloaks could have been worn for non-functional reasons which outweighed their practical limitations in wet conditions, such as the quantity of raw materials they required, preferences relating to their visual appearance, or other conceptual factors. This concept of "better" could have been based on these non-functional factors. While this evidence does not give any further indication about which factors were most important, or what type of pile was preferred, investigating these materials further, and reconsidering this concept of "better", could help develop a deeper understanding of the wider priorities and attitudes of this society.

The production process

Although it was not the main focus of this research, it was possible to observe and compare the different production processes for the various materials while producing the samples. As expected, the pile materials took considerably longer to produce than the plain textile, especially when the length of time required to prepare the fleece locks by pulling them from the fleece and separating the *tog* and *thel* is also considered (table 6). Although the production methods used did not allow for a comparison between the time required to produce the textile and skin-based samples, it was noticeable that the pile fabric gave a lot more flexibility to produce a wide range of different materials. Unlike the skin-based samples, it was possible to choose to use only specific sections of the fleece, and control how they were arranged in the pile by altering the density or making decorative patterns. As previously discussed, the density of the pile made a clear difference to the fabric's physical properties, and having this control over the finished result would have given the original

Sample	Average time to weave 1 cm (mins)	Average time to prepare fleece for one pile row (mins)	Total length (cm)	Total width (cm)
1 Plain fabric	14.9	0	28.5-30	23.5-24
2 Dense pile	18.3	18.3	29-29.5	23
3 Less dense pile	19.3	6.5	29	24

Table 6: Time required to produce the textile samples 1 to 3

producers considerable flexibility to make a material that suited their practical needs or the resources they had available, as well as aesthetic preferences. Pile fabric with decorative patterns is represented in at least one early medieval archaeological example - a striped pile fabric with alternating rows of red and blue dyed fleece from Birka (Sweden) (Priest-Dorman 2001, 13). Guðjónsson also mentions sources describing a variety of more complex fabrics, including striped pile and fabric with pile on both sides (Guðjónsson 1962, 69). These examples indicate that some producers of the period did take advantage of their ability to manipulate the features of pile fabric, and this flexibility could well have been a reason for people choosing to use pile textiles over furs.

Non-functional factors

The numerous different perspectives collected during the public consultation further emphasised the many complex factors that could have influenced people's material choices.

Fleece pile fabrics were new to all the participants. However, they all had opinions on how well the materials would work, and how they would use them, and many of these opinions were complicated and strongly held. These opinions could only have been based on immediate sensory experiences along with the participants' preconceptions and other associations. This emphasises the potency of these sensory and conceptual factors in informing technological choices and highlights the importance of investigating these factors in more depth in the future.

One of the main reasons for comparing *vararfeldir* with skin-based materials was the well-established assumption that pile fabric was used because of its similarity to sheepskin or fur. During the consultation, 22 participants mentioned this factor, but while 16 of those people thought they were similar, the other six thought they were completely different, and there were numerous different opinions about whether or not similarity would be a benefit. Some participants thought the *vararfeldir* samples were good imitations of sheepskin, with added practical benefits, while others saw them as similar but not enough to be convincing, and some even found them unpleasant or uncomfortable to look at. At the same time, several participants preferred the less dense pile fabric, as the unique pile structure was more obvious, and they thought the denser pile fabric was less interesting or valuable as it looked too similar to sheepskin, which they viewed as cheaper and less unique. This wide range of opinions emphasises the subjectivity of these associations between materials, and how even people with similar perceptions can respond and behave in very different, and sometimes unexpected ways. It seems that more caution is needed before assuming that *vararfeldir* were valued because of a straightforward similarity with furs or sheepskin, as these associations can vary significantly, even in a relatively small group of modern people.

The results of these experiments also highlighted the subtlety of the factors behind technological choices, and how easily they can be overlooked by limited methodologies. The properties that appeared to set *vararfeldir* apart from the other materials during the controlled experiments were very subtle, only observable in combination and with an awareness of the complex needs of using them in a real environment. The drying properties of materials used in wet conditions has not previously been considered in discussions of *vararfeldir*, and it was not part of the original plan for the experiments. It was added following suggestions from consultation participants who had prior experience of using similar materials in wet conditions and the results proved to be very insightful. This emphasises the value of engaging numerous perspectives to help inform experimental methodologies. It highlights the importance of including communities with practical expertise, who bring attention to the nuances of real-world usage that can easily go unrecognised in academic contexts, and be overlooked in experimental projects, especially where realistic testing is not possible.

Further considerations

Several suggestions for developing these experiments further have already been mentioned, particularly carrying out more detailed sensory surveys with multiple participants, comparing pile materials with a wider variety of skin and fur types evidenced in the period, and developing the practical experiments though more realistic testing, by, for example using full-scale reconstructions in real weather conditions. Realistic experiments would also be particularly valuable in investigating how different properties would work in combination with each other, and suggesting other factors that might only become apparent in the complexities of the real-world environment.

Opening up the discussion through the public consultation also generated numerous new ideas for factors to investigate in future experiments. In addition to the materials' drying properties, these suggestions included wind resistance, how long the materials would be useable, and the impact of lanolin or other surface coatings, as well as more complex ideas such

as how small they could be compacted for travelling, their cushioning potential for sleeping or sitting on, the bulk they would add to a person's appearance, and their potential for reuse. The idea of multipurpose materials has particular relevance when considering the signs of alteration or reuse found in the Heynes fragments, which were sewn together, with additional yarn loops attached (Guðjónsson 1962, 66–67), and the high degree of cloth recycling observed in north Atlantic textile assemblages (Hayeur Smith 2020, 59, 161). It would be very valuable to consider these later stages of a *vararfeldr*'s use life in more depth.

Several results from this experiment would also benefit from wider contextual investigation: for example, adding the pile locks to the experimental samples represented a significant investment of resources including the time required to prepare fleece for the pile. However, the impact of this must be considered in the wider context of fibre preparation for textile production. There is evidence that the undercoat and outer coat of the fleece were routinely separated and used for different purposes in this period (Hayeur Smith 2020), which would mean that adding pile consisting only of outer coat would not represent as much of an additional investment of time and resources as it might initially appear. Similarly, it is tempting to view woven pile fabric as a less costly, and more sustainable alternative to sheepskin, as it did not require the animal to be killed. However, the relative value of these materials would have been very dependent on the farming practices of the time. Conceptual factors, such as which materials were more of a novelty, would also have been heavily influenced by the distribution of pile textile production, the number of people capable of producing it, and the availability of fur (which was dependent on species distribution and local hunting practices). All of these need much broader investigation to understand fully.

Conclusion

By taking a broad, contextualised approach, this research has developed new knowledge about the properties of *vararfeldir* in their wider context and begun to shed light on why these cloaks might have been so much in demand.

The investigation of their physical properties has suggested that *vararfeldir* could have been chosen for their exceptional suitability for use in wet weather but for very different reasons than had previously been assumed. Producing the samples for the project highlighted the flexibility afforded by their production process, and the ability to produce a range of different practical or decorative features.

Consulting a wide range of perspectives highlighted the complexity of the factors that can influence technological choice, provided numerous alternatives to a simple functional explanation, and challenged the traditional assumption that the appeal of *vararfeldir* was necessarily related to their similarity to sheepskin or fur.

These results have broader implications for the understanding of the early medieval world. Comparing different densities of pile fabric has enabled reflections on the intriguing statement in *Grágás* that some cloaks were preferable to others and suggested that this may not represent a straightforward functional assessment but could reveal more complex societal priorities.

Numerous practical and sensory properties, possible ways of using *vararfeldir*, and contextual considerations have also been suggested, providing many avenues for future research. While a comprehensive understanding of how and why *vararfeldir* were used remains a long way off, this investigation has deepened understanding of the factors that may have contributed to it, and provided a stronger evidence base on which to build future investigations.

The key to the depth and range of this project's impact was its contextualised, multistranded experimental approach. By placing pile textiles in the context of other materials that might have been used alongside them, supplementing controlled testing with sensory observations and perspectives from numerous participants, considering non-functional factors, and building on the expertise of experienced communities, the experiments provided a wide range of insights, enabling the archaeological and documentary evidence to be viewed in a new way.

Investigating *vararfeldir* as just one part of an interconnected textile landscape has expanded the understanding of societal forces in which these textiles were embedded, from people's practical needs, social preferences and day-to-day experiences, to available resources, competing materials, the unique environmental requirements of communities around the north Atlantic, and the vast trade networks that united them. Far from simply providing details of one unique type of textile, these results have demonstrated the potential of holistic, contextualised methodologies to transform understanding of textiles and the societies that produced and used them.

Acknowledgements

The author would like to thank Fotevikens Museum, Höllviken (Sweden), for providing the location for the survey, all the survey participants, and the many others who contributed their invaluable perspectives.

Bibliography

Andersson Strand, E. (2015) Textile production, organisation and theoretical perspectives on trade in the Scandinavian Viking Age. In A. L. Huang and C. Jahnke (eds), *Textiles and the Medieval Economy: Production, Trade and Consumption of Textiles, 8th-16th Centuries.* Oxford: Oxbow Books, 8–22.

Anonymous and Attwood, K. C. (2015) *The Saga of Gunnlaug Serpent-tongue.* London: Penguin Classics.

Anonymous and Kunz, K. (2001) Eirik the Red's Saga. In Ö. Thorsson and B. Scudder (eds), *The Sagas of Icelanders*. London: Penguin Books, 653–676.

Anonymous and Scudder, B. (2001) Egil's Saga. In Ö. Thorsson and B. Scudder (eds), *The Sagas of Icelanders*. London: Penguin Books, 3–184.

Barber, E. J. W. (1992) *Prehistoric Textiles: the Development of Cloth in the Neolithic and Bronze Ages, with Special Reference to the Aegean.* Princeton: Princeton University Press.

Cartwright, B. H. J. (2015) *Making the Cloth That Binds Us: the Role of Spinning and Weaving in Crafting the Communities of Viking Age Atlantic Scotland (AD c. 600–1400)*. Ph.D. thesis, University of Cambridge.

Crowfoot, G. (1949) Textiles from a Viking Grave at Kildonan on the Isle of Eigg. *Proceedings of the Society of Antiquaries of Scotland* 83, 24–28.

Crowfoot, G. (1966) Report written 1947. In G. Bersu and D. M. Wilson (eds), *Three Viking Graves in the Isle of Man. Medieval Archaeology Monograph Series 1.* London: The Society for Medieval Archaeology, 80–83.

Dennis, A., Foot, P., and Perkins, R. (2000) *Laws of Early Iceland: The Codex Regius of Grágás, with Material from Other Manuscripts, vol.* 2. Winnipeg: The University of Manitoba Press.

Durrenberger, E. P. (1992) *The Dynamics of Medieval Iceland: Political Economy and Literature.* Iowa City: University of Iowa Press.

Ericson, P. G. P., Iregren, E. and Vretemark, M. (1988) Animal exploitation at Birka – a preliminary report. *Fornvännen* 83, 81–88.

Ewing, T. (2009) *Viking Clothing*. Stroud: The History Press.

Fell, C. E. and Lund, N. (1984) *Two Voyages At the Court of King Alfred: The Ventures of Ohthere and Wulfstan Together with the Description of Northern Europe from the "Old English Orosius".* York: Sessions.

Gelsinger, B. (1981) *Icelandic Enterprise, Commerce and Economy in the Middle Ages*. Columbia: University of South Carolina Press.

Gilligan, I. (2010) The Prehistoric development of clothing: archaeological implications of a thermal model. *Journal of Archaeological Method and Theory* 17(1), 15–80.

Graves-Brown, P. M. (2000) Introduction. In P. M. Graves-Brown (ed), *Matter, Materiality and Modern Culture*. London: Routledge, 1–9.

Guðjónsson, E. E. (1962) Forn röggvarvefnaður. Árbók *Hins Íslenzka Fornleifafélags* 59, 12–71.

Hakonardottir, H., Johnston, E., Kløve Juul, M., Andersen, R. and Ove Martinussen, A. (2016) *The Warp-Weighted Loom: Kljásteinavefstadurinn Oppstadveven.* Leikanger: Skald.

Harris, S. (2008) Exploring the materiality of prehistoric cloth-types. In P. Cunningham, J. Heeb and R. Paardekooper (eds), *Experiencing Archaeology by Experiment, Proceedings of the Experimental Archaeology Conference, Exeter 2007.* Oxford: Oxbow Books, 81–102.

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.

Harris, S. (2014) Sensible dress: the sight, sound, smell and touch of late Ertebølle Mesolithic cloth types. *Cambridge Archaeological Journal* 24(1), 37–56.

Hayeur Smith, M. (2015) Weaving wealth: cloth and trade in Viking Age and Medieval Iceland. In A. L. Huang and C. Jahnke (eds), *Textiles and the Medieval Economy: Production, Trade and Consumption of Textiles, 8th-16th Centuries.* Oxford: Oxbow Books, 23–40.

Hayeur Smith, M. (2020) *The Valkyries' Loom: The Archaeology of Cloth Production and Female Power in the North Atlantic*. Gainesville: University Press of Florida.

Ingimundarson, J. H. (1992) Spinning goods and tales: market, subsistence and literary productions. In G. Pálsson (ed), *From Sagas to Society: Comparative Approaches to Early Iceland.* Enfield Lock: Hisarlik Press, 218–230.

Joyce, R. A. (2005) Archaeology of the body. *Annual Review of Anthropology* 34, 139–158.

Lemonnier, P. (1993) Introduction. In P. Lemonnier (ed), *Technological Choices: Transformations in Material Cultures Since the Neolithic*. Abingdon: Routledge, 1–5.

Mannering, U. (2017) *Iconic Costumes, Scandinavian Late Iron Age Costume Iconography.* Oxford: Oxbow Books.

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: Textile Production in the Aegean and Eastern Mediterranean Bronze Age*. Oxford: Oxbow Books, 75–100.

Owen-Crocker, G. R. (2004) *Dress in Anglo-Saxon England.* 2nd ed. Woodbridge: The Boydell Press.

Priest-Dorman, C. (2001) Trade cloaks: Icelandic supplementary weft pile textiles. In N. McKenna (ed), *Medieval Textiles* 28, 8–14.

Pritchard, F. (1992) Aspects of the wool textiles from Viking

Age Dublin. In L. Bender Jørgensen and E. Munksgaard (eds), *Archaeological Textiles in Northern Europe: Report from the 4th NESAT Symposium 1.–5. May 1990 in Copenhagen, Tidens Tand 5.* Copenhagen: Det Kongelige Danske Kunstakademi, 93–104.

Sillar, B. and Tite, M. S. (2000) The challenge of 'technological choices' for materials science approaches in archaeology. *Archaeometry* 42, 2–20.

Sturluson, S., Findlay, A. and Faulkes, A. (2011) *Heimskringla Vol. 1 The Beginnings to* Óláfr *Tryggvason.* London: Viking Society for Northern Research.

Thomas, J. (2006) Phenomenology and material culture. In C. Tilley, W. Keane, S. Küchler, M. Rowlands and P. Spyer (eds), *Handbook of Material Culture.* London: SAGE Publications Ltd., 43–59.

Walton, P. (1989) *Textiles, Cordage and Raw Fibre from 16–22 Coppergate: The Archaeology of York: The Small Finds 17/5.* London: Council for British Archaeology.

Wincott Heckett, E. (1992) An Irish "shaggy pile" fabric of the 16th century – an insular survival? In L. Bender Jørgensen and E. Munksgaard (eds), *Tidens Tand 5, Archaeological Textiles in Northern Europe, Report from the 4th NESAT Symposium 1–5 May 1990 in Copenhagen.* Copenhagen: Det Kongelige danske kunstakademi, 158–168.

Internet sources

Anonymous and DaSent, G. W. (1861) The Story of Burnt Njal. In S. Thordarson (ed), Icelandic Saga Database https://www.sagadb.org/brennu-njals_saga.en (accessed 29 July 2021)

Anonymous and Hight, G. H. (1914) Grettir's Saga. In S. Thordarson (ed), Icelandic Saga Database https://sagadb.org/grettis_saga.en2 (accessed 29 July 2021)

Kløve Juuhl, M. (2013) Varafeldur: an Icelandic rya reconstruction. In Norwegian Textile Letter https://norwegiantextileletter.com/article/96/ (accessed 29 July 2021)

LaFleur, R. (2017) Finally, a varafeldur, 2017. In Robbie LaFleur https://robbielafleur.com/2017/05/01/finally-a-varafeldur-2017/ (accessed 29 July 2021)

Mader, M. (2017) Reproducing a vararfeldur. In Northern Women Arts Collaborative https://northernwomen.org/2017/03/11/864/ (accessed 29 July 2021)

Nordic Homecraft (2013) In Search of Bed Rugs and Boat Rya http://nordichomecraft.blogspot.com/2013/02/in-search-of-bed-rugs-and-boat-rya.html (accessed 29 July 2021)

Author:
jh1010@exeter.ac.uk

Marianne Vedeler

Golden textiles from Gokstad

Abstract
Viking Age textiles with interwoven gold threads are rare in Scandinavia. Two such textiles were found in a Viking ship grave at Gokstad in Norway. Apart from brief overviews, the materials, techniques and find context of these textiles have not been described in detail before. The silk and gold embroidery was made with stem-stitch and simple laid-work. A madder-dyed silk thread was used to make the flower pattern, in combination with a thread consisting of 80% pure gold lamella with a core of silk. A similar gold thread was used in a narrow band found with the embroidery. The 4 mm to 4.5 mm wide band is probably a remnant of tablet weaving. Both embroidery and band were found hidden inside a hollow ridgepole holding up the roof of a grave chamber. The precious gold and silk materials and the time-consuming and specialised technology used to make the gold thread suggests that these textiles were very valuable.

Keywords Viking Age, embroidery, tablet weave, gold threads

Introduction

The renowned Viking ship grave from Gokstad in Norway was discovered in 1880 and first published in 1882 (Nicolaysen 1882). The man's grave, dating from about the year 900 CE (Bonde and Christensen 1993) revealed a variety of finds, including a very well-preserved Viking ship. The various textiles found in the grave have received little attention, apart from two articles summarising them and presenting an overview which date back to 1973 and 1988 (Hougen 1973; Ingstad 1988). This paper focuses on the materials, techniques and find context of an unparalleled embroidery and a golden band found at Gokstad.

A peculiar find context

Two textiles with gold lamella were found inside a burial chamber raised on the deck of the Viking ship. The timbered chamber was shaped like a tent, with a thick oak ridgepole running along the centre of the roof (fig. 1). The rafters were fixed to this horizontal beam, which was the highest point of the chamber (fig. 2). When the excavator, Nicolay Nicolaysen, and his team were about to remove this heavy ridgepole, it parted lengthwise into two equal sections. The massive tree trunk had been deliberately cut lengthwise, hollowed

Fig. 1: The Gokstad burial chamber as shown in The Viking Ship Museum (MCH) at Bygdøy, Oslo, Norway until 2021 (Image: Kirsten Helgeland, Museum of Cultural History, University of Oslo)

Fig. 2: The hollow ridgepole holding the heavy roof of the chamber roof (Image: Marianne Vedeler)

out and put together again, before it was raised in the chamber. Hidden from sight, inside the two sections, were blue clay and what would prove to be one of the Gokstad burial's greatest treasures (Nicolaysen 1882, 48). One half of the ridgepole revealed exquisite textiles in silk and gold threads of which one was an embroidery so far without close parallels. The other half contained the remains of a band made of gold-wrapped thread.

In the museum catalogue, written in 1881, the gold textiles are described as: 'Lumps of clay-mixed cloth that has been inter-woven with gold thread. On account of its current state, the only thing to be said is that it has been very fine and of dark color' (Nicolaysen 1882, museum number C10459). Unfortunately, only very few fragments of the underlying textile described as a fine cloth of dark colour are preserved (fig. 3). However, the techniques, materials, function and provenience of the golden textiles may provide useful information for an interpretation as to why the textiles were hidden in this location.

Embroidery

The embroidery is small, measuring approximately 2.8 cm x 3 cm. The motif is floral, made up of two circles, one inside the other, that are punctuated by smaller flower shapes (fig. 4). Combinations of stem-stitch and simple laid-work have been used to make the pattern. Laid-work is formed by laying one or more threads on the fabric and sewing over them at intervals with another thread to secure them in place. By using this technique, most of the precious metal will be visible on the surface of the embroidery. This is a technique that was commonly used in Chinese metal thread embroideries in this period (pers. com. Yarong 2013) However, it is also present in embroideries with gold found in the Valsgärde boat graves in Sweden, dating to the tenth century CE and in embroideries without metal thread found at the Oseberg ship grave from Norway dating to the early ninth century CE (Nockert 2006, 325). Embroideries with metal in laid-work are also present in several other Scandinavian artworks from the later Middle Ages (Franzén and Nockert 2012, 42).

In the Gokstad embroidery, a gold-wrapped silk thread has been used in combination with threads of pure silk (Skals 2015). The high-quality materials used emphasise the high status of the grave for an elite member of Norse society. In sections of the embroidery, two gold threads lie parallel but are sewn separately with simple laid-work. Traces of red colour can be seen on the s-spun silk thread used to stitch down the gold lamella. There is approximately 1 mm between the couching stitches in the laid-work. An s-spun silk thread has also been used to form the stem-stitch contours of the flower pattern.

Two samples of silk thread have been analysed for dye. A high-performance liquid chromatography (HPLC) coupled to a diode array detector (DAD) was used. When the embroidery was studied in a simple stereo loupe, two colours were visible. One was a faint red colour and the other what seemed to be a golden colour. When the two samples were analysed, results showed that both samples had a very similar composition, consisting of alizarin purpurin, pseudopurpurin, and anthragallol. These are markers of madder dyestuff. But the quantity of alizarin and anthragallol turned

Fig. 3: Box containing remains of clay and fibres. A wool fibre was found here with one of the gold threads. The original museum label states "Remains of gold in-woven cloth" (Image: Marianne Vedeler)

Fig. 4: Gold and silk embroidery found inside the ridgepole (Image: Ellen Cathrine Holte, Museum of Cultural History, University of Oslo)

out to be much higher in the golden than in the red sample. The differing quantities of these components suggest that different recipes were employed to obtain different colours on the thread (Łucejko et al. 2021, 2284).

Madder can produce a wide range of colours from yellow and orange to scarlet red and almost brown (Eastaugh et al. 2008, 250). It is therefore difficult to know exactly what tint the embroidery once had but it is probable that it was made in two shades of red in combination with the gold thread.

The embroidered floral pattern does not have any near parallels in Nordic finds. Stem-stitch and laid-work were used in silk embroideries from the ninth century CE Oseberg grave but the patterns in these embroideries are either animals enclosed in medallions, geometrical patterns, crosses or a combination of animals and leaf vines (Nockert 2006, 325–337). Stem-stitch was also one of the techniques used in the wool embroideries found at Bjerringhøj/Mammen in Denmark dated to the late tenth century CE. However, no similar flower-patterns were identified. Instead, there are masks, animals and various acanthus leaves (Hald 1950). Embroideries detected in one of the two tenth century CE boat graves from Valsgärde in Sweden revealed a pattern of foliate derivation (Graham-Campbell 1980, 102).

Gold band

The other textile found inside the roof beam was a narrow band, approximately 4 mm to 4.5 mm wide and made with gold lamella (fig. 5). Five strips of the band were recorded, measuring 63.1 cm in length. It is probably remnants of a tablet-woven band, but only the weft threads of gold remain. The lamella is made of narrow strips, about 0.4 mm to 0.5 mm wide. These were wound in an S-twisted spiral around a core, which is now missing. The core was probably made of silk, as is the core of the gold thread used for the embroidery. The band also once had a warp made of another material which is now lost. Only the metal threads in the weft are preserved. It is therefore not possible to reconstruct the precise pattern or the exact weaving technique used or even be sure it was made with tablets. However, there are several features which suggest that the Gokstad band is the remains of a tablet weave.

The tablets used in tablet weaving are usually square-shaped frames made from antler, bone or wood. These simple, punctured frames provide a surprisingly wide variety of technical opportunities. Although relatively few bands with metal thread dating to the Viking Age have been found, a variety of tablet-woven bands made of wool are preserved (Geijer 1938; Hald 1950, 227–242; Nockert 2006, 141–159). The ones that are in relatively good condition show a variety of techniques and a high degree of artisanship. They suggest that brocaded bands were most common during the Viking Age (Nockert 2006, 142–143). Weft threads can be woven to float so that most of the thread is on display on the surface of the fabric; this effect is called brocading. The band from Gokstad is quite narrow. It was possibly part of a broader band, forming a narrow brocaded patterned area within it. Other examples of this type, which date to the same period, also survive. Excavation of grave Bj 962 in Birka, Sweden, revealed

a man's burial dated to the tenth century CE. A tablet-woven band with a chequerboard pattern made with silver-wrapped thread was found on a penannular brooch in the chest region of the deceased. The silver *lahn* (metal wrapped thread) in the band was used as a brocaded weft that formed the chequerboard decoration (Larsson 2007, 175).

There are other examples of tablet-woven bands in which the metal-wrapped threads are almost covered by the warp; for example, five bands worked with silver and silk threads dated to the end of the tenth century CE were found in the Hørning grave in Jutland, Denmark (inventory number NM C31320, Hedeager Krag and Ræder Knudsen 1999, 164–165; Hedeager Krag 1999, 429–433). In one (band IV), the silver threads are partly covered by silk. The band is approximately 5 cm wide, and therefore much broader than the golden band from Gokstad.

Preserved patterns on surviving tablet-woven bands dating to this period are all geometrical. In Ness in Norway (Arntzen 2011, 33–42), Önsvalla in Sweden (Nockert 1982, 204–206) and Tampere Vilusenharjo in Finland (Tomanterä 1978, 17) geometrical patterns were visible in the bands when documented. In the case of the Önsvalla band, the pattern forms stars and zig-zag patterns made with alternating gold and silver threads worked into the 1.3 cm wide band (Nockert 1982, 204–206).

A number of tenth century CE bands made with another type of metal thread have been found in Birka, Sweden. These are made in drawn metal wire without a fibre core but, as with the types of bands discussed above, geometrical patterns dominate (Geijer 1938; Nockert 2006, 142–143). The same type of geometrical patterns can also be found in a number of tablet-woven bands made of wool. These were probably made locally (Nockert 2006, 150–151). In Oseberg in Norway, a complete tablet loom with tablets and work-in-progress fabric on it were found in the grave. There can be no doubt that such bands were produced in Scandinavia. The question is whether the metal-wrapped thread was imported or locally produced. It is possible that the tablet-woven bands made with metal-wrapped thread were woven in Scandinavia, but with imported threads made of silk, gold and silver-wrapped *lahn*.

Gold-wrapping technology used in the threads from Gokstad

Metal thread was used in combination with other textile fibres in both the embroidery and the narrow band found in the Gokstad grave. The metal content used in the thread as well as the production techniques can provide valuable information about their provenance. There are several ways to make metal thread. In general, four kinds of gold and silver threads appear in fabrics from the early and high Middle Ages (Hardin and Duffield 1986, 233). Drawn metal wire, flat hammered strips, cut metal-wrapped thread and metal/membrane-wrapped thread. Two of these are made entirely of metal, either as drawn metal wire or as flat hammered strips. This type of thread dominates the finds from Birka in Sweden and was used in parallel with metal-wrapped silk thread (Larsson 2007, 146). In a tenth century CE find from Vangsnes in Norway, passementerie with drawn gold wire was found with thread made of flat strips (Hougen 1973, 79). The threads from Gokstad are of another kind. In

Fig. 5: Remnants of a tablet-woven band from Gokstad: a - with gold-wrapped silk thread used in the weft; and b - the warp and weft (?) threads that held the gold threads in place on the surface are not preserved (Image: Ellen Cathrine Holte, Museum of Cultural History, University of Oslo)

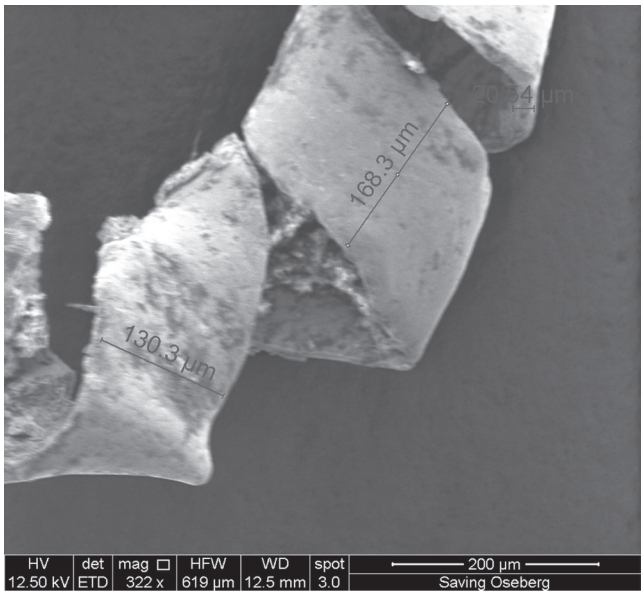


Fig. 6: Detail of the gold-wrapped thread used in the embroidery (Image: Calin Steindal, Museum of Cultural History, University of Oslo)

both the embroidery and in the band, the metal was wrapped around a fibre core forming a thread termed *lahn*. There are several ways to make a metal-wrapped thread with a core of fibre. One was to hammer out or cast plates of gold or silver into extremely thin sheets. The metal sheets were cut into narrow strips called lamella and wound or "spun" around a core of silk (or linen) with a distaff. Another method, found in high medieval textiles, was to use gilt membrane strips that were created by beating gold sheets onto an animal membrane (Bravermanová et al. 2020, 126, 143). These were then cut into lamellae and wound or "spun" around a core of silk. In addition to these two types of metal wrapping, some Persian threads, mostly used in the 14th century CE, were made of gilded silver. In this type of thread, a thin layer of gold was laid over the silver strip. The process of "water-gilding" used an amalgam of mercury to fix the gold onto the silver surface (Hardin and Duffield 1986, 245).

To answer what kind of materials and techniques have been used to make the gold thread from Gokstad, the metal thread was investigated using scanning electron microscopy (SEM) and optical microscopy studies. The aim of these studies was to identify the chemical compounds of the metals and the method used for making the thread. The optical microscopy study revealed that the metal-wrapped silk thread from Gokstad is not rounded but consists of a flat lamella with a thickness varying between 11 µm and 25 µm (fig. 6). Sharp edges along the strips suggest that it was cut from a metal sheet (Karatzani 2008, 412). The gold lamella was cut into approximately 130 µm to 170 µm wide strips and then wound around a core of silk forming an s-twisted spiral. The same method was used to make the metal thread in both the embroidery and the band.

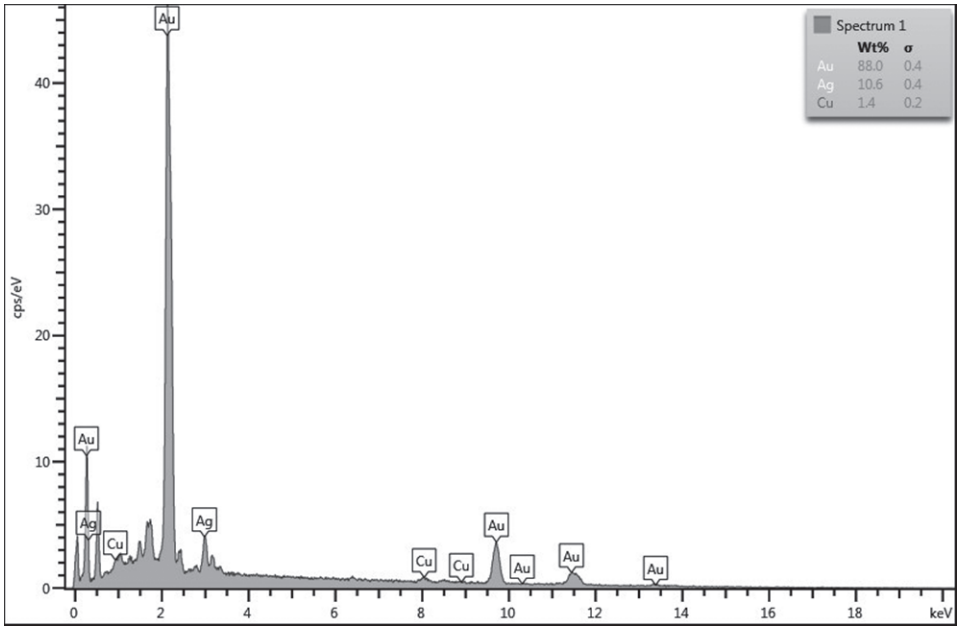


Fig. 7: Trace elements on the surface of a metal thread from Gokstad showing a high percentage of gold (Au) mixed with a smaller percentage of silver (Ag) and a very small percentage of copper (Cu) (Image: Calin Steindal, Museum of Cultural History, University of Oslo)

The next question was whether the lamellae were made of gilded silver, pure gold or a combination of metal and animal membrane. The gold thread from Gokstad contains a large quantity of gold. The SEM measurements show between 82% and 88% of gold mixed with a smaller quantity of silver (between 10% and 18%) which produced a soft and flexible thread. A very small amount of copper is also present but there are no traces of mercury (fig. 7).

The investigation revealed no traces of animal membrane. Cross-section SEM energy dispersive X-Ray spectroscopy (SEM/EDS) was used to obtain information about whether the threads were gilt or not. To detect any trace of layers in the lamella, a scan was made of the metal edge. If the gold had been beaten onto a membrane or if different layers of gold and silver had been used, traces of the different layers would be visible, at least in fragments where some of the organic core is preserved. The scan showed that gold and silver is evenly distributed right through the metal. The conclusion must therefore be that there are no traces of a foil made of other metals or substances in the thread. It is made from one single plate of gold mixed with a smaller amount of silver and an even smaller amount of copper. There were also significant quantities of silicates found on both the inside and outside of the metal thread. This could have come from natural ochre in the earth of the grave, or perhaps traces of an unknown dyestuff.

The gold lamellae were once wound around a core of organic fibre, which has now decomposed. This is especially so for the tablet-woven band. For the embroidery, the situation is better. Here, both the silk thread used in the embroidery and some small traces of the core inside the gold thread have been preserved. Fibre analysis of the fragments inside the gold lamella showed they were very degraded. It is most probably red-dyed silk (Skals 2015, 2, fig. 9). Red colour is visible under the fluorescence microscope but the fragment is too small to be analysed by HPLC.

In nearly half of all sites dated to Viking Age Scandinavia where silk was found, silk thread was used in combination with gold or silver thread. Silver metal thread, as well as gold, was used in both embroidered textiles and tablet-woven bands (Vedeler 2014, 55). The gold and silk-wrapped threads have several advantages over the solid drawn gold wire. First, the production demands less of the precious metal, and a lighter thread can be made. Such a thread is relatively flexible, making it easier to work on a textile fabric. The silk core makes the thread flexible and less likely to break than those without such a core. Nevertheless, a wrapped gold and silk thread is still subject to abrasion.

The question of provenance

The method used to make the metal thread found at Gokstad corresponds with analysis of other historical samples, among those from an Islamic cemetery in Valencia dated to the 11th to 13th centuries (Martínez et al. 2018). The gold and silk threads found at Gokstad were probably imported but a thorough and broad comparison with other findings from the eighth to tenth centuries must be made to investigate the question of provenance further.

Bands made with metal-wrapped organic thread comparable to that in Gokstad are known from many European archaeological sites dated as early as the seventh century (Pritchard 1988, 152). Similar bands are also found across the Nordic area in modern Norway, Sweden, Denmark, and Finland. Either silver or gold was used, although in some cases, both metals are found in combination with silk (table 1).

The place of production for metal threads from Scandinavian Viking Age graves has so far been based on visual comparisons conducted before new electrochemical methods were available (for example, Geijer 1972, 275). Comparative studies of Scandinavian material are therefore limited.

The tablet-woven band and the embroidery from Gokstad may have been produced at different sites, even if the metal-wrapped thread used in the two is very similar. It is also possible that the gold and silk thread was produced with silk from one area and gold from another. The pattern and style of the Gokstad embroidery is different to other known embroideries found in the Viking world and may have been imported as a finished product. The floral pattern is unlike the animal styles and geometrical patterns that are typical of Scandinavia. However, the tablet-woven bands found in Viking Age graves are generally assumed to be Scandinavian products. Tablet-woven bands with geometrical patterns have been found in some Early Iron Age graves, and the tradition continues in Scandinavia into the Middle Ages testifying to the presence of a specific Scandinavian language of design and technique (Hald 1950; Hougen 1935; Nockert 2006; Raknes Pedersen 1988; Schlabow 1976). With this in mind, it is highly likely that the tablet-woven band from Gokstad was produced locally made of imported raw materials. There are several possible places of origin for the silk.

Metal-wrapped silk thread became popular in China from the eighth century CE. Gold for the decoration of silk textiles was extensively used in China during

Site (references)	Use of metal threads	Metal	Date (CE)	Body Gender	Used as
Gokstad	Embroidery, tablet weave	gold	Approx. 900 CE	Male	Clothing
Ness (Arntzen 2011, 33-42)	Tablet weave with geometrical pattern	silver	10th century	Male	Headdress
Birka Bj962 (Geijer 1938, 172, table 6; Larsson 2007, 175)	Tablet weave with geometrical pattern	silver	10th century	Male	Unknown
Birka Bj967 (Geijer 1938, 172)	Tablet weave with geometrical pattern	silver	10th century	Female	Head dress
Valsgärde 12 (Bender Jørgensen 1992,160-161; Nockert 2006, 336)	Embroidery	gold, silver	10th century	Male	Clothing
Valsgärde 15 (Bender Jørgensen 1992, 160-161; Nockert 2006, 336)	Embroidery	gold, silver	10th century	Male	Collar/cloak trimming
Önsvala (Nevishög) 24 (Nockert 1982, 204-206)	Tablet weave with geometrical pattern	silver	Viking Age	Female?	Clothing?
Bjerringhøj (Hald 1950, 107-116; Rimstad et. al 2021, 14)	Tablet weave, needle binding	gold, silver	10th century	Male	Clothing?
Hvilehøj (Hedeager Krag and Ræder Knudsen 1999, 161-164)	Tablet weave	gold, silver	10th century	Female	Clothing?
Hørning Church (Hedeager Krag and Ræder Knudsen 1999, 164-165; Hedeager 1999, 429-433)	Tablet weave	silver	10th century	Female	Unknown
Slotsbjergby (Hedeager Krag 1998, 126)	Tablet weave	gold	Viking Age	Unknown	Unknown
Eura Luistari (Lehtosalo-Hilander 1982, 13, 237-240)	Tablet weave	silver	10th century	Male	Clothing
Tampere Vilusenharju (Tomanterä 1978, 17)	Tablet weave with geometrical pattern	gold, silver	Viking Age	Male	Clothing
Fyrkat 4 (Roesdahl 1977, 102-103)	Embroidery	gold, silver	10th century	Female	Unknown
Fyrkat 22a (Roesdahl 1977, 102-103)	Unknown	gold	10th century	Unknown	Unknown
Fyrkat 22b (Roesdahl 1977, 102-103)	Unknown	gold, silver	10th century	Unknown	Unknown
Ladby (Hedeager Krag 2004, 81-86)	Embroidery	gold	10th century	Male	Clothing

Table 1: Published graves dating to the Viking Age in Scandinavia containing “spun” metal-wrapped thread

the Song (969 CE to 1279 CE), Liao (90 CE to 1125 CE) and Jin (1115 CE to 1234 CE) dynasties (Chen Yan Shu 2011). Both hammered gold sheets wrapped around a silk core and gold sheets beaten onto animal membrane were used, especially in north-western China during the ninth and tenth centuries CE. A collection of beautiful silk fabrics with gold embroideries from this period is preserved in the Peking University Collection, Beijing. Gold thread is most often used in laid-work. One example of a gold and silk embroidery is a pair of exceptionally well-preserved boots decorated with gold and silk thread from Ye Mao Tai village, dating to the Liao Dynasty (916 CE to 1125 CE).

A geographically closer provenance for metal thread would be the large Persian production area, where many of the woven silk fabrics found in Scandinavian graves were made. Persia itself had very little gold and had to import it for use in textile production. Written sources from the late Middle Ages and Early Modern times mention India, Aleppo, Constantinople, Armenia and Georgia as sources of gold imported to Persia (Hardin and Duffield 1986, 233). Near Eastern metal threads contain little copper, as does the Gokstad thread. Unlike the gold thread from Gokstad, almost all gold and silver threads dating to early medieval period Persia which have been investigated were metals attached to an animal membrane (Hardin and Duffield 1986, 239). This makes it less probable that the gold and silver threads from Gokstad originated from this area.

Embroideries of gold and silk were probably also produced in England during the Anglo-Saxon period. Bands trimming the Anglo-Saxon embroideries attributed to St Harlindis and St Relindis are examples of textiles with "spun" gold threads (Spies 2000, 60-61). The same stitches were being used there as in Gokstad, although the surviving designs are different (Lester-Makin 2019). It has been suggested that silk embroideries found at Oseberg, a grave from the same district as Gokstad, have an Anglo-Saxon origin (Nockert 2006, 337). However, there are several difficulties in tracking the origin of these silk embroideries and their provenance remains uncertain (Lester-Makin 2019, 85)

A survey of early tablet-woven bands suggests that all preserved examples with spun gold threads dating from the eighth to the 11th centuries CE have a Germanic, Anglo-Saxon, Scandinavian or possibly Islamic provenance (Spies 2000, 60–61). The question of the origin of the materials used in the production of the bands is complex. Documented trade routes from central Europe to Scandinavia also raise the question of the potential production of gold threads in Europe, which needs further exploration. An answer to the question as to where the Gokstad gold thread was produced may be provided by a thorough electrochemical comparison with other preserved finds dating from the eighth to the tenth centuries CE.

Use of the band and the embroidery

The band and the embroidery were probably sewn onto a textile at the time they were discovered because Nicolaysen reported that he had found a long piece of what he thought was silk (Nicolaysen 1882, 48). Unfortunately, very few traces of such a textile exist today, and the Museum of Cultural History has no documentation on any later separation of fragments. The textile was, according to the museum catalogue, mixed with blue clay. The gold-wrapped thread and the silk used in the embroidery and in the tablet-woven band were obviously more sturdy than the fabric to which they were probably once attached. However, when analysing the gold lamella, a small fragment of thread attached to the gold sample was found. There is no doubt that this is a tiny piece of wool. The characteristic cuticle in the fibres is preserved, and in many cases so are the medulla (Skals 2015, 2, fig. 4). This small fragment of wool could be remnants of the ground fabric to which the band and the embroidery were once attached. What Nicolaysen thought was silk was a piece of fine wool cloth.

Tablet-woven bands have been used for several purposes in the Viking Age. Apart from decoration on clothing, they were used as borders on the tapestries found in the ninth century CE Oseberg grave (Nockert 2006, 385; Vedeler 2019). None of these has remains of any metal-wrapped thread. However, examination of similar finds in Scandinavia in which metal-wrapped thread has been used makes it clear that when attached textiles are preserved, they have been interpreted as parts of clothing (table 1). They are, however, not associated with a specific type of garment. Embroidery and tablet-woven bands with metal-wrapped thread were most probably used as decoration on more than one type of clothing. At Valsgärde in Sweden, at least two graves contained metal-wrapped thread. In grave number 12, dated to the tenth century CE, there were fragments of silk samite interpreted as clothing (Grave Nos 12/918 and 12/973, Bender Jørgensen 1986). They are embroidered with a silver-wrapped silk thread. A total of 12 cast bronze buttons were also found. Another grave, similarly dated to the tenth century CE, contained a silk samite with metal embroidery depicted as either a collar or cloak trimming (Grave no. 15/5915, Bender Jørgensen 1986; Graham-Campbell 1980, 102). Traces of brocading in wool and gold have

also been found (Bender Jørgensen 1986, 161). Another example comes from Önsvala, Nevishög in Sweden. Two graves at this rich cemetery revealed textiles with metal-wrapped thread (Grave 24 and 2, Larsson 1982, 146–149, 155–167). In both cases, the textiles were interpreted as clothing (Nockert 1982, 204–206).

Embroideries and bands with metal-wrapped thread were sewn onto a variety of different textile qualities. The tablet-woven silk band with silver and gold threads found in a man's grave at Tampere Vilusenharju, Finland, is an example where the band was attached to a twill fabric (Tomanterä 1978, 17). A brooch attached to the band indicates that it was part of the man's clothing.

In Birka, Sweden, 53 very rich graves have so far revealed textiles with metal thread, all except two with thread made of metal wire (Larsson 2007, 163-175). Most of these are tablet-woven bands, which seem to have been used in the same way as the bands with metal-wrapped organic thread. Over 50% of these tablet-woven bands were found around or in connection with the deceased's head and were probably part of various forms of headdresses for both men and women (Larsson 2007, 176). Another 20% of the bands from Birka were found with a knife, a sword or other grave gifts. Approximately 20% were found in the body region often near the shoulders or breast. The latter were probably used as decoration on clothing (Larsson 2007, 177).

Fragments of gold embroidery found together with silver passementerie at a ship burial from Ladby, Denmark was also interpreted as remnants of clothing (Hedeager Krag 2004, 81). A grave found at Fyrkat in Denmark contained a gold-wrapped thread attached to a blue wool cloth. The textile could be remnants of an embroidery with an unknown function (Grave 4, Østergård 1977, 103).

A 1.5 cm wide band made with silk and silver threads found at Ness in northern Norway attached to the back of a man's skull (Arntzen 2011, 33–42), and could be remnants of a headdress.

These and several other examples indicate that embroideries and various bands made with metal-wrapped thread were used as decoration on different kinds of clothing and on different parts of the garments linked to both men and women.

What was the function of the textiles from Gokstad? How were they used? The golden textiles were certainly an extraordinary find - not least because of their original context. Why place the most precious of textiles hidden from sight inside the ridgepole? It must have required extra work to hide the textiles in this way. The significance of the location deserves a study of its own. Nevertheless, the peculiar find context of the Gokstad embroidery and band also raises many questions about their purpose and use before burial. Finding textiles with ridgepole could lead to the conclusion that the textile had been used as a wall decoration, and that this function was continued inside the grave chamber by simply fixing the textile to the beam to hold it in place. Looking at the quality and nature of the textiles this seems highly unlikely. Furthermore, the golden textiles were found inside the hollowed pole, not attached to the outside. This makes it even more unlikely that the textile was used as a wall decoration. Similar finds across Scandinavia suggest that textiles like these were used as decoration on clothing. In the case of the Gokstad embroidery, it was probably originally sewn onto a garment made of fine wool. Considering the context and the quality of the golden decorations, it seems more likely that this was part of a garment hidden from sight between the two parts of the ridgepole.

Conclusion

The materials and techniques used in the golden textiles from Gokstad resemble a very limited number of other finds from high status graves dating to the Viking Age in Scandinavia. They bear witness to good artisanship and prosperity. The embroidery, formed in a floral shape, was made with red silk and gold thread. The silk thread may have been in two shades of red, while the gold lamellae was also wrapped around a core of red silk. The preserved band is probably a remnant of a narrow tablet weave, but only the weft threads of gold remain. It is, however, difficult to trace the place of production, especially of the gold thread. The spun gold thread used in both textiles could have been imported as thread and then used to craft the textiles locally but these could also have been produced in a number of different areas discussed above. The question of where the materials originated is complex, and their provenance remains uncertain.

Both textiles were probably originally used as decoration on clothing. Small traces of remaining fibres indicate that the garment was made of fine wool cloth. The deceased was probably not dressed in this at the funeral. The peculiar find context inside a hollow beam in the burial chamber raises questions about the meaning and purpose of these textiles in life and death.

Acknowledgements

The analysis of gold, fibres and dyes was funded by the *Gokstad Revitalised* project. Many thanks to Hartmut Kutzke for reading the text on gold technology and for

operating the SEM in cooperation with Calin Steindal at the University of Oslo. Thanks also to Irene Skals at the National Museum of Denmark for doing the fibre analysis, and to Jeannette J. Łucejko and Illaria Degano at the University of Pisa for analysing the dyestuffs. My deepest thanks to Wang Yarong at the Chinese Academy of Social Sciences, who informed me about the use of gold-wrapped silk thread in Chinese finds and who also gave me the opportunity to see the collection of Tang silk at the Peking University in Beijing. I also owe thanks to two anonymous reviewers who gave me valuable advice and tips for improving this article.

Bibliography

Arntzen, J. E. (2011) En "palisadehaug" fra yngre jernalder i Nord-Norge? *Nicolay* 114, 33.

Bender Jørgensen, L. (1986) *Forhistoriske textilier I skandinavien, Prehistoric Scandinavian Textiles*. Copenhagen: Det kongelige nordiske oldskriftselskab.

Bonde, N. and Christensen, A. E. (1993) Dendrochronological dating of the Viking Age Ship Burials at Oseberg, Gokstad and Tune, Norway. *Antiquity* 67, 575–583.

Bravermanová, M., Březinová, H. and Vichová, J.B. (2020) High Medieval textiles of Asian and Middle Eastern provenance at Prague castle, Czech Republic. *Archaeological Textile Review,* 62, 126–143.

Chen Yan Shu (2011) 陈彦姝, 清华大学美术学院来源: Song, Liao and Jin silk adorned with gold**.** *Decoration Magazine* 1/12. Beijing: Tsinghua University.

Eastaugh, N., Walsh, V., Chaplin, T. and Siddall, R. (2008) *Pigment Compendium. A Dictionary and Optical Microscopy of Historical Pigments*. London/New York: Routledge.

Franzén, A. M. and Nockert, M. (2012) *Prydnadssömmar under medeltiden*. Stockholm: Kungl. Vitterhets Historie och Antikvitets Akademien.

Geijer, A. (1938) *Birka III. Die Textilfunde Aus den Gräbern.* Uppsala: Kungl. Vitterhets historie och antikvitetsakademien.

Geijer, A. (1972) *Ur textilkonstens historia*. Lund: Gleerup.

Graham-Campbell, J. (1980) *Viking Artifacts: A Select Catalogue*. London: British Museum.

Hald, M. (1950) *Olddanske tekstiler.Komparative tekstil- og dragthistoriske studier paa grundlag af mosefund og gravfund fra jernalderen.* Copenhagen: Det kongelige nordiske oldskriftselskab.

Hardin, I. R. and Duffield, F. J. (1986) Characterization of Metallic Yarns in Historic Persian Textiles by Microanalysis. In H. Needles (ed.) *Historic Textile and Paper Materials*. Advances in Chemistry. Washington DC: American Chemical Society, 231–252.

Hedeager Krag, A. (1998) Dress and power in Prehistoric Scandinavia c. 550-1050 AD. In L. Bender Jørgensen and C. Rinaldo (eds), *Textiles in European Archaeology. Report from the 6th NESAT symposium, 7-11th May 1996, Borås,* GOTARC Series A, Vol. 1. Göteborg: Institutionen för Arkeologi, Göteborgs Universitet, 125–130.

Hedeager Krag, A. (1999) Fränkisch-byzantinische Trachteinflüsse in drei dänischen Grabfunden des 10. Jahrhunderts. *Archäologisches korrespondenzblatt* 29(3), 425–444.

Hedeager Krag, A. (2004) New Light on a Viking Garment from Ladby, Denmark. In J. Maik (ed.), *NESAT VIII, Priceless Invention of Humanity. Textiles, Acta Archaeologica Lodziensia* 50(1). Lodz: Lodzkie Towarzystwo Naukowe, 81–86.

Hedeager Krag, A. and Ræder Knudsen, L. (1999) Vikingetidstekstiler. Nye oppdagelser fra gravfundene i Hvilehøj og Hørning. *Nationalmuseets Arbejdsmark 1999*, 159–170.

Hougen, B. (1935) *Snartemofunnene: studier i folkevandringstidens ornamentikk og tekstilhistorie*. Norske Oldfunn VII. Oslo: Oldsaksamlingen.

Hougen, B. (1973) Gulltråd fra Gokstadfunnet. Et fragment. In E. Kivikoski, P. Sarvas and A. Siiriäinen (eds), *Honos Ella Kivikoski.* Suomen Muinaismuistoyhdistyksen aikakauskirja 75. Helsinki: Finska fornminnesföreningen, 75–81.

Ingstad, A. S. (1988) Textiles from Oseberg, Gokstad and Kaupang. In E. Munksgaard, L. Bender Jørgensen and B. Magnus (eds), *Archaeological Textiles. Report from the 2nd NESAT symposium 1.–4.V 1984*. Arkæologiske skrifter 2. Copenhagen: Arkæologisk Institut, Københavns Universitet, 133–48.

Karatzani, A. (2008) Study and analytical investigation of metal threads from Byzantine/Greek ecclesiastical textiles. *X-Ray Spectrom.* 37, 410–417.

Larsson, L. (1982) In Gräber und Siedlungsreste der Jüngeren Eisenzeit bei Önsvala im südwestlichen Schonen, Schweden. *Acta Archaeologica* 52, 129–196.

Larsson, A. (2007) *Klädd krigare*. Skifte i skandinaviskt dräktskick kring år 1000. Uppsala: Uppsala Universitet.

Lehtosalo-Hilander, P. (1982) *Luistari I. The Graves*. Helsinki: Suomen Muinaismuistoyhdistyksen Aikaklauskirja 82(1).

Lester-Makin, A. (2019) *The Lost Art of the Anglo-Saxon World. The Sacred and Secular Power of Embroidery*. Oxford & Philadelphia: Oxbow Books.

Łucejko, J. J., Degano, I. and Vedeler, M. (2021) Textile dyes from Gokstad Viking ship's grave. *Heritage* 2021(4), 2278–2286.

Martínez, B., Piquero-Cilla, J., Montoya, N., Doménech-Carbó, M. T. and Doménech-Carbó, A. (2018) Electrochemical analysis of gold embroidery threads

from archeological textiles. *Journal of Solid State Electrochemistry* 22(7), 2205–2215.
Nicolaysen, N. (1882) *Langskibet fra Gokstad ved Sandefjord*. Kristiania: Alb. Cammermeyer.
Nockert, M. (1982) Textilfunde von Önsvala, Nevishög KSP, Schonen. In L. Larsson (ed), Gräber und Siedlungsreste der Jüngeren Eisenzeit bei Önsvala im südwestlichen Schonen, Schweden, Anhang II. *Acta Archaeologica* 52–1981, 202-208.
Nockert, M. (2006) Brickväv och brickband, Siden, Silkebroderi. In A. M. Christensen and M. Nockert (eds), *Tekstilene.* Osebergfunnet bind IV. Oslo: Kulturhistorisk museum, Universitetet i Oslo, 141-149, 277–337.
Pritchard, F. (1988) Silk braids and Textiles of the Viking Age from Dublin. In E. Munksgaard, L. Bender Jørgensen and B. Magnus (eds), *Archaeological Textiles, Report from the 2nd NESAT symposium 1.-4. V. 1984.* Arkæologiske skrifter 2. Copenhagen: Arkæologisk Institut, Københavns Universitet, 149–161.
Raknes Pedersen, I. (1988) The Analyses of the Textiles from Blindheim, Giske. In E. Munksgaard, L. Bender Jørgensen, B. Magnus (eds), *Archaeological Textiles. Report from the 2nd NESAT symposium 1.–4. V. 1984*. Arkæologiske skrifter 2. Copenhagen: Arkæologisk Institut, Københavns Universitet, 116–125.
Rimstad, C., Mannering, U., Jørkov, M. L. S. and Kanstrup M. (2021) Lost and found: Viking Age human bones and textiles from Bjerringhøj, Denmark. *Antiquity* 95,1–18.
Østergård, E. (1977) Tekstiler. In E. Roesdahl, *Fyrkat. En jysk vikingeborg. II. Oldsagerne og gravpladsen.* Copenhagen: Nationalmuseet.
Schlabow, K. (1976) *Textilfunde der Eisenzeit in Norddeutschland*. Göttinger Schriften zur Vor- und Frühgeschichte 15. Neumunster: Karl Wachholtz Verlag.
Skals, I. (2015) *Identifikation af textilfibre fra Gokstad-fundet*. Report project 50318. Copenhagen: Nationalmuseet i København.
Spies, N. (2000) *Ecclesiastical Pomp Aristocratic Circumstance. A Thousand Years of Brocaded Tabletwoven Bands.* Jarretsville: Arelate Studio.
Tomanterä, L. (1978) Appendix 2 in Terhi Nallimaa-Luoto: *Tampereen Vilusenharju – nuoremman rautakauden kalmisto Pirkanmaalla*. Master's thesis. Karhunhammas 3, Turku: University of Turku.
Vedeler, M. (2014) *Silk for the Vikings*. Ancient Textiles Series. Oxford: Oxbow.
Vedeler, M. (2019) *The Oseberg Tapestries.* Oslo: Scandinavian Academic Press.
Yarong, W., Chinese Academy of Social Sciences, Beijing, China – personal communication, 24 October 2013.

Internet sources

UNIMUS database (undated) https://www.unimus.no/portal/#/ (accessed 1 November 2021)

Author:
marianne.vedeler@khm.uio.no

Lise Bender Jørgensen, Dagfinn Moe and Hana Lukesova

Viking Age textiles and tapestries: drawings by Miranda Bødtker

Abstract
For many years, illustrator Miranda Bødtker (1896–1996) made drawings for botanists, zoologists and archaeologists at Bergen Museum, the University of Bergen in Norway. After her death, thousands of drawings were discovered as part of her estate. Among them were numerous unpublished drawings of archaeological textiles from five sites. Bødtker's illustrations show that although several scholars have studied the textiles, none had seen them all. This includes textiles from two Viking Age burials, Grønhaug and Dale, both of which comprise remains of tapestries hardly mentioned in the archaeological literature. This paper presents Bødtker's drawings of textiles from these two sites and discusses how they compare with published descriptions and new photos of the textiles, with drawings of textiles from the Oseberg burial, and to what degree this form of documentation meets current scientific demands.

Keywords: Grønhaug, Dale, western Norway, documentation, archaeological textiles

Introduction

Drawings have long been an essential form of documentation in archaeology, and are often preferred to photographs, but are nowadays largely replaced by digital solutions. Drawings have also been used to document archaeological textiles. During the 1904 excavation of the Oseberg ship burial, excavator Gabriel Gustafson hired Ola Geelmuyden to paint watercolours of selected items including textiles. Later, Sophie Krafft and Mary Storm carried out many drawings of the Oseberg textiles (Christensen and Nockert 2006; Vedeler 2019). These drawings show many details no longer visible in the original textiles, as demonstrated by Marianne Vedeler in her recent publication of the Oseberg tapestries (Vedeler 2019). This makes the drawings invaluable sources for these unique textiles.

This paper presents a series of drawings by Miranda Bødtker (1896–1996) of archaeological textiles from sites in western Norway, dating to the Viking Age. The drawings have only recently become known (Moe 2006; Bender Jørgensen and Moe 2020). The textiles, however, have been examined and described by several archaeologists and textile scholars over the years. This makes it is possible to compare what Bødtker saw and drew with what various scholars saw and described with words, but rarely documented with photos. As will be seen, Bødtker's observations and those of the scholars display similarities as well as differences. The drawings thus inspire questions as well as open new possibilities for the interpretation of the finds. In some cases, artist and scholar noticed different aspects of the textiles; in other cases, differences were more marked: several drawings show textiles that have not been recorded in previous publications. What new data do the drawings offer us, and what do they tell us about drawings as scientific documentation?

An artist and her work

Miranda Bødtker was born and raised in Bergen (fig. 1). She was educated at the Bergen School of Arts and Crafts and what is now *Konstfack*, the Stockholm University of Arts, Crafts and Design. In 1920, she was employed as a pattern designer at the Bergen School of Arts and Crafts where she remained in post until her retirement in 1966 (Moe 2006). Bødtker developed

a rare interest for details in nature, especially flowers and animals, using them to create new motifs to use in various crafts, especially textiles. A small hand-lens was one of her most important tools. As part of her work (and perhaps partly as a hobby) she documented old bedspreads and tapestries, wall paintings, craft items and much more. In her role as a teacher of pattern design, she created her teaching portfolio, using her insights in the small details of nature. She also became a highly esteemed volunteer at Bergen Museum (now part of the University of Bergen). Her sharp eye for detail was important in the documentation carried out at the museum departments of archaeology, zoology and especially botany (Korsmo 2006). Here, a large part of her production was done in close collaboration with the scientists. She illustrated the Norwegian handbook of flowers *Norsk Flora* (Nordhagen 1970) and made numerous drawings of archaeological artefacts including textiles.

During her 30 years in retirement, the Botanical Department in Bergen Museum became Bødtker's main contact with science. Her meticulous drawings form important contributions to numerous scholarly works (for a list, see Moe 2006, 62–63) but as she survived most of her scientific colleagues, many of her illustrations – especially the earliest – were forgotten. As she had no heirs, the Botanical Department finally inherited her estate, and it was a great surprise when her belongings were unpacked and proved to contain more than 10,000 watercolours and many black-and-white drawings. Only a handful of her drawings had until then been published. In 2006, an exhibition of a small part of her work was organised and a book was published commemorating her life and work (Moe 2006).

Fig 1: Miranda Bødtker (Image: © University Museum of Bergen, unknown photographer)

Bødtker's drawings of archaeological textiles

Bødtker established early contacts with the archaeologists at Bergen Museum. Haakon Shetelig, curator and later professor at Bergen Museum between 1901 and 1942, and his successor Johannes Bøe invited her to draw and document archaeological artefacts. Among these are a collection of drawings in Indian ink and a few watercolours showing textile fragments found in excavations in western Norway and Rogaland. It comprises 28 plates with drawings of textiles from the following sites: Grønhaug in Bø, Torvestad, Karmøy, Rogaland (B 5758 g); Øvre Tofte, Halsnøy, Kvinnherad, Hordaland (B 5406 b, c); Dale, Ytre Holmedal, Sunnfjord, Sogn and Fjordane (B 3106 b); Døsen, Hordaland (B 6091); and Blindheim, Vigra, Møre and Romsdal (B 8628). According to Bødtker's notebook commenting on her drawings of the Grønhaug find (By 10036_30), they were made in 1941. All the drawings are arranged in plates measuring 25 cm x 32.5 cm. Most of them contain written notes including information about size and magnification. Bødtker was obviously fascinated by the ancient textiles. Her drawings of textiles from Øvre Tofte, Døsen and Blindheim are not included in this paper. They are published and discussed by Bender Jørgensen and Moe (2020) where references to detailed studies and documentation of the textiles by Bente Magnus, Margareta Nockert and Inger Raknes Pedersen can be found.

This article focuses on the drawings of the textiles from the Grønhaug and Dale finds. The textiles are briefly mentioned in Bergen Museum's published annual reports and in some cases in publications of the finds of which they were part (Lorange 1877, 51–52; Shetelig 1902; 1912). Several are described by Johan Hiorth (1908), in Bjørn Hougen's studies of Norwegian textiles from the Migration Period and Viking Age (Hougen 1935, 2006), and in Lise Bender Jørgensen's catalogue of prehistoric textiles from Norway (Bender Jørgensen 1986). In these works, descriptions are brief and almost without illustrations. Photographs of a few textiles from Grønhaug can be seen in Arnfrid Opedal's study of ship burials at Avaldsnes (Opedal 1998, 72). In 2012, textile conservator Hana Lukesova at the University Museum of Bergen examined the textiles from Grønhaug and Dale (Lukesova 2012). In

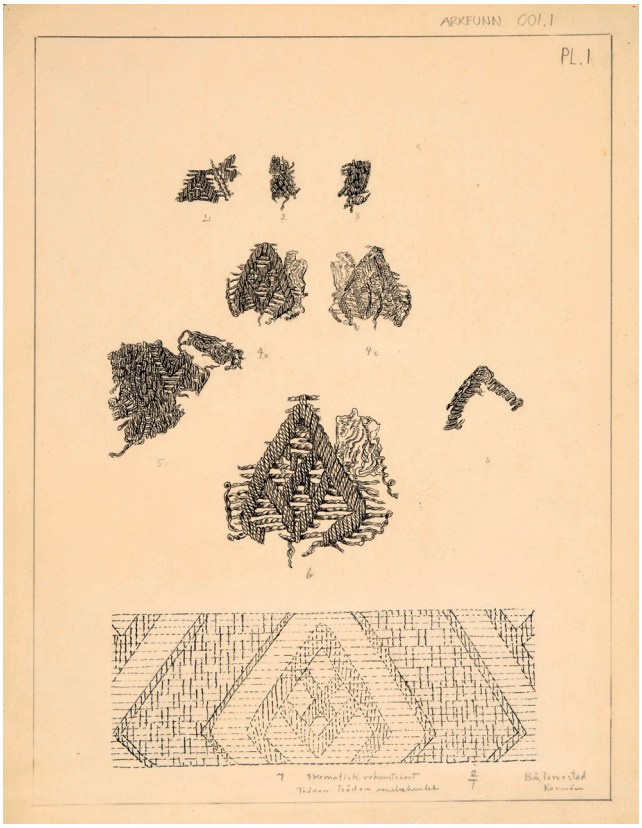


Fig 2 (left): Plate 1 (museum no. By 10036_1) fragments of coarse tapestry from B 5758 g Grønhaug, Rogaland (Image: © University Museum of Bergen)
Fig. 3 (right): Fragments of coarse tapestry woven with motifs in soumac as on Plate 1, (Image: © University Museum of Bergen, Adnan Icagic)

preparation for this paper, Lukesova re-examined some of the textiles and selected items to be photographed in order to compare them with Bødtker's drawings.

Grønhaug in Bø, Norway

Grønhaug in Bø, Torvestad, Rogaland (B 5758 g), a burial mound on the island of Karmøy was excavated by Haakon Shetelig in 1902. The finds were brought to Bergen Museum where they acquired the museum number B 5758 (Shetelig 1902, 1912). The mound proved to contain a 15 m long boat, used for the burial of a single person. The grave had been plundered and the grave goods scattered. The latter included masses of down and feathers and several hundreds of very small textile fragments. Bødker depicted only a few of them. Shetelig 's interpretation was that the deceased had been laid to rest on an eiderdown duvet, which was placed near the middle of the boat. Dendrochronology has shown that the boat was built approximately 780 CE and it is thought that the burial took place between 790 CE and 795 CE (Bonde and Stylegar 2009, 162). This makes the find closely contemporary with the attack on Lindisfarne in 793 CE traditionally seen as the beginning of the Viking Age.

Shetelig described the textiles as follows: several larger and smaller fragments of textiles. One was a very fine one, still partly brightly coloured in red-brown, and assumed to be remains of clothing. In addition, there were some coarser pieces: a single fragment is very coarse and Shetelig suggested that it might be remains of a sail (Shetelig 1902, 10). Some years later the textiles were examined by Johan Hiorth (1908, 18). He found that they consisted of four different fabrics:

A) A very fine wool tabby, coloured dark red-brown. Referring to a Miss H. Christensen, Hiorth added that it had been woven using a very coarse sett and a very tight warp, and a loose but tightly woven weft;
B) A coarser and lighter fabric than the previous, very thin;
C) A coarse wool 2/2 twill; and
D) A 2/2 hemp twill, presumably from a sail, and a fourfold string of two-ply hemp

Hiorth's descriptions are repeated in *Vestlandske graver fra jernalderen* (Shetelig 1912, 223), with 'probably of the boat's tent' to Shetelig's earlier suggestion that fragments D are the remains of a sail. Hiorth's assessment of raw materials is based on superficial observation, not on fibre analysis. Although different twills (one of them of light brown colour) and a fourfold string are preserved in the Grønhaug find, none of them were made of plant fibres. Even if additional fragments, now lost, existed in Hiorth's time, no method was available in 1908 to distinguish between species of plant fibre. The first methodology for this was published over a decade later (Herzog 1922). Hiorth's identification is likely to be mistaken.

The next examination of the Grønhaug textiles was carried out by Lise Bender Jørgensen in the summer of

1982 (Bender Jørgensen 1986, 257, catalogue N:IV:4). Her findings were as follows:

1) Textile fragments, largest piece 9 cm x 7 cm. Weave: repp, z/z-twisted yarns, 35/10 threads/cm
2) Several larger textile fragments, largest pieces 9.5 cm x 7.5 cm and 10 cm x 9 cm. Weave: repp with brocaded pattern (presumably figured tapestry), S2z/S2z-plied yarns, pattern weft also S2z-plied, 28/12 threads/cm + brocading
3) Textile fragment, 20 cm x 15 cm. Weave: repp, z/z-twisted yarns, 25/6 threads/cm
4) Several larger textile fragments found with masses of down/feathers. Presumably remains of a pillow or eiderdown. Seam. Weave: 2/2 twill, z/z-twisted yarns, 24/7 threads/cm

Bender Jørgensen's repps 1) and 3) correspond to Hiorth's A and B, while his coarse 2/2 wool twill is probably Bender Jørgensen's 4). Hiorth's hemp twill and string are not included in Bender Jørgensen's records, while Bender Jørgensen's brocading (3) is missing from Hiorth's notes.

Lukesova described the find B 5758g as very extensive, comprising hundreds of small fragments that were very fragile and thus difficult to handle. She was able to recognize at least 12 different structures, but her list of preserved fragments is not complete due to the complex nature of the find which still needs a thorough textile analysis. They are as follows:

1. Fine tabby (rib weave)
2. Coarse tabby (rib weave)
3. Tapestry-like patterned weave I.
4. 2/2 twill (fine)
5. Coarse textile remains (one thread system)
6. Diamond twill
7. 2/2 twill (coarse)
8. Tabby
9. 2/1 twill
10. Tapestry-like weave II – soumak
11. Very coarse textile remains (one thread system)
12. String and other unidentified structures

Miranda Bødtker's drawings of textiles from Grønhaug comprise 22 plates, numbered 1 to 16 (plates

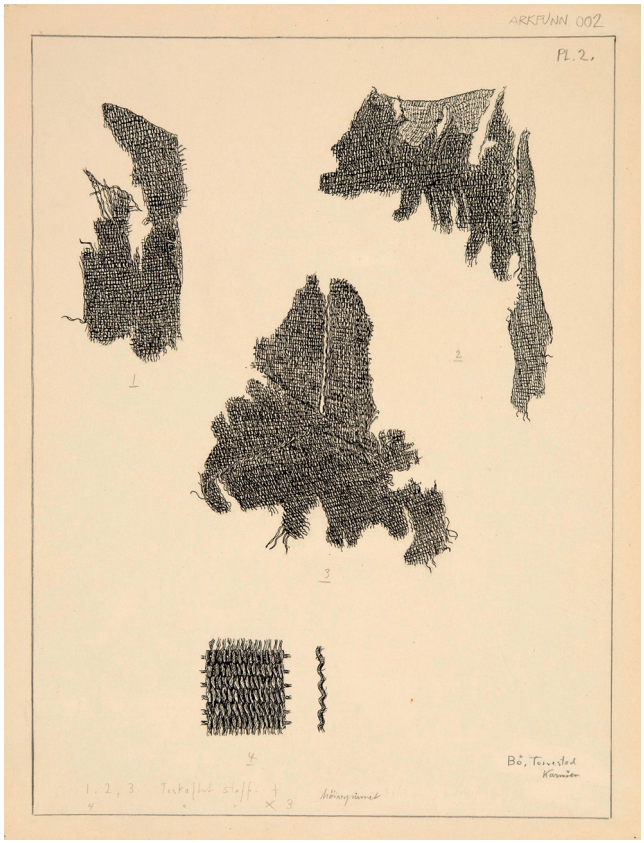
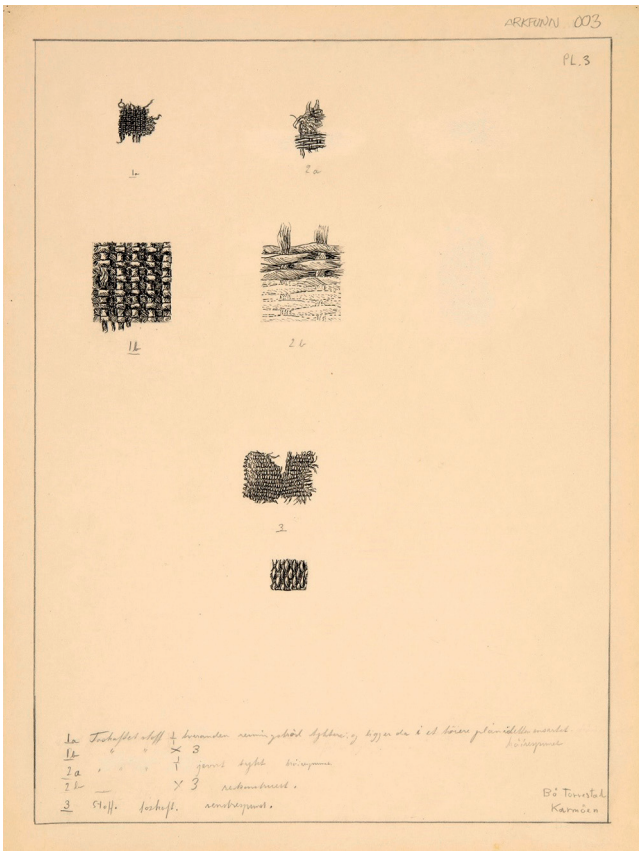


Fig. 4 (left): Plate 2 (museum no. By 10036_4) fragments of coarse repp from B 5758 g Grønhaug, Rogaland (Image: © University Museum of Bergen)
Fig. 5 (right): Three fragments of coarse repp as on Plate 2 (Image: © University Museum of Bergen, Adnan Icagic)

11 to 13 include a subset a, b and in one case c). Two unnumbered plates are also included. They are now in the Collection of Cultural History in the University Museum of Bergen (By 10036_1 – By 10036_28). At least 10 different fabrics can be discerned. They include at least two different types of tapestry, several fabrics in tabby: one is a fine repp with an imprint of a pattern, another is a coarse repp. There are several twills represented: coarser, balanced and unbalanced twills and small fragments of fine diamond twill of the Birka type (for definitions, see Bender Jørgensen 1986, 357). In addition, Bødtker's drawings include remains of caulking and a plaited string. Only parts of these are represented in Hiorth's and Bender Jørgensen's descriptions. These observations reflect almost a century of scientific interest in textiles which explains why the styles of recording differ. Miranda Bødtker's drawings include several hitherto unpublished textiles from Grønhaug, which makes them particularly valuable.

Plate 1 According to Bødtker's handwritten accompanying text, plate 1 (fig. 2) shows fragments of very thick fabric. Regular parts where the warp is clearly visible. Nos 1 to 6 depict six fragments of the fabric. No 4 is depicted in several versions: face and reverse (4a and 4c); two views (at different sizes) of the same fragment's face side (4b) and a schematic reconstruction (7). In the latter, the middle area is based on 4 and perhaps 5, whereas the areas left and right are based on Bødtker's knowledge of pattern construction. The yarns are described as left twisted (s). Bødtker's drawings and descriptions partly correspond to Bender Jørgensen's type 2, but as the thread count of the latter, 28/12 threads/cm, does not fit Bødtker's description as 'very thick' it is unlikely that Bender Jørgensen saw these textiles. This also applies to Hiorth. Lukesova (2012) assessed these fragments as type 10. Tapestry-like weave II - soumak, with 7/14 threads/cm, warp: S2z, weft: S2z (fig. 3).

Plate 2 (fig. 4) shows three fragments and magnification of a repp fabric in right-twisted (z) yarn and traces of what looks like sewing in the drawing but on closer examination of fragments proved to be folds. The



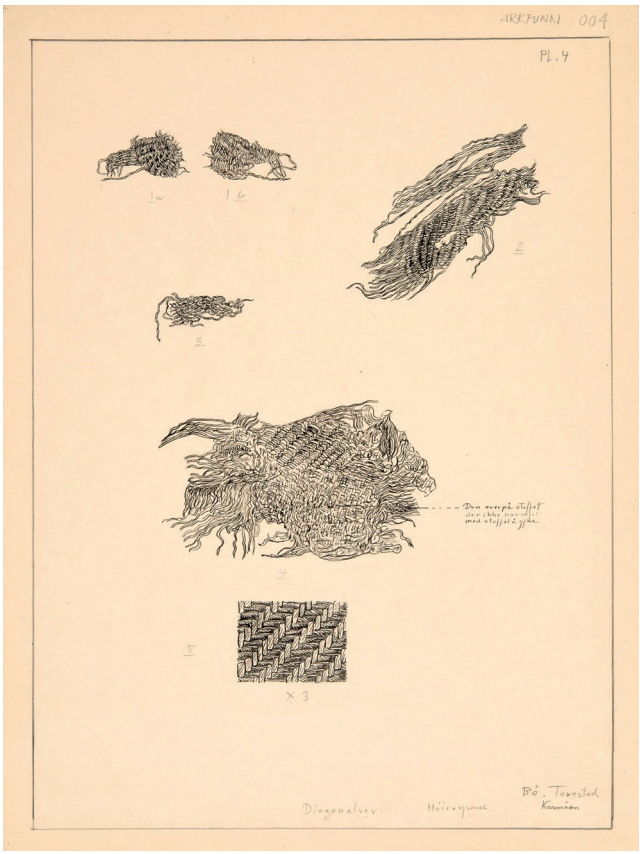
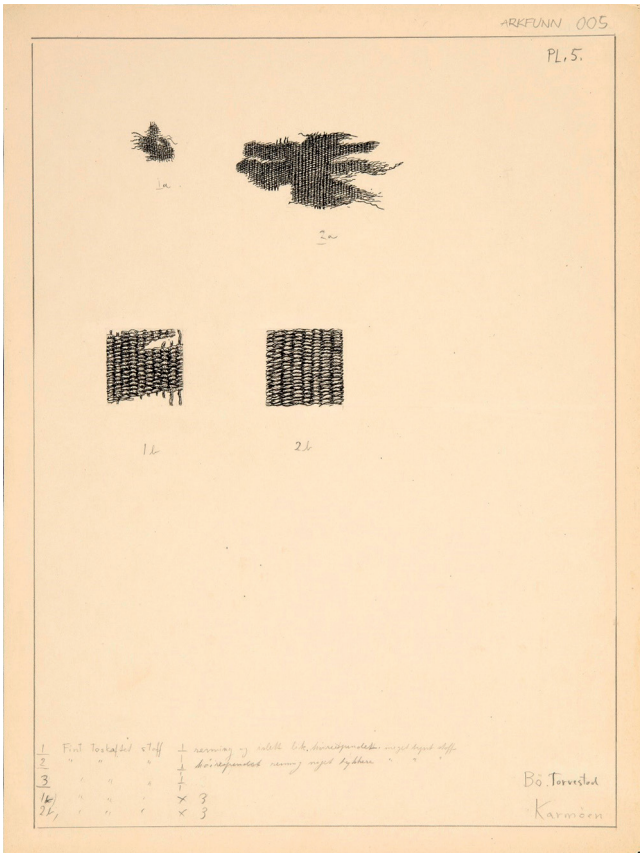


Fig. 6 (eft): Plate 3 (museum no. By 10036_5) fragments of tabby from B 5758 g Grønhaug, Rogaland
Fig. 7 (right): Plate 4 (museum no. By 10036_6) fragments of 2/2 twill from B 5758 g Grønhaug, Rogaland
(Images: © University Museum of Bergen)



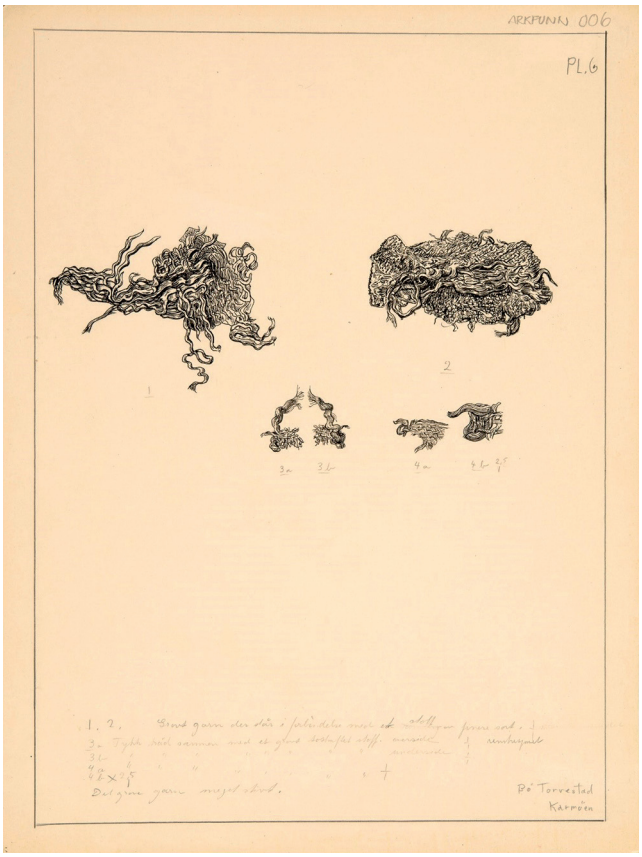


Fig. 8 (left): Plate 5 (museum no. By 10036_7) fragments of tabby from B 5758 g Grønhaug, Rogaland
Fig. 9 (right): Plate 6 (museum no. By 10036_8) fragments of very coarse textile remains from B 5758 g Grønhaug, Rogaland
(Images: © University Museum of Bergen)

magnification indicates 6/28 threads/cm. This fabric is likely Bender Jørgensen's type 3 and either Hiorth's type A or B and corresponds to Lukesova's type 2. Coarse tabby (rib weave), 25/6 threads/cm, z/z (fig. 5).
Plate 3 (fig. 6) shows three fragments of tabby-woven fabric and magnifications of these. Nos 1 and 2 are described by Bødtker as made of right-twisted yarn (z) and no 3 as left-twisted (s). The drawings are quite diverse and likely to represent three different fabrics. No 1 is a balanced tabby where every second warp thread is thicker. It has about 10/12 threads/cm. No 2 is a tight repp with 2/10 threads/cm. No 3 is another repp, rendered as warp-faced, but the numbers of threads/cm cannot be calculated. The quality of the latter corresponds to Bender Jørgensen's type 1 and 3, but the yarn twist does not. It means that none of the three fabrics appears to have been recorded by Bender Jørgensen. As Hiorth did not mention yarn twist it cannot be ascertained if any of the drawings represent Hiorth's type A or B.
Plate 4 (fig. 7) shows four fragments of 2/2 diagonal twill, one of them with down attached, and a magnified scheme for the structure. The yarns are described as right-twisted (z). The fabric corresponds to Bender Jørgensen's type 4 except for the thread count, and may also represent Hiorth's type C. This

Fig. 10: Very coarse textile remains as on Plate 6 showing red-brown threads of one system (probably warp), z-spun (Image: © University Museum of Bergen, Adnan Icagic)

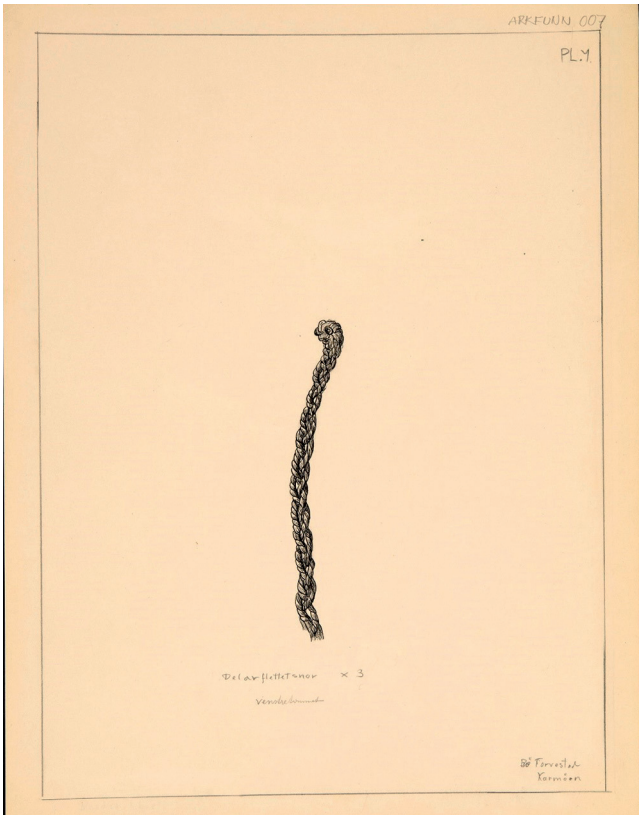


Fig. 11 (left): Plate 7 (museum no. By 10036_9) plaited string from B 5758 g Grønhaug, Rogaland (Image: © University Museum of Bergen)
Fig. 12 (right): Two strings from B 5758 g: the left one is depicted on Plate 7, the right one is probably the string that Hiorth thought was made of hemp (Image: © University Museum of Bergen, Adnan Icagic)

fabric perhaps relates to Lukesova's type 7. Twill 2/2, 12/9 threads/cm, z/z.

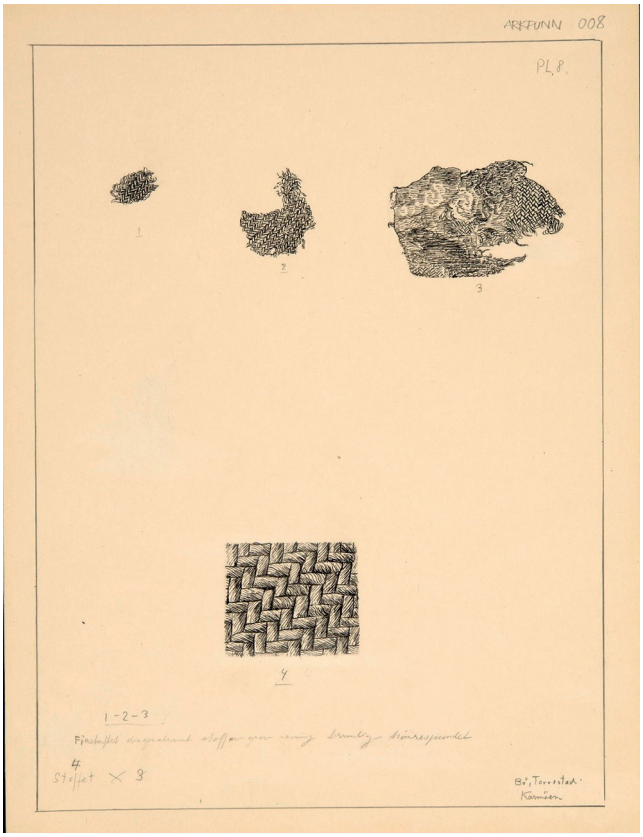
Plate 5 (fig. 8) shows two samples of fine tabby made of right-twisted yarns (z) plus magnifications. Bødtker describes no 1 as a very fine fabric with similar yarn in warp and weft while the warp of no 2 is slightly thicker. They derive from the same fabric depicted in Plate 10 (see below). The fabrics correspond to Lukesova's type 1. Fine tabby (rib-weave).

Plate 6 (fig. 9) shows coarse wool threads connected to a thinner but still coarse tabby-woven fabric. Bødtker notes that the yarn in no 3 is left-twisted (s) and that wool threads and fabrics are entangled all over it. Bender Jørgensen and Moe (2020, 184) suggested that this could be undecorated parts of Bender Jørgensen's type 2 and that it might be remains of a piled fabric, but Lukesova (2012) interprets the coarse wool threads as her type 11. Very coarse textile remains (one thread system only) – probably warp. The threads are long and wavy in a very regular way (see fig. 10), something that is typical for warp threads. They are spun in the z-direction, but no thread count can be calculated. The threads are stuck together with organic remains that might be a decomposed plant fibre weft.

Plate 7 (fig. 11) shows a string, plaited from three left-plied (s) threads. Bødtker does not mention any fibre type. It cannot be the string that Hiorth described as a four-plied hemp string, which most probably referred to a four-plied string made of animal hairs (fig. 12, right side). Bender Jørgensen did not record strings as she focused on textile structures.

Plate 8 (fig. 13) shows samples of thick 2/2 diagonal twill, brownish, made of right-twisted yarn (z). No 4 is magnified 3:1. This is likely to represent Hiorth's type C but is not represented in Bender Jørgensen's records. It may derive from the same fabric as the twill in Plate 4. The fabric may correlate to Lukesova's type 7. Twill 2/2 (coarse), 12/9 threads/cm, z/z or it may be another 2/2 twill not in Lukesova's list.

Plate 9 (fig. 14) displays thick diagonal twill with a nap on one side, made of right-twisted yarns (z). This might be a sample of Bender Jørgensen's type 4 or perhaps Hiorth's type C, although both of them described it as a 2/2 twill. It is Lukesova's type 9, twill 2/1, 12/12 threads/cm, z/z (dark brown and red-brown) and one side napped. Photos (fig. 15 and fig. 16) show face and reverse. Textiles with a napped surface were found in the harbour of Haithabu where they were interpreted as the remains of garments (Hägg 1984, 121–126; Hägg 2015). Finishing processes such as napping were common in the ancient world. They are also often difficult to recognise in archaeological textiles, especially if it is not possible to examine both sides. This also applies to 2/1 twills that are known



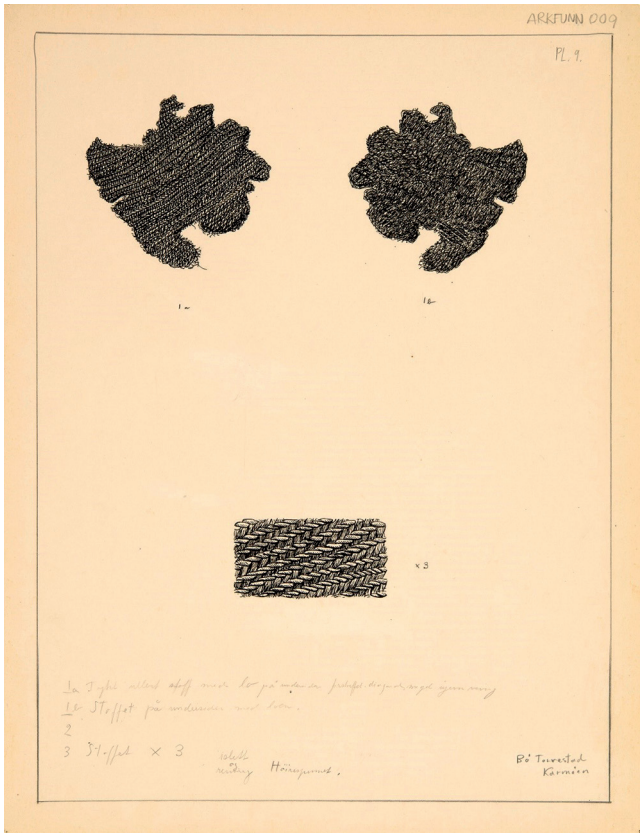


Fig. 13 (left): Plate 8 (museum no. By 10036_10) fragments of thick 2/2 diagonal twill, B 5758 g Grønhaug, Rogaland
Fig. 14 (right): Plate 9 (museum no. By 10036_11) fragment of napped 2/1 twill, B 5758 g Grønhaug, Rogaland
(Images: © University Museum of Bergen)

Fig. 15 (left): Napped 2/1 twill, face side, as on Plate 9 (Image: © University Museum of Bergen, Adnan Icagic)
Fig. 16 (right): Napped 2/1 twill, reverse side, as on Plate 9 (Image: ©University Museum of Bergen, Adnan Icagic)

throughout the first millennium CE. They are rare in Viking Age textiles from Scandinavia but appear as diagonal as well as lozenge twills. Bender Jørgensen (1986, 358) recorded none from Norwegian finds but listed diagonal 2/1 twills in three Danish burials and lozenge twills in two, all dated to the tenth century CE. Swedish finds (including Birka) number two finds of diagonal 2/1 twill and nine to ten burials with lozenge twills. A diagonal twill from Birka is dated to the ninth century CE, the rest to the tenth century (Bender Jørgensen 1986, 358). At Haithabu diagonal 2/1 twills appear among finds from the harbour

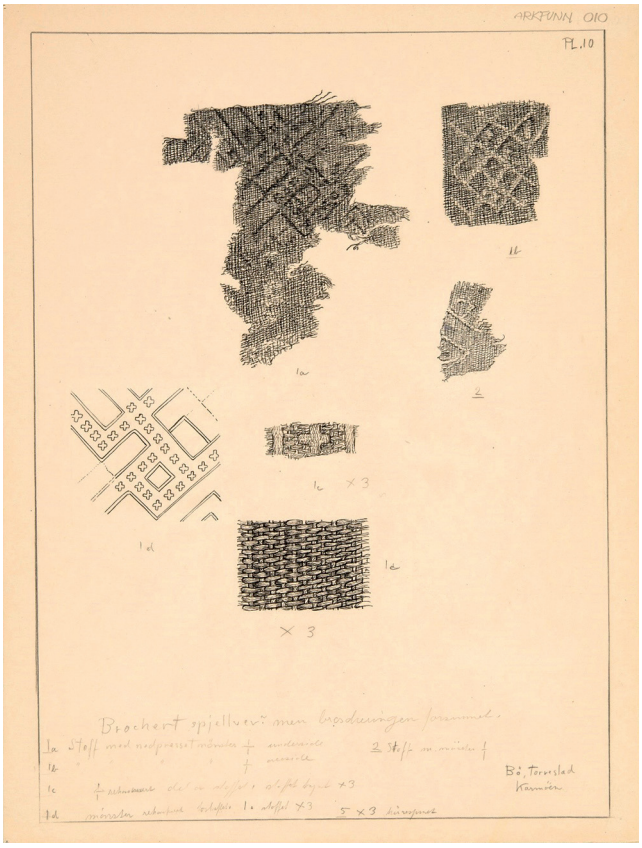


Fig. 17 (left): Plate 10 (museum no. By 10036_12) fragments of tabby with an imprint of a pattern B 5758 g Grønhaug, Rogaland. The pattern is reconstructed
Fig. 18 (right): Tabby with an imprint of a pattern as on Plate 10 (Images: © University Museum of Bergen, Adnan Icagic)

and the settlement; they date to the late ninth and throughout the tenth centuries (Hägg 2015, Tables 4 and 6). The napped 2/1 twill from Grønhaug is thus an early example of this type of fabric in Scandinavia.

Plate 10 (fig. 17) shows fragments of the fabric described by Bødtker as *brosjert spjellvev* which translates as brocading woven on a rigid heddle. She further notes that the brocading weft has disappeared. According to Bødtker, drawings no 1a and 1b show the front and reverse of the fabric with an imprint of a pattern of another textile item. Drawings 1c and 1d are reconstructions, only drawing no 2 depicts a fabric with a pattern. The yarns are right twisted (z). The magnification shows a fine repp. This fabric was not described by Johan Hiorth or Lise Bender Jørgensen. Lukesova found this to be her type 1 – a fine tabby-rib weave with an imprint of another fabric (fig. 18). The imprint of the pattern is reminiscent of fine wool fabric with decoration in weft pick-up found in a late Viking Age burial at Hvilehøj in Denmark (NM C 4280a), described by Margrethe Hald (1980, 111-119).

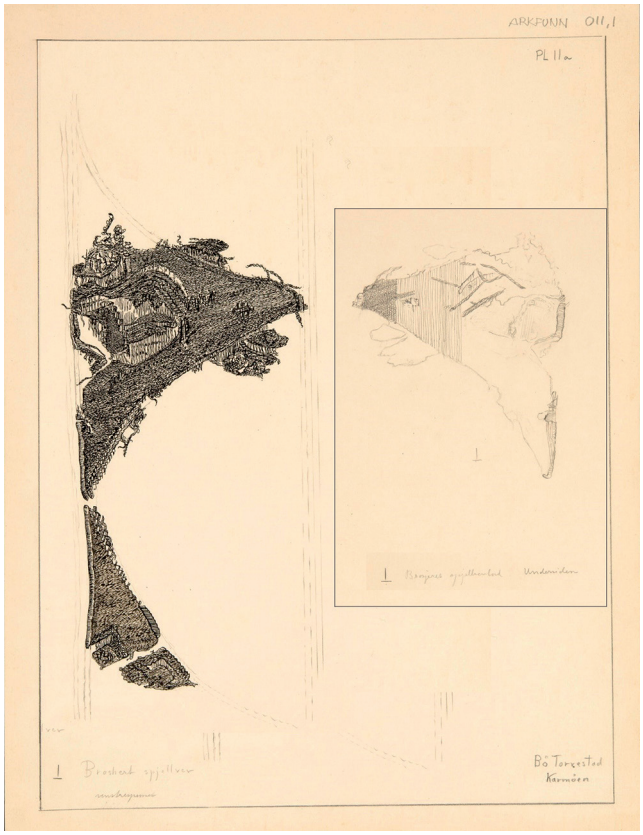
Plates 11-13 form a group. The textiles are all described by Bødtker as *brosjert spjellvev* but are actually fragments of a fine tapestry made of left-plied (s) yarns. Plate 11a with 11b inserted (fig. 19) shows a mounting of three fragments (the front and reverse sides). According to Bødtker's notebook (By 20036_30), she interpreted these as depicting a bird. The same fragments are shown in fig. 21 and fig. 22, along with the fragment depicted on plate 12a (fig. 20).

Plate 12a (fig. 20) is another piece of tapestry (no 1) with a sketch of how she understood the motif (no 2), which can be compared with fig. 21, the fragment to the right.

Plate 12b (fig. 23) presents one fragment (no 1) and a draft reconstruction of its pattern (no 2). Nos 3 and 4 are the front and reverse of the same fragment magnified four times in watercolour (compare with fig. 24). Bødtker's interpretation of what is front and reverse is contrary to that of Lukesova (see below).

Plate 12c (fig. 25) presents two more fragments of the same fabric and magnifications in colour.

Plate 13a (fig. 26) shows three more fragments (all of them are in fig. 27) depicted in different ways: nos 1 and 2 show organic fragments containing several layers of different materials; no 3 shows a fragment adhering to no 2 magnified four times; no 4 is the same fragment in watercolour; nos 5 and 7 are probably lifted off no 1 or 2; and nos 6 and 8 are magnifications of these.



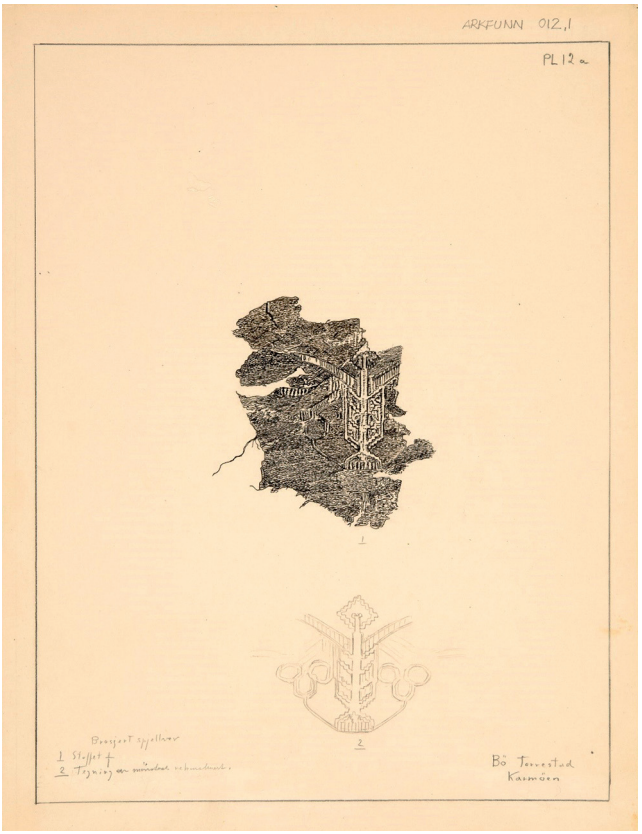


Fig. 19 (left): Plate 11a with 11b inserted (museum nos. By 10036_13 and By 10036_14) fragments of fine tapestry from B 5758 g Grønhaug, Rogaland
Fig. 20 (right): Plate 12a (museum no. By 10036_15) fragment of fine tapestry from B 5758 g Grønhaug, Rogaland
(Images: © University Museum of Bergen)

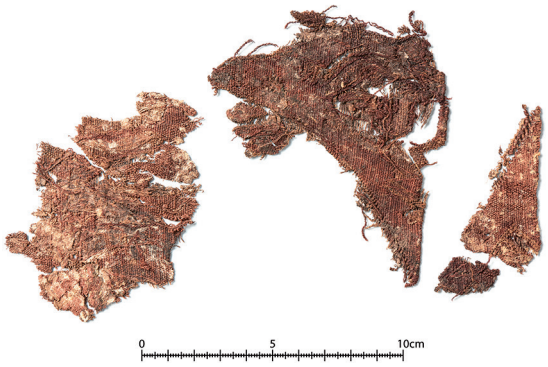


Fig. 21: Fragments of fine tapestry, face side, as on Plates 11a-b and 12a (Image: © University Museum of Bergen, Adnan Icagic)
Fig. 22: Fragments of fine tapestry, reverse side, as on Plates 11a, b and 12a ((mage: © University Museum of Bergen, Adnan Icagic)

Plate 13b (fig. 28) shows one fragment (no 1), with magnification in watercolour (no 2).

The textiles in plates 11–13 correspond to Bender Jørgensen's type 2 (fine wool repp in S-plied yarn, 28/12 threads/cm with brocading/figured tapestry). They also match Lukesova's type 3: Tapestry-like patterned weave I with a twill-effect on the front side and a tabby-rib-weave-effect on the reverse. The reverse side can be distinguished due to the loose pattern yarns. Both warp and weft are plied in S from 2z. Lukesova mentions red and ochre colour in weft. However, the colours are heavily faded, and it is possible there

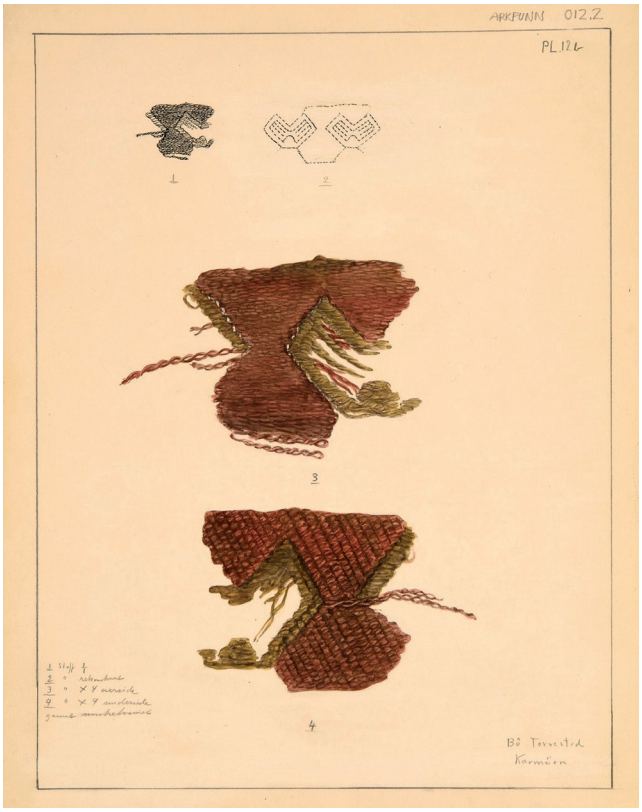
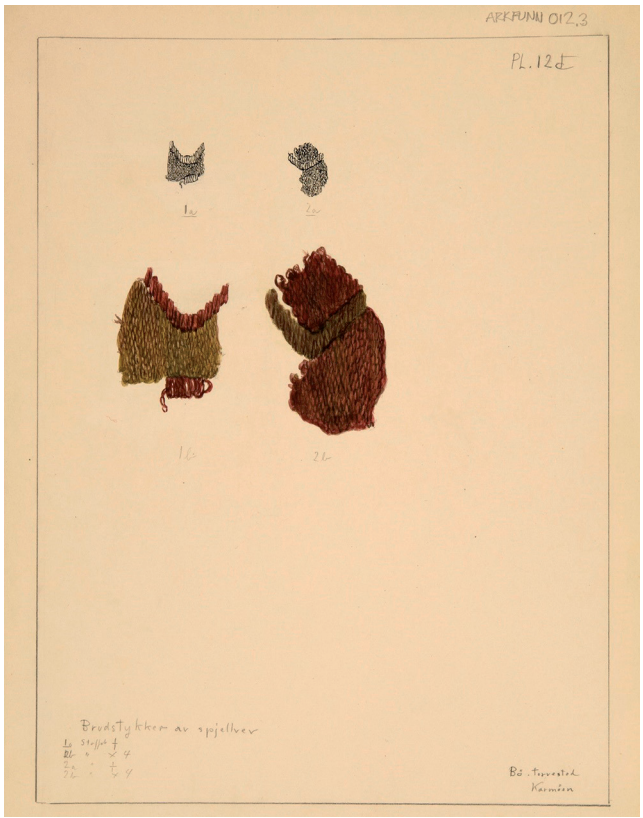


Fig. 23 (left): Plate 12b (museum no. By 10036_16) fragment of fine tapestry from B 5758 g Grønhaug, Rogaland
Fig. 24 (right): The fragment of fine tapestry on Plate 12b
(Images: © University Museum of Bergen, Adnan Icagic)

were more that cannot now be distinguished. She also mentions the remains of feathers and some black substance on the surface of some fragments.

Parts of these textiles, in particular Plates 13a-b, have close parallels among the figured tapestries found in the Oseberg burial (see, for example, Hougen 2006, 61–63; Vedeler 2019, 36). Hougen was aware of the textiles from Grønhaug. He mentions that several of



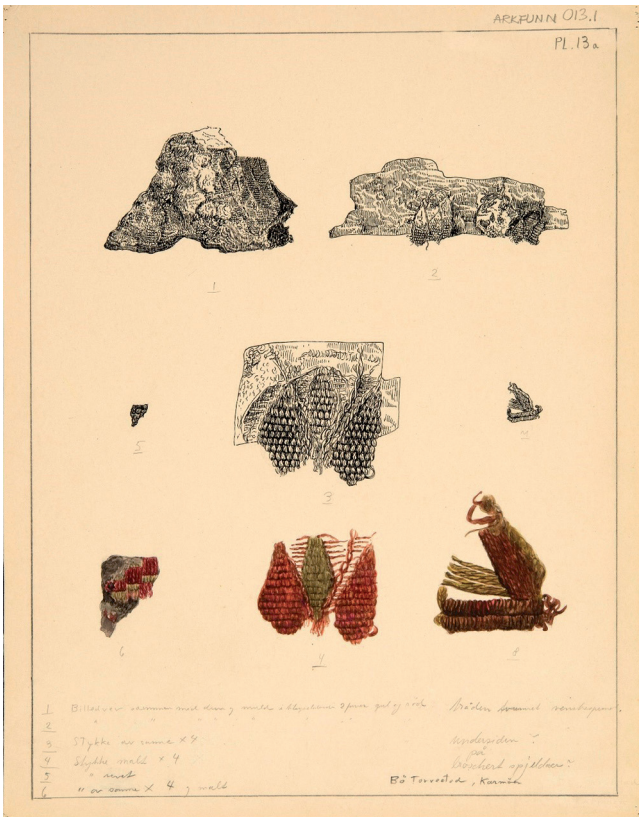


Fig. 25: Plate 12c (museum no. By 10036_17) fragments of fine tapestry from B 5758 g Grønhaug, Rogaland
Fig. 26: Plate 13a (museum no. By 10036_18) fragments of fine tapestry from B 5758 g Grønhaug, Rogaland
(Images: © University Museum of Bergen)

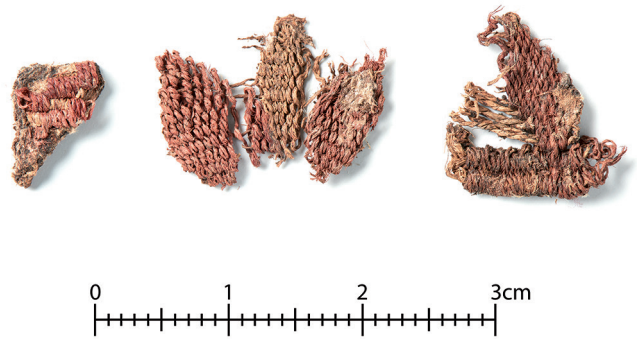
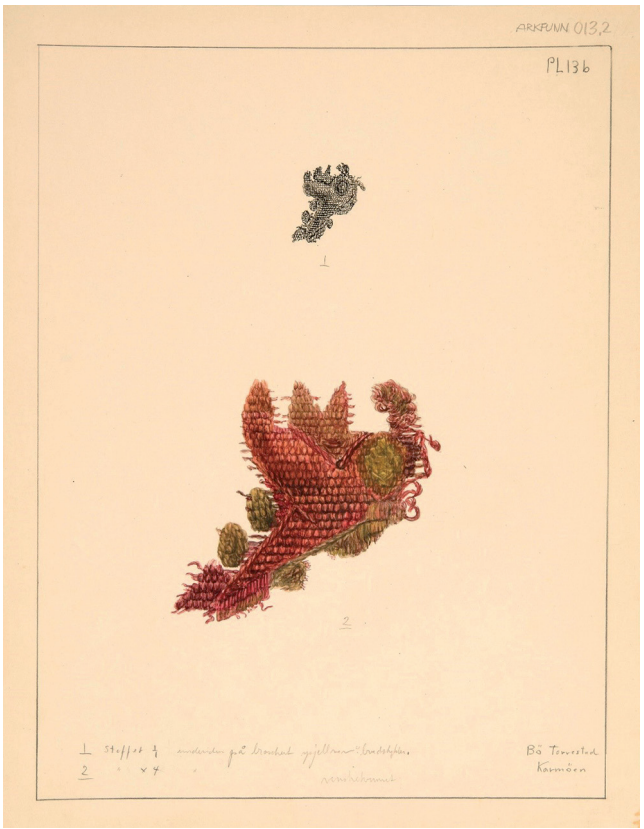


Fig. 27: Three very small fragments of fine tapestry as on Plate 13a (Image: © University Museum of Bergen, Adnan Icagic)

them are figured tapestries and that they comprise what he terms ground pattern 1, remains of figured motifs and the characteristic slinging outline termed *snärjing* (soumak) in Swedish (Hougen 2006, 75). He also mentions a similar find B 4772 c from Jåtten, Hetland, Rogaland (Hougen 2006, 75). The Jåtten find is interesting because all textile remains from this find are remarkably similar to the Grønhaug textiles in quality: type 1. rib weave; type 2. 2/2 twill; type 3. tapestry-like weave – soumak (weft twining over a changing number of warp threads in this case); and 4. braid (Lukesova 2012).

The figured tapestries depicted in Plates 11 to 13 differ from the fragments of fabrics with geometric patterns shown in Plate 1. The Oseberg tapestries often combine different elements, but as the textile remains shown in Plate 1 are much coarser, it is unlikely that they represent bands of geometric motifs framing the figured parts of the Grønhaug tapestries.

Plate 14 (fig. 29) shows two fragments (with magnifications) of what Bødtker terms *gåseøiemønster* (lozenge twill) but is actually diamond twill (for the difference, see Bender Jørgensen 1986, 14 and 288), made of right-twisted (z) yarns. Neither of these pieces has been described by Hiorth or Bender Jørgensen. Lukesova ascribed this group of several small fragments to type 6. diamond twill, pattern approximately 20/14 threads, 40/14 threads/cm, z/z (fig. 30). These textiles can be attributed to the Birka type, fine diamond twills made of z-twisted yarns that



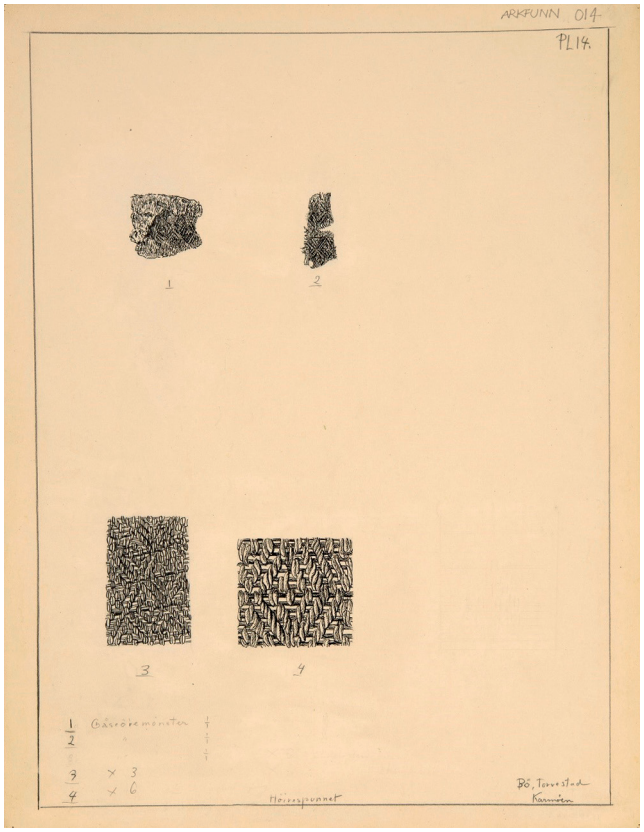


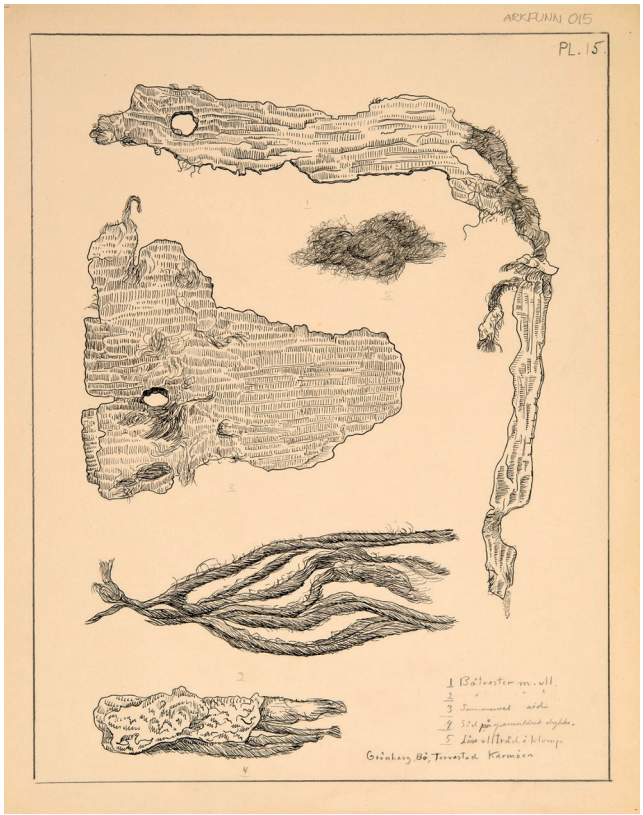
Fig. 28 (left): Plate 13b (museum no. By 10036_19) fragment of fine tapestry from B 5758 g Grønhaug, Rogaland
Fig. 29 (right): Plate 14 (museum no. By 10036_20) fragments of diamond twill from B 5758 g Grønhaug, Rogaland
(Images: © University Museum of Bergen)

Fig. 30: Fragments of diamond twill as on Plate 14 (Image: © University Museum of Bergen, Adnan Icagic)

have been found in numerous Scandinavian burials from the Merovingian and Viking Age Periods from 600 CE to 1000 CE (Bender Jørgensen 1986, 357–360). They were first observed among the textile finds from Birka (Geijer 1938) and were long thought to be imported luxury fabrics deriving from places as diverse as Frisia, Syria, the British Isles and western Norway. Recent light stable isotope analysis indicates that they were produced in north-western Europe (von Holstein 2012).

Plate 15 (fig. 31) shows 'boat remains with wool' and represents caulking in the form of lumps of wool and thick, z-twisted wool thread. This is another example of parts of the Grønhaug find that have been overlooked by scholars. The fragments depicted on this plate are still preserved. Wool and rags were commonly used for caulking as noted in a number of other finds such as the boat from Øvre Tofte, Halsnøy (Magnus 1980), the Oseberg ship (Ingstad 2006, 235), and in the harbour of Haithabu (Hägg 1984, 15).

Plate 16 (fig. 32) shows a solid wool fabric in diagonal twill made of right-twisted (z) yarns with a much denser warp than weft. It displays a seam sewn with s-twisted thread. The fabric might be a sample of Bender Jørgensen's type 4 that includes a seam, and Hiorth's type C. Lukesova described this fragment as type 4 (2/2 twill, 32/7-8 threads/cm, z/z, red-brown colour in both systems, the denser system is darker). The sewing yarn is plied S2z. Bødtker only shows a



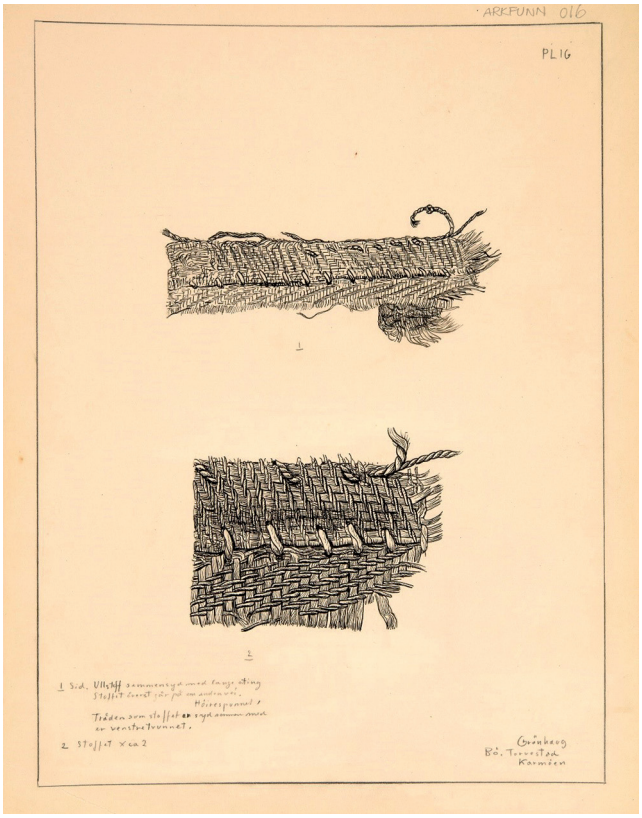


Fig. 31: Plate 15 (museum no. By 10036_21) fragments of caulking from B 5758 g Grønhaug, Rogaland
Fig. 32: Plate 16 (museum no. By 10036_22) fragments of caulking from B 5758 g Grønhaug, Rogaland
(Images: © University Museum of Bergen)

Fig. 33: Arkfunn 019 (museum no. By 10036_25) fragment of 2/2 twill with a ring-shaped pattern from B 3106 b Dale, Sogn and Fjordane(Image: © University Museum of Bergen)

section of one fragment but there are several fragments preserved in the find and they are obviously cut in long strips. This makes it likely that they also derive from caulking.

Two unnumbered plates also belong to the Grønhaug find (Bender Jørgensen and Moe 2020, 185–186). All fragments are described as 'unclear fabric'. They are all tiny, but according to the authors some appear to be tabby and one is half-basket weave.

Dale in Norway

Dale, Ytre Holmedal, Sunnfjord, Sogn and Fjordane (B 3106 b) is a man's burial dating to the Viking Age complete with weapons, tools, and rivets and roves which show that a boat was part of the burial. Finds also included three fragments of textiles, the largest piece 22 cm x 16 cm. The find was made in 1875 by landowner Peder P. Dale who was removing a burial mound, originally 4 ells high and built over an irregular heap of stones (Lorange 1877, 51–52). Archaeologist Anders Lorange described the textiles

Fig. 34: Three textile fragments from B 3106 b Dale, Sogn and Fjordane. Two are 2/2 twill and one is tabby, left face sides and right reverse sides. One of the twill fragments has a ring-shaped pattern as in fig. 33 (Image: © University Museum of Bergen, Adnan Icagic)

as three fragments of woollen cloth, one yellow, the other two brown with yellow stripes; the largest piece, 7 inches (17.75 cm) long and 4 inches (10 cm) wide has a yellow ring about ¾ inches (2 cm) wide and an inner diameter of 1½ inches (3.75 cm). The threads on the back form long loose loops (Lorange 1877, 52).

This corresponds well to Miranda Bødtker's drawing and description of 'thick brown fabric with the yellow-brown ring, diagonal weave'. The drawing (fig. 33) shows a fragment with a ring-shaped motif made in lighter yarn. A detail shows a part of it. Bødtker does not supply information on yarn twist, or what she thinks is warp and weft. Based on the drawing, the horizontal threads appear to be the warp, the vertical threads weft. The ring-shaped motif is thus created by the weft. Bødtker's drawing suggests that the motif was made in an interlinking technique (compare fig. 34).

In 1982, Lise Bender Jørgensen examined the Dale textiles, describing them as 2/2 diagonal twill with a woven-in motif, z/z-twisted yarns, 8/6 threads/cm, and three different colours (Bender Jørgensen 1986, 265, catalogue N:V:74). Lukesova (2012) described two different textile structures in this find: 1. two fragments, one of them with a ring pattern, both in 2/2 twill, 8/6 threads/cm, z/z, warp: light brown, weft: dark brown in the background, light brown in the pattern (fig. 34). She also mentions long, loose, weft-pattern threads on the reverse side, not loops as indicated by Lorange. A selvedge has been preserved on the fragment without a pattern together with a sewing yarn plied in S2z following two edges of the fragment in a way that suggests buttonhole stitch. The sewing yarn has a light brown colour similar to the pattern weft thread. Lukesova interprets the wedge shape of this fragment together with the seam as a possible indication of a tailored garment. 2. Plain weave, 5/4 threads/cm, z/s, warp: light brown, weft: light brown, one weft thread dark brown, which indicates a pattern.

Bødtker's drawings as archaeological sources

What do we learn from Miranda Bødtker's drawings? They give us an almost shocking wealth of detail, even for someone who has seen the original textiles and tried to describe them. Bødtker's drawings of the Grønhaug textiles show several elements that have eluded textile scholars and offer new insights into designs and weaving techniques of the past. Bødtker's drawings were made in 1941 and thus form a unique source for how these easily perishable textiles have withstood many years in museum stores and exhibitions. Although the material is extremely fragile, many fragments depicted in Bødker's drawings are still preserved in their original form as demonstrated by the photographs. Colours on the tapestry fragments appear more faded today than documented in the drawings. The dyestuffs may have degraded during the post-excavation period, even though there are no records of any wet treatment except to the fragments of caulking that were conserved in 1972. The drawings are thus important documentation of how the colours appeared in earlier times.

Adding several items to the previous records of the textiles from Grønhaug, Bødtker's drawings contribute to the record of Merovingian Period and Viking Age textiles from Norway. This applies in particular to the tapestries and other ornamented fabrics (fig. 2, fig. 19, fig. 20, fig. 23, fig. 25, fig. 26, fig. 28), the napped 2/1 twill (fig. 14) and the fine diamond twill of Birka type (fig. 29). The tapestries were buried some 40 years – a generation – earlier than those from Oseberg and offer a welcome contrast in terms of design and technique. This also applies to the imprint of fabric with a geometric pattern (fig. 17). The 2/1 twill is currently the earliest example of this cloth type in Scandinavia, while the diamond twill adds to records of the Birka type.

The fine tabbies and repps of fig. 4, fig. 6, fig. 8 and fig. 17, the napped 2/1 twill (fig. 14) and the fine diamond twill (fig. 29) might be remains of clothing and other textile items, while the tapestries and the imprint of patterned fabric (fig. 17) are likely to derive from soft furnishings, perhaps wall hangings. Bødtker notes on Plate 13 (fig. 26) that the fragments of tapestry were found with down remains. One of the items on fig. 7 also had remains of down. However, down was found everywhere and although it is evident the burial contained some kind of bedding, it is difficult to ascertain which of the textiles served as pillowcases or a duvet cover.

Neither Bender Jørgensen nor Lukesova have been able to identify the twill that Hiorth and Shetelig suggested could derive from a sail or a tent. The remains of the boat have been examined by Arne Emil Christensen (Christensen 1998). He suggested it was built to be rowed by eight rowers although he could not exclude the possibility that it had a small keelson and thus a mast. This makes it unlikely that a sail was deposited in the burial.

It must therefore be presumed that the person laid to rest in Grønhaug had fine garments and richly decorated soft furnishings including warm and soft bedding.

The main focus of Miranda Bødtker's drawings was on technical details, whereas it was the motifs that Sofie Krafft and Mary Storm concentrated on when

drawing the textiles from Oseberg (Christensen and Nockert 2006; Vedeler 2019). This means that they offer different information and opportunities for telling different stories. Bødtker's objects are far more fragmented, and it is difficult to discern recognisable motifs in the remains of figured tapestries from Grønhaug. Krafft and Storm had better preserved textiles to draw. Although their drawings do depict technical details, these were obviously not where they applied their main effort. Bødtker's eye for small details and her skills in tapestry weaving certainly also played a role. She applied her knowledge of textile art and her deep dedication to displaying what she saw accurately. Her skills qualified her to illustrate important botanical works such as *Norsk Flora,* and the same abilities emerge just as clearly from her drawings of the archaeological textiles.

Bender Jørgensen and Moe (2020) found several discrepancies between Bødtker's drawings and the analyses of the textile scholars. Some are caused by difficulties in comparing brief descriptions in words with detailed drawings of a large number of fragments that clearly derive from many more fabrics than the four types that both Hiorth and Bender Jørgensen settled on from Grønhaug. Some of these have now been resolved. Other discrepancies relate to the Øvre Tofte, Døsen and Blindheim finds and are not included in this paper. In sum, they demonstrate that interpretations depend on the ability and experience of the observer and that it is useful to re-investigate the original textiles with fresh eyes, updated knowledge, and new tools and methods. Investigations based on secondary sources such as historical scientific drawings are very valuable. They do however always include at least two sets of interpretation: those of the person who executed the drawing, and those of the one who is scrutinising it. Visual depictions, such as scientific drawings and photographs, should always be understood not as originals, but as secondary sources of information. Lukesova's findings from 2012 make it obvious that the textile finds from Grønhaug and Dale are under-researched and deserve much more attention. This also applies to the whole subject of archaeological textiles, a challenging field that requires knowledge from a wide range of disciplines and advanced scientific methods.

The drawings stand the test of time as scientific documentation and are still able to contribute to research. Miranda Bødtker's drawings, especially those of the textiles from Grønhaug and Dale, are a treasure chest and their subjects deserve to be fully investigated and appreciated as such.

Potential for further studies

It is noteworthy that Bødtker's drawings comprise several examples of textiles that have eluded the attention of textile scholars. This is emphasised by Lukesova's findings. This calls for further investigation – for example, into where these items were when Hiorth, Hougen and Bender Jørgensen went through the textiles from the same sites in Bergen Museum. Were they at that time being conserved, perhaps displayed in the exhibition or lent to another museum? As most of them are preserved and have been identified by Lukesova, it is likely that they were simply overlooked due to their fragmentary and fragile condition.

Bødtker's watercolours make it obvious that there is a rich potential for analyses of dyestuffs and mordants. As most of the precious fragments are very small in size, ethical considerations should be made before any sampling. The remains of figured tapestries from Grønhaug display similarities to those from the Oseberg burial and suggest a well-established style. As with the figured fabric from Dale, the tapestries have not been analysed in detail, the technique is still unidentified, and they all deserve a closer examination.

Acknowledgements

The drawings belong to *Olaf Grolle Olsens Legat til Universitetet i Bergen med tilførsel av arv etter Miranda Bødtker*. Thanks are due to the University Museum of Bergen, to Adnan Icagic who did the numerous photographs, to Aud Beverfjord who helped to merge two of Miranda Bødtker's drawings into one, and to John Peter Wild who transformed our Scandinavian/Czech text into proper English.

Bibliography

Bender Jørgensen, L. (1986) *Forhistoriske textiler i Skandinavien / Prehistoric Scandinavian Textiles*. Copenhagen: Det Kongelige Nordiske Oldskriftselskab.

Bender Jørgensen, L. and Moe, D. (2020) En glemt skat: Miranda Bødtkers tegninger af arkæologiske tekstiler. *Viking* 83, 179–218.

Bonde, N. and Stylegar, F-A. (2009) Fra Avaldsnes til Oseberg. Dendrokronologiske undersøkelser av skipsgravene fra Storhaug og Grønhaug på Karmøy. *Viking* 82, 149–168.

Christensen, A. E. (1998) Skipsrestene fra Storhaug og Grønhaug. In A. Opedal, *De glemte skipsgravene: makt og myter på Avaldsnes*. Stavanger: Arkeologisk museum i Stavanger, 206–220.

Christensen, A. E. and Nockert, M. (2006) *Osebergfunnet Bind IV. Tekstilene*. Oslo: Kulturhistorisk Museum, Universitetet i Oslo.

Geijer, A. (1938) *Birka III. Die Textilfunde aus den Gräbern*.

Uppsala: Almqvist and Wiksells Boktryckeri.
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.
Hägg, I. (1984) *Die Textilfunde aus dem Hafen von Haithabu.* Berichte über die Ausgrabungen in Haithabu 20. Neumünster: Karl Wachholtz Verlag.
Hägg, I. (2015) *Textilien und Tracht in Haithabu und Schleswig*. Kiel/Hamburg: Wachholtz-Murmann Publishers.
Herzog, A. (1922) Zur Unterscheidung von Flachs und Hanf auf optischem Wege. *Textile Forschung* 4, 58–61.
Hiorth, J. (1908) Undersøgelser af forhistorisk uld og tøirester fundne i norske gravhauger. *Stavanger Museums Årshefte* 1908(3), 1–24.
Hougen, B. (1935*) Snartemofunnene: Studier i folkevandringstidens ornamentikk og tekstilhistorie*. Oslo: Universitetets oldsaksamling.
Hougen, B. (2006) Billedvev. In A. E. Christensen and M. Nockert (eds), *Osebergfunnet Bind IV Tekstilene*. Oslo: Kulturhistoriske Museum, 15–131.
Ingstad, A. S. (2006) Brukstekstilene. In A. E. Christensen and M. Nockert (eds), *Osebergfunnet Bind IV Tekstilene*. Oslo: Kulturhistoriske Museum, 185–276.
Korsmo, E. K. (2006) Lar flere bli kjent med Miranda. *På Høyden*, https://pahoyden.khrono.no/lar-flere-bli-kjent-med-miranda/309519 (Accessed 4 April 2021)
Lorange, A. (1877) Fortegnelse over oldsager indkomne i 1876 til Bergens Museum. *Foreningen til norske fortidsminders bevaring, Aarsberetning for 1876*, 49–60.
Lukesova, H. (2012) *Textile Finds in Viking Age Collection*. Unpublished report. the University Museum of Bergen.
Magnus, B. (1980) Halsnøybåtens tekstiler. *Arkeo* 1980, 22–25.
Moe, D. (2006) *Miranda Bødtker 1896–1996, 100 år i kunsthåndverkets og dokumentasjonens tjeneste*. Bergen Museums Skrifter 20. Bergen: Symbolon AS.
Nordhagen, R. (1970) *Norsk flora. Illustrasjonsbind*. Tegninger av Miranda Bødtker. Del 1. Oslo: Aschehoug and Co.
Opedal, A. (1998) *De glemte skipsgravene: makt og myter på Avaldsnes*. Stavanger: Arkeologisk museum i Stavanger.
Shetelig, H. (1902) En plyndret baadgrav. *Bergens Museums Aarbok,* chapter 8.
Shetelig, H. (1912) *Vestlandske graver fra jernalderen*. Bergen: A/S John Griegs Boktrykkeri.
Vedeler, M. (2019) *Oseberg. De gåtefulle billedvevene*. Oslo: Spartacus forlag/Scandinavian Academic Press.
Von Holstein, I. (2012) *A light stable isotope (C, N, H, O) approach to identifying movement of medieval textiles in North West Europe*. Unpublished PhD thesis. York: University of York.

Authors:
lise.bender@ntnu.no
d.moe@online.no
hana.lukesova@uib.no

Ulla Mannering, Charlotte Rimstad and Irene Skals

The textile bog find from Vong in Denmark

Abstract
In 1950, Margrethe Hald published an unremarkable textile find from a peat bog called Vong in Denmark. The find has now been 14C dated to the 15th century CE, placing it in a time period for which few textiles are preserved. Although the precise clothing type cannot yet be recognised, the Vong bog find sheds new light on textile types and their uses and reuse in the Late Medieval period.

Keywords: bog find, wool textiles, clothing, medieval period, Denmark

Introduction

In 1950, the Danish textile researcher Margrethe Hald published her doctoral thesis, in which a find from a bog called Vong was included (Hald 1950). This bog is located in southern Jutland approximately 10 km from the modern town of Esbjerg on the west coast of Denmark. In the later English edition of her work, Hald wrote: "In 1942 a collection of cloth fragments from three different textiles were found in Vong Mose" (Hald 1980, 67). In Denmark, a large collection of prehistoric textiles and some textiles from more recent periods were recovered during peat cutting in the 18th to the mid-20th century CE. Unfortunately, not much more is known about the recovery of the Vong textiles, as the museum journal file is missing (Journal 611/42). This is probably also the reason why the find was never properly recorded or researched.

Hald continued: "[Fig. 51] shows the shape of the two largest and two smaller pieces, all of the same quality, thick golden brown cloth in three-shaft twill. The yarn of the warp and the weft is S-spun. The thread count of piece I is 88 warps and 74 wefts to 10 x 10 cm, and of piece II 92 warps and 74 wefts to 10 x 10 cm. The textile is cut to a pattern, and there are traces of hems and sewing, but it is difficult to decide to what kind of garment they belong. The find includes some scraps of coarse, black woollen cloth, and some patches fastened with strips of leather to the paler fabric of pieces I and II. Clear traces of fulling are visible and the scraps have different shapes. Here and there an edge is turned over, possibly for a larger piece to be added. In the diagram [...] the pieces are arranged as if they make up part of a garment. There are 80 and 100 threads to 10 x 10 cm. The yarn of the warp is S-spun and the weft is Z-spun. Finally, there is an oval piece of cloth about 35 x 21 cm. It is of dark brown, coarse S-spun yarn woven in three-shaft twill. The thread count is 60 warps and 72 wefts to 10 x 10 cm. The yarn is sheep's wool, the dark pieces have been dyed with woad" (Hald 1980, 67).

Despite the fact that the description is very precise, its brevity and lack of photographs has kept this find out of reach for researchers. This paper presents an update including new photographs, patterns, revised textile analyses, 14C dating and fibre analyses, which now bring this interesting find to the notice of present-day clothing researchers.

Dating

Although Hald's report on the Vong find only mentioned the textile pieces and no additional objects that could date it, she located it in the Early Medieval

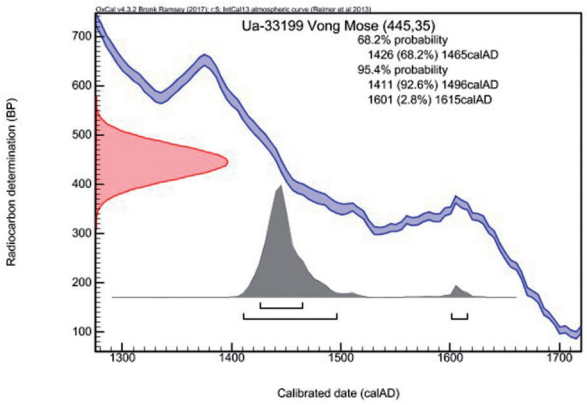


Fig. 1: The calibrated 14C dating of the textiles from Vong (Image: Bente Phillipsen)

era owing to the use of the three-shaft twill (2/1-twill) and in the Kragelund Group (Hald 1980, 196). A radiocarbon 14 dating analysis undertaken by the Danish National Research Foundation's Centre for Textile Research at the University of Copenhagen in 2007 confirmed Hald's dating to the Medieval period, although this placed it slightly later to between 1411 CE and 1496 CE with 95.4% probability (fig. 1).

This result puts the Vong pieces among a rare group of textiles from the Medieval period, which in Denmark is defined as 1050 CE to 1536 CE. These include the find of a bog body clad in a wool kirtle from Kragelund (1045 CE to 1155 CE) and the single bog find of a kirtle from Moselund (1050 CE to 1155 CE), both in Jutland (Østergård 2004, 124–126, 135–139), as well as the Old Norse garments from Greenland, dated from 990 CE to 1450 CE (Østergård 2004, 253). However, only a few of the Old Norse textile garments belong to the 15th century CE. There are hardly any other textiles preserved from this century in Denmark, making the Vong textiles welcome additions. Other relevant finds are the textile from Boringholm dated to the 14th century CE (Østergård and Walton Rogers 2006). From Norway, a few more or less complete Medieval textiles and clothing items are known (Vedeler 2007), while the textiles found in the old town of Oslo, dated to the 15th century CE, are too fragmented to determine their function as clothing (Kjellberg 1977–79, 83–104). From Sweden, the Bocksten Man has the best known complete clothing ensemble, dated to the 14th century CE (Nockert 1997, 137).

The textiles

As Hald observed, the Vong textiles are of three different kinds. There are four light brown fragments of 2/1 twill (inventory number C37593), two large and two smaller fragments which are clearly cut to shape (fig. 2 to fig. 4). The thread count is 8 to 9/10 threads per cm and the thread is from 0.7 mm to 0.9 mm thick in

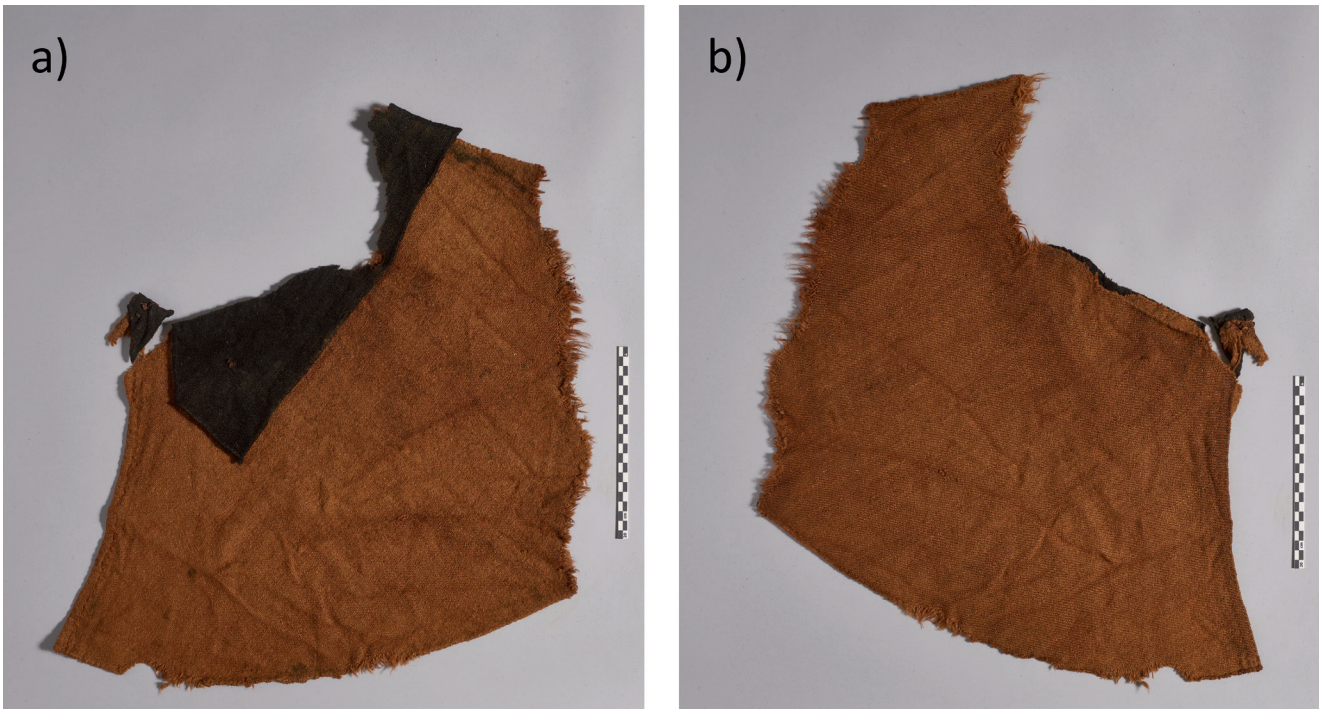


Fig. 2: Vong C37593, fragment 1: a – front with C37594, F1 and F2; and b – back (Images: Roberto Fortuna)

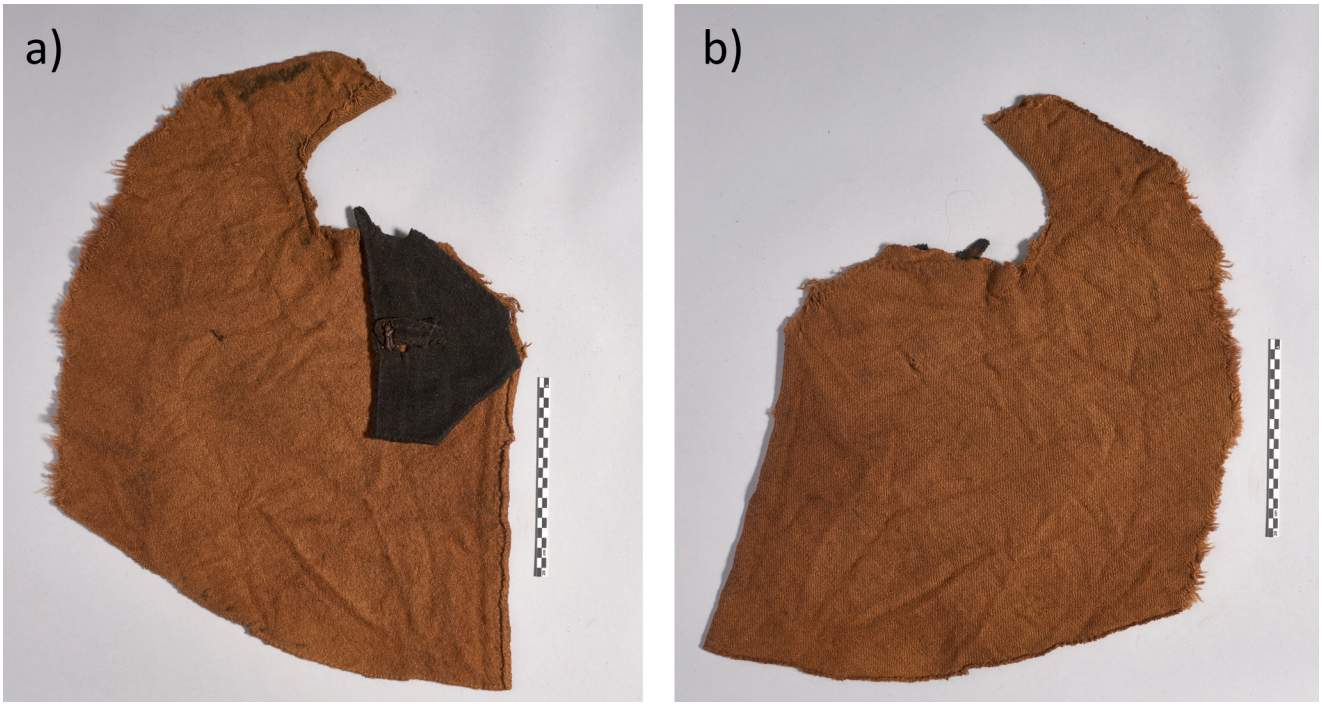


Fig. 3: Vong C37593, fragment 2: a – front with C37594, F3, F4 and F5; and b – back (Images: Roberto Fortuna)

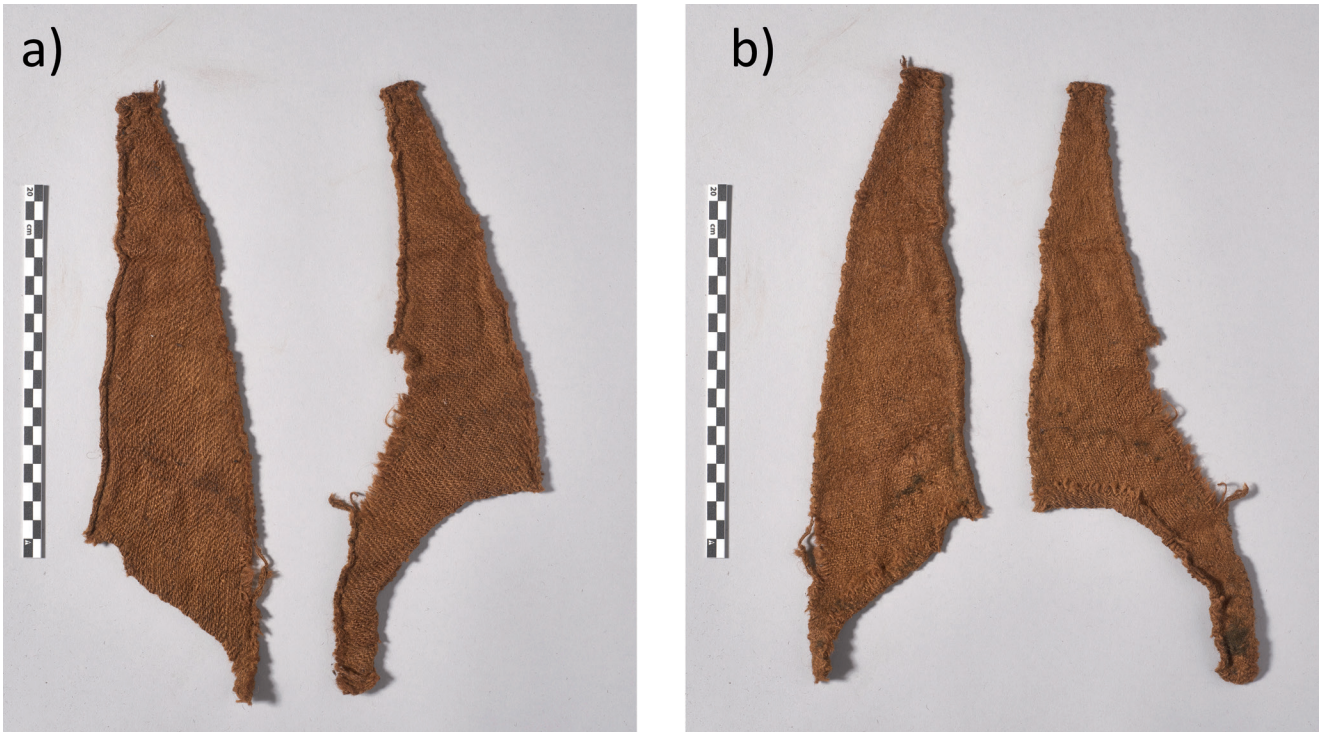


Fig. 4: Vong C37593, fragments 3 and 4: a – front; and b – back (Images: Roberto Fortuna)

Fig. 5: Close-up of the Vong textile surfaces: a – C37593 front; b – C37593 back; c – C37594 front; and d – C37594 back (Images: Charlotte Rimstad)

both the warp and weft. The yarn is single s/s twisted and the twist angle for the warp is 32^0 to 36^0 and for the weft 38^0 to 40^0 (table 1). The largest fragments mirror each other in shape and each has what seems to be half an armhole. Along the edges, there is a 0.7 cm to 1.5 cm wide fold, except for a torn edge, probably where the two pieces were once united. There are no inserted gores and no traces of fastening in the fabric.

No dye analyses have been carried out on these fragments, but given their present appearance, they may have been of white, undyed wool. They are likely to have been the lining of the garment, and traces of black wool fibres on the light brown fabric, coming from C37594, show that the two fabric types were once closely connected (fig. 5a and fig. 5b). Small traces of a plant fibre textile, probably flax, are visible on both sides of the fabric, indicating the presence of both a middle lining and an inner linen lining. The sewing thread was also of plant fibres and small remnants are still visible in the otherwise empty stitch holes along the edges of the fabric. The still visible parts of the sewing threads have a thread diameter of 0.14 mm and twist of approximately 44. The threads are either z-twisted or z-plied. A similar use of plant fibre sewing threads has also been recorded in British textiles (Crowfoot et al. 1992, 151).

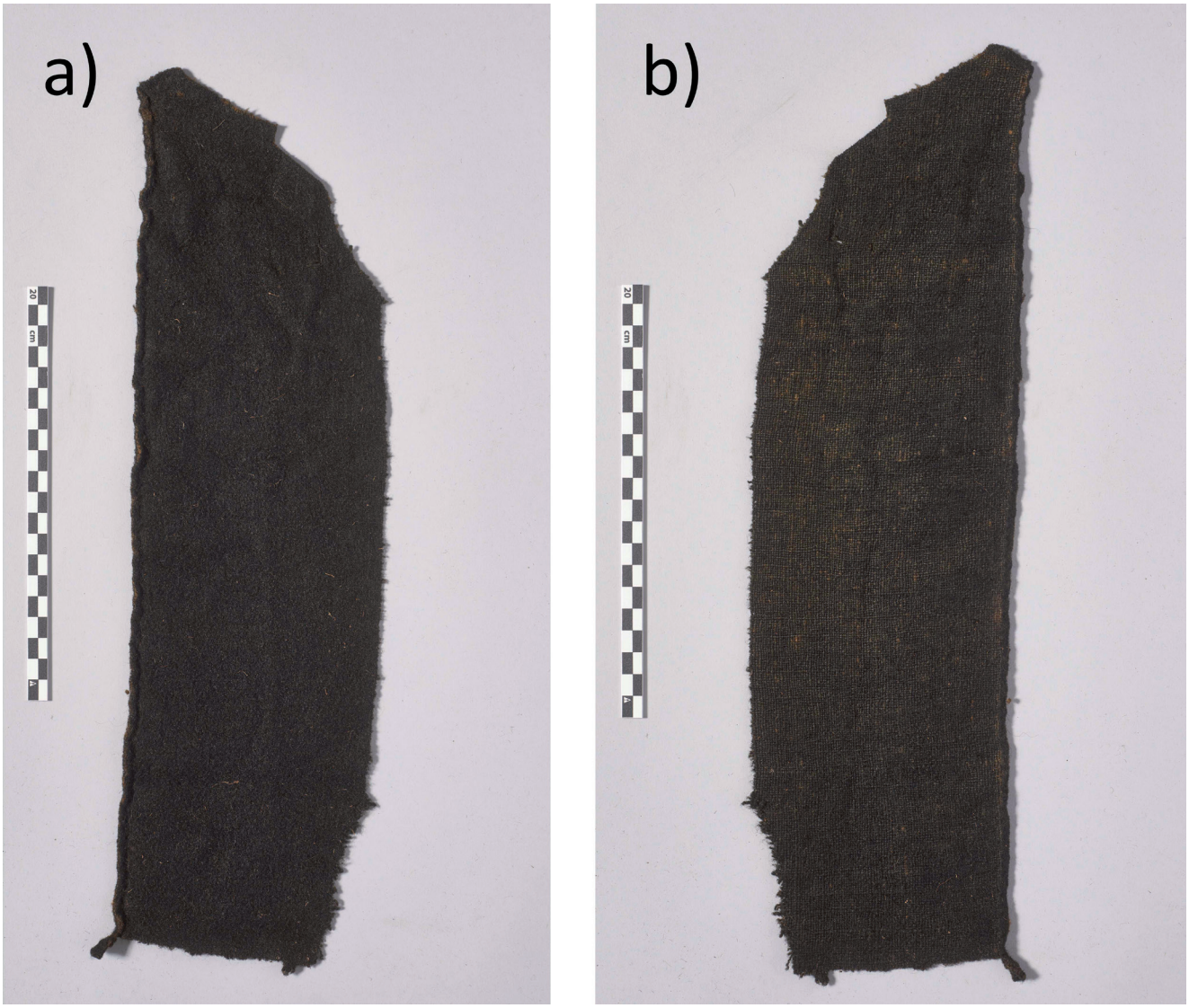


Fig. 6: Vong C37594, fragment 6: a – front; and b – back (Images: Roberto Fortuna)

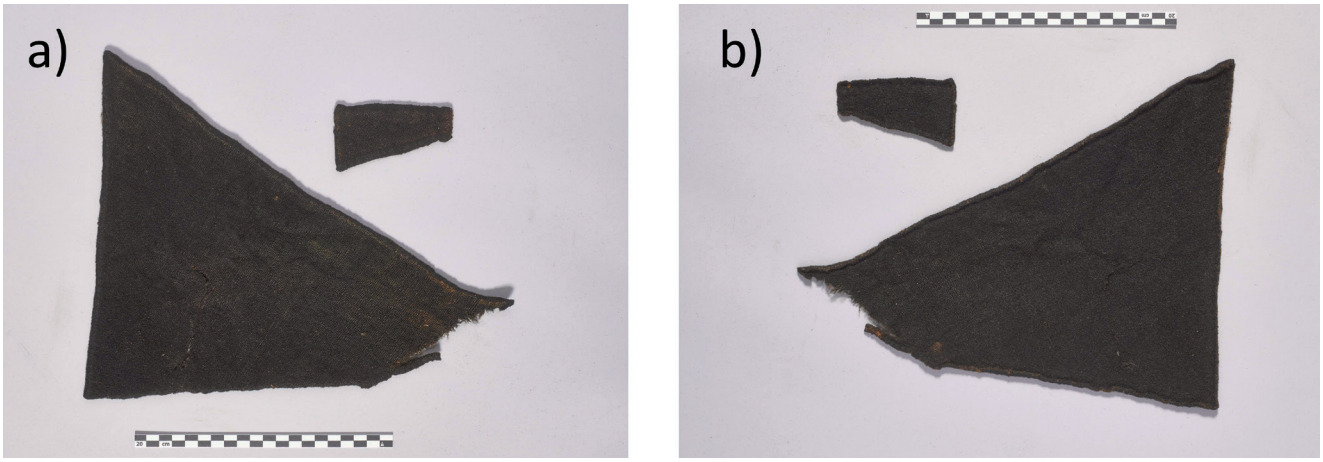


Fig. 7: Vong C37594, fragments 7 and 10: a – front; and b – back (Images: Roberto Fortuna)

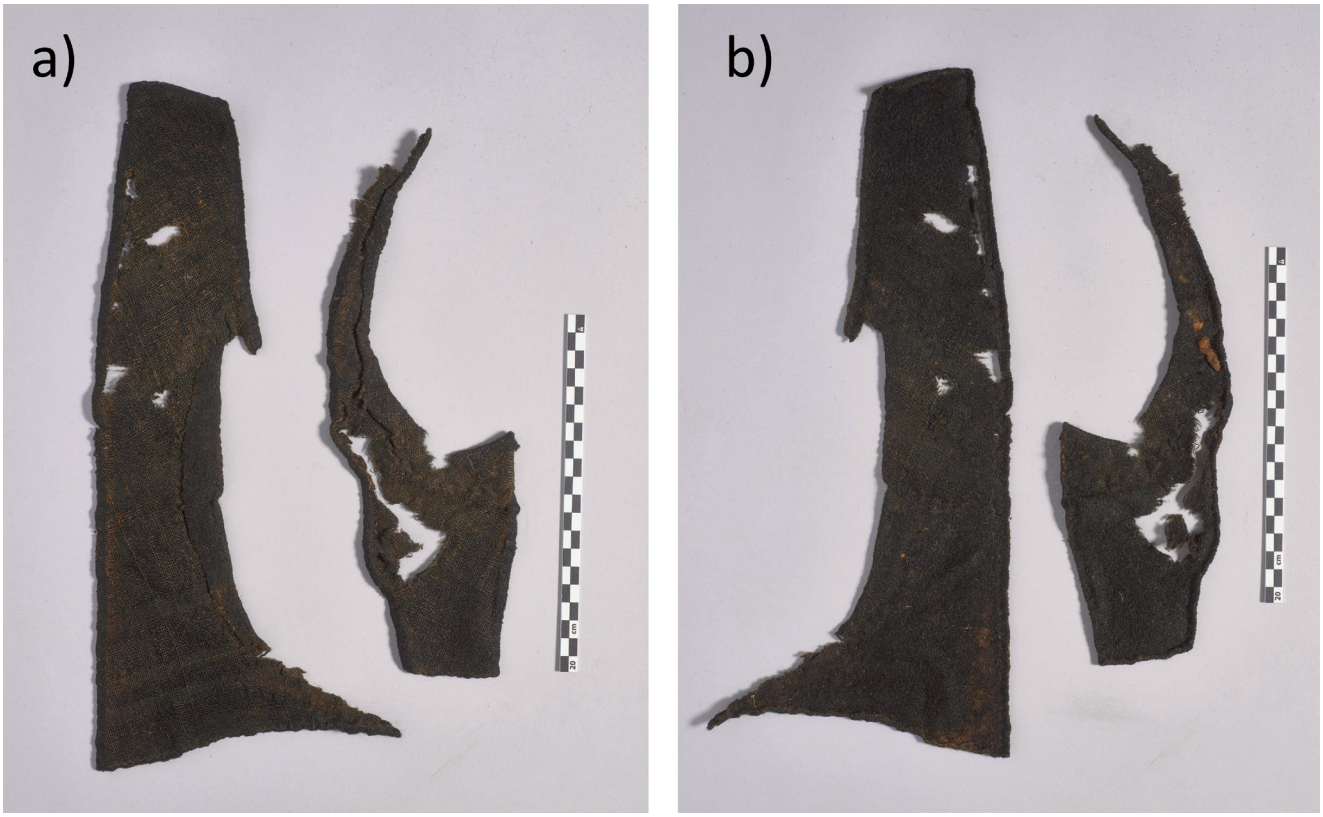


Fig. 8: Vong C37594, fragment 8 and 9: a – front; and b – back (Images: Roberto Fortuna)

The black fragments (C37594) are smaller in size but greater in number (fig. 2a, fig. 3a, and figs 6 to 8). There are ten in all and they consist of a tabby woven, fulled wool textile with a thread count of 10/10 per cm, and 0.6 mm to 0.8 mm thick threads in warp and weft. The yarn is single z/s twisted, and the twist angle for both the warp and weft is 30^0 to 40^0 (table 2). This type of fabric was termed *klæde* (woollen cloth) from the Medieval period onwards in Denmark (Lorenzen 1975, 9). The pieces are clearly fulled but the nap has worn off on the outer side. It is better preserved on the inner side, where it touches the light brown 2/1 wool twill (fig. 5c and fig. 5d). The black textile layer in the garment was clearly pieced together. Except for the five fragments (C37594 F1-F5) that are still attached to the 2/1 wool twill (C37593 F1 and F2), their exact position is unclear, and the various rectangular, triangular and trapezoid shapes may fit in several places. Three of the fragments still attached to C37593 F2 are tied together with leather thongs that go through all the layers of fabric (fig. 9). The two fragments placed on C37593, F1 are also tied with a leather thong in two different places. The leather thongs are barely visible on the other side of the textiles. The leather thong is about 0.5 cm wide but, as the edges in many places are folded in towards the middle, it looks much narrower.

The two narrow textile straps (C37594 F4 and F5) are finger-shaped with one rounded end and the other end cut straight off. They are possibly the remains of some sort of back-strap as is seen on modern vests. The straps measure about 0.5 mm in width and are tied together with several stitches and knots made in the leather thongs.

In 1945, Hald had a sample from one of the black pieces tested for dye. Mogens Skytte Christiansen identified woad in it (Hald 1980, 137). *Klæde* was often used as the outer fabric for coats and other outerwear in the Medieval period, and the fabric could be turned inside out for alteration purposes. It is thus most likely that the black fabric functioned as the outer part of the garment.

The oval fragment, C37595, is a coarse 2/2 twill, made of a naturally pigmented brown wool (fig. 10). There is only one piece of this fabric type preserved and its function is not clear. The 2/2 twill has a thread count of 7/6 threads per cm. The warp direction is identified as the thread system with the thinner threads: from 0.8 mm to 0.9 mm threads in the warp and 1.0 mm to

Fig. 9: Vong C37594, detail of fragments 3 to 5 (Image: Roberto Fortuna)

pattern. Stitch holes are recorded along the edge, about 5 mm to 10 mm apart, and a 2-ply black wool cord is placed near the straight edge, which may be the remains of a sewing thread.

The wool fibres

Fibre analysis has been conducted on samples from all three fabrics using a Primo Star iLED microscope from Zeiss with x10 magnification and equipped with an AxioCam ERc5s camera according to the methodology described in 2018 (Skals et al. 2018). Diameter measurements were taken using the camera software and the statistical data was analysed in Excel. From textile C37593, samples of the warp and weft (S.1 and S.2) were analysed. Sample 1 has a majority of fine and medium fibres and few coarse fibres. The coarsest fibre recorded measures 64 microns. In Sample 2, almost half of the fibre content is coarse (table 4).

A cumulative frequency diagram presents the sum of the percentages of fibres at each diameter (fig. 11). The two curves coincide in the first 15% of measurements,

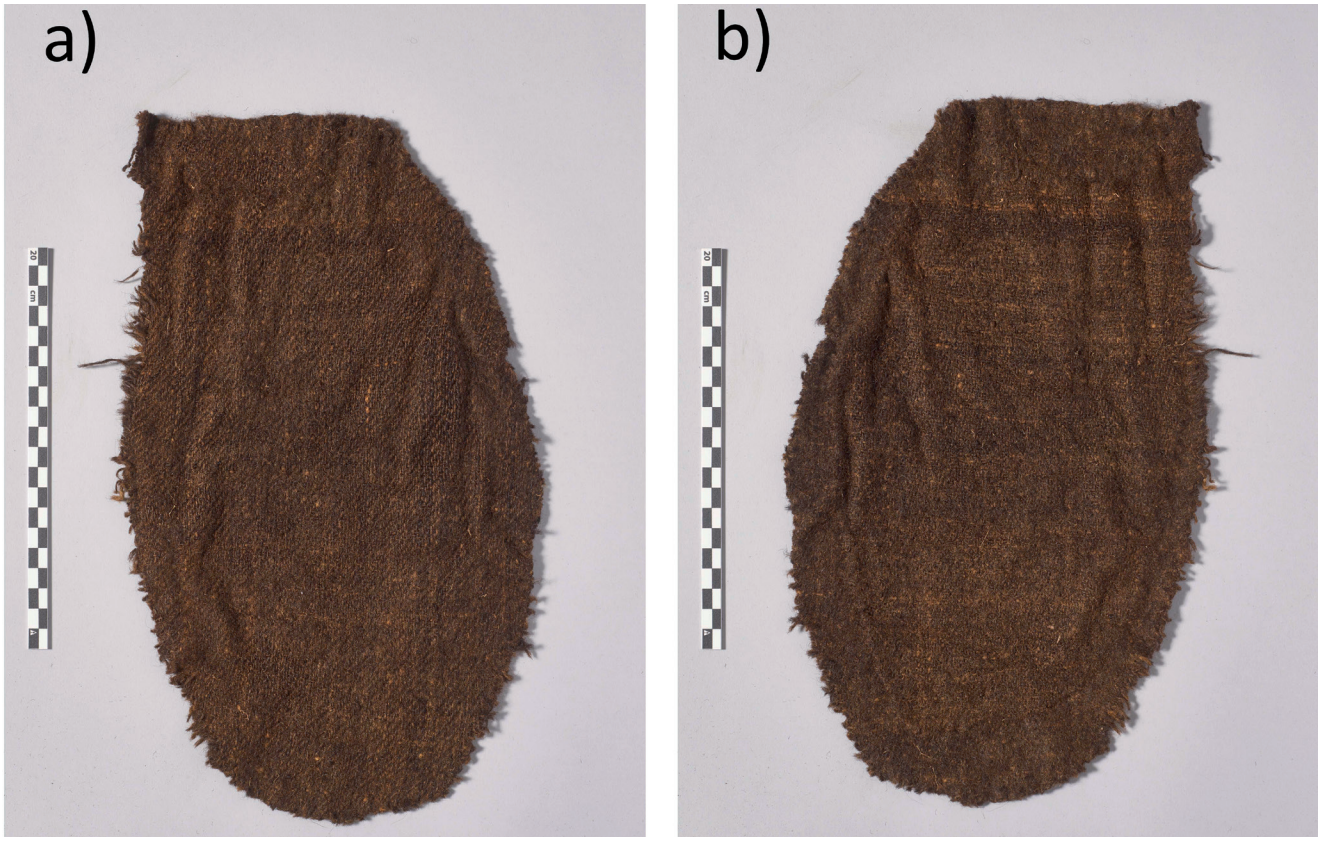


Fig. 10: Vong C37595: a – front; and b – back (Images: Roberto Fortuna)

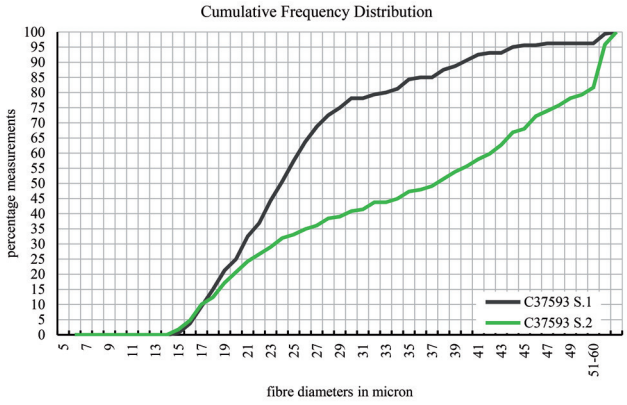


Fig. 11: The two samples from textile C37593 have similar curves for about 15% of the measurements after which they separate and become distinctly different (Image: Irene Skals)

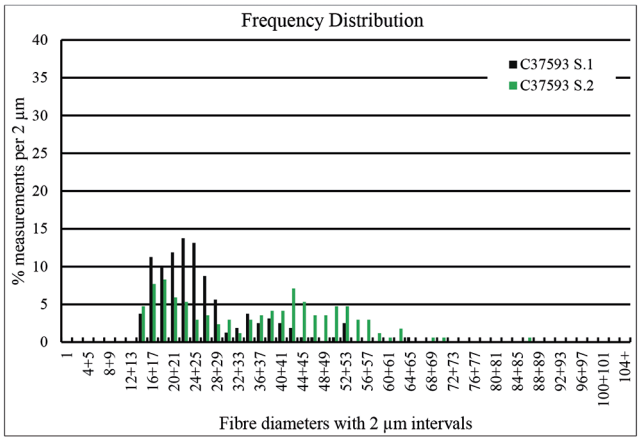


Fig. 12: In the histogram of the fibre analysis of textile C37593, the results are displayed in three peaks and the dominance of different fibre types is demonstrated (Image: Irene Skals)

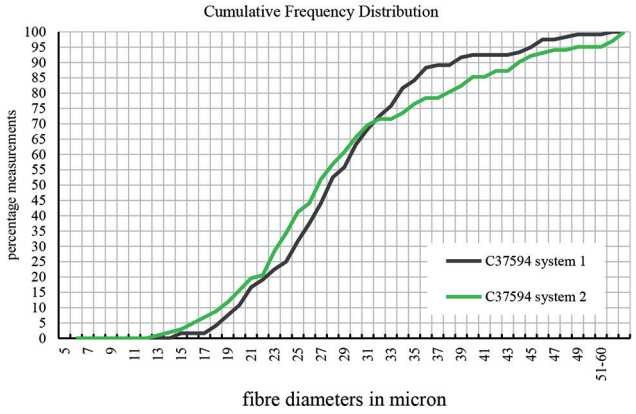


Fig. 13: The variations in the contents of the three fibre groups are illustrated in the separation of the curves showing the results from fibre analysis of textile C37594 (Image: Irene Skals)

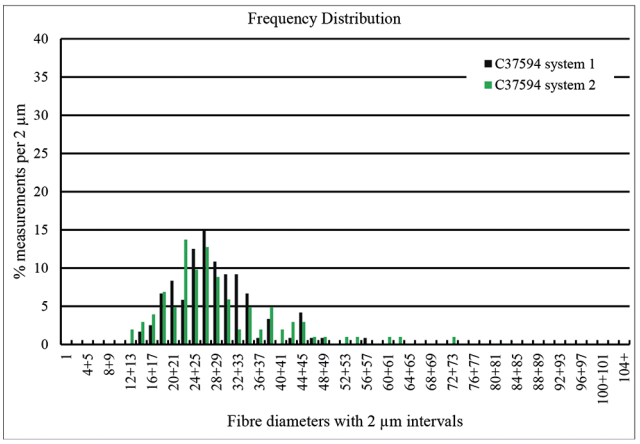


Fig. 14: The histogram of the fibre analysis of the warp and weft from textile C37594 are almost identical with only small differences in the height of the peaks (Image: Irene Skals)

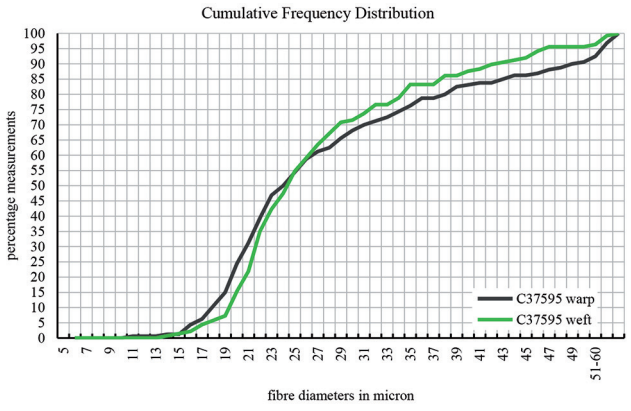


Fig. 15: The small variation in the contents of medium and coarse fibres in the yarns from textile C37595 are expressed in the curves (Image: Irene Skals)

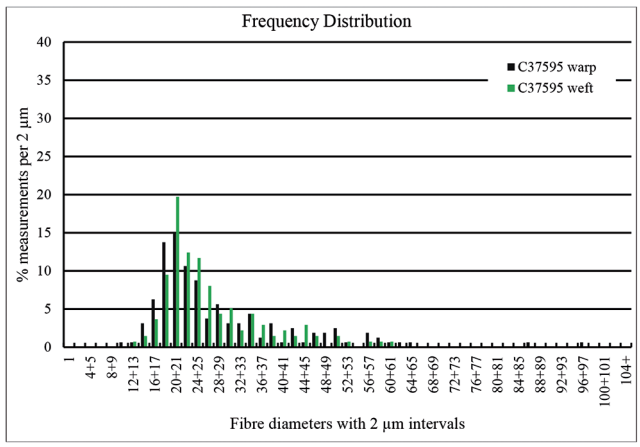


Fig. 16: The histograms showing the fibre analysis of textile C37595 illustrate the similarity in the wool used in the two yarns (Image: Irene Skals)

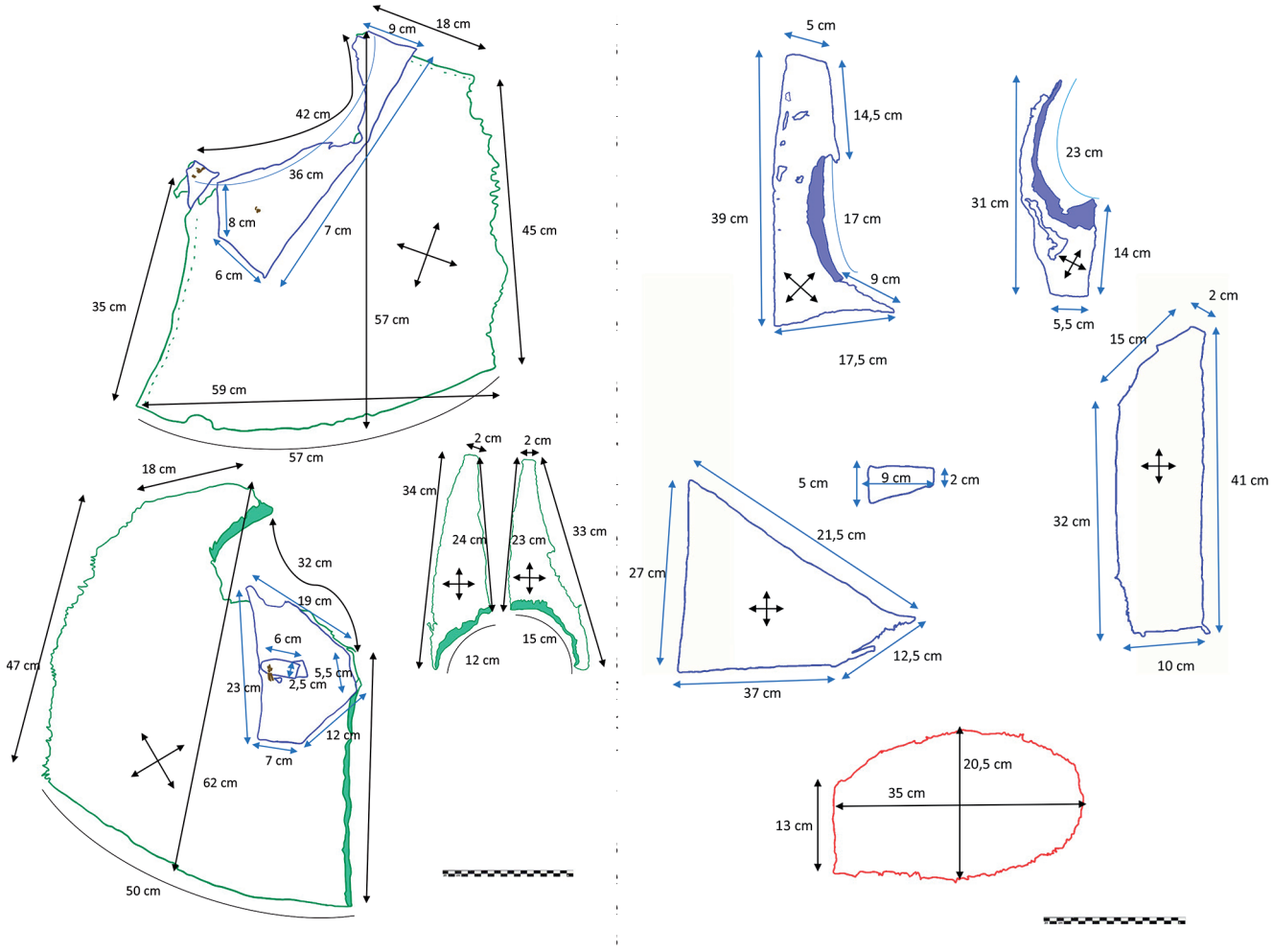


Fig. 17: Drawings of all the Vong pieces (Image: Charlotte Rimstad)

(table 6). The two cumulative frequency curves vary only slightly and the histograms are also almost identical (fig. 15 and fig. 16). The difference in the quality classifications as D (66% < 40.49 µm, 34% > 40,5 µm, 5% > 60.49 µm) and CD (80% < 40.49 µm, 20% > 40.5µm, 2% > 60.9 µm) are because there are 2% more fibres measuring more than 60 microns in Sample 1. Unpigmented fibres and fibres with different degrees of pigmentation are mixed in these yarns.

The results from the fibre analyses indicate that the raw wool used for these three types of textiles had a broad range of different fibre thicknesses varying from the very fine to coarse with the coarsest measuring less than 100 microns. This type of wool appears in Danish textiles from the Late Iron Age onwards, and the Vong results are comparable to results from analyses of Viking Age textiles (Skals et al. forthcoming). It appears that this type of wool made it possible to produce different yarns for different purposes. In Danish Viking Age textiles, yarns with a majority of coarse fibres were generally used for warps. This characteristic has also been recorded in the Old Norse textiles from Greenland (Walton Rogers 2003). Based on the identification of the coarse fibres occurring in the supposed weft thread, it is thus likely that the warp and weft direction in textile C37593 should be switched.

A further comparison is provided by the textiles from the Danish castle Boringholm dating from 1300 CE to 1400 CE. These were analysed and classified as hairy medium (Østergård and Walton Rogers 2006) according to Ryder's fleece type system (Ryder 1983). Although not all the calculations from the Boringholm textiles have been published, there seems to be a correlation with the wool types from Vong. The fibre analyses indicate the use of a typical local wool, and that the preparation of the wool for spinning and weaving conformed to well-known local standards.

The Vong clothing pattern

In 1950, Hald published a drawing of the patterns of four of the Vong pieces (Hald 1980, 69) but based on the current analysis, it is likely that all pieces belong to the same clothing item (fig. 17). The difficult and still unsolved question is what sort of garment was it? Based on the textile and wear analysis it is most likely that the two larger and two smaller 2/1 light wool twill fragments constituted the lining of the garment but it is uncertain how they should be pieced together and if other vital parts are missing.

The two largest pieces are cut in a similar specific shape, which suggests armholes and shoulder seams. However, they are not large enough to make up a complete garment. The two smaller fragments, which also almost mirror each other, may have been some kind of gusset or part of the neck opening. The remains of a few flax fibres or threads on both sides of this textile indicate the presence of a middle and inner lining. It is therefore likely that the light wool twill was never visible in the original clothing item. The ten smaller dark blue wool tabby pieces have a much more fragmented appearance. Nevertheless, interpretation of the wear on the textile and the attractive original colour suggest that they probably belong to the outer front side of the garment. The pieces can be placed in different ways but are not numerous enough to cover the whole surface of the inner lining. If this interpretation is correct, it places the clothing item in the category of secondary production and illustrates the reuse of textiles. This is not unlikely considering the bog context in which it was found.

It can be argued that the preserved pieces have some similarities with the later style of waistcoat (in Danish, a *brystdug*) from Lolland-Falster in southern Denmark dated to the 19th century (fig. 18). The waistcoat's armholes are constructed by the front and back pieces as well as smaller additional pieces sewn onto the front (Andersen 1960, 118–119). The two largest pieces from Vong are too uneven in their cut, and lack the part that should constitute the back and neck pieces, to be a complete garment. Another possibility is that the pieces constitute the hood that in later periods was worn under a hop-hat (Andersen 1960, 78, 101–107). Both options are possible and need to be supported by a 3D-reconstruction. In both cases the use relates to men's clothing in which the third oval piece of the brown 2/2 wool twill has no obvious function. Judging by the shape alone, it could be a pocket, or it may have been used as a patch for repair. Mending everyday clothing is a well-known phenomenon in many earlier and later clothing finds. In general, the finds show that in many societies, it was worth the effort and was a necessary standard practice to use and reuse clothing items and textile material until they became rags (Waagepetersen 1974; Jensen 1989; Ciszuk and Hammerlund 2013).

Fig. 18: Waistcoat (in Danish *brystdug*) from Lolland-Falster in Southern Denmark dated to the 19th century CE (Image: @ Museum Lolland-Falster)

On this basis, it can be concluded that the find is not complete and that something is missing to make it a functional clothing item, although there are no records of more textiles remaining in the bog or any additional later finds in the same area. On the other hand, it cannot be assumed that the peat diggers found or handed over all the textile pieces belonging to the find. This leaves an open question as to whether the Vong garment was complete or already a rag when left in the bog. The textile from Tvis in Denmark, dated to the 19th century CE seems to have suffered a similar fate (Mannering 2017), as opposed to the very careful and intentional bog deposits dating to the Early Iron Age (Hald 1980; Mannering et al. 2010).

Comparative sources for this type of garment are few (thus far) and it has not been possible until now to link the pieces to a known style or type of garment. It is hoped that this article will inspire colleagues with expertise in medieval clothing to include the Vong

textiles in their future studies and help to solve the mystery of its form and function.

Acknowledgements
For this article, the dating from 2007 has been calibrated by Bente Philipsen from the National Museum of Denmark. We also thank Jane Malcolm-Davies and Anna-Margrethe Jonsson for looking at the pattern and advice regarding possible parallels.

Bibliography

Andersen, E. (1960) *Danske Bønders Klædedragt*. Copenhagen: Carit Andersens Forlag.

Ciszuk, M. and Hammarlund, L. (2013) The Gunnister Man Project II: Weaving, Cutting, Sewing, and Finishing. In J. Banck-Burgess and C. Nübold (eds), *The North European Symposium for Archaeological Textiles XI*, 13–13 May 2011 in Esslingen am Neckar, 77-84. Rahden/Westf.: Leidorf.

Crowfoot, E. Pritchard, F. and Staniland, K. (1992) *Textiles and Clothing*. London: Boydell Press.

Hald, M. (1950) *Olddanske Tekstiler, Komparative tekstil- og dragthistoriske Studier paa Grundlag af Mosefund og Gravfund fra Jernalderen*. København: Gyldendal.

Hald, M. (1980) *Ancient Danish textiles from bogs and burials: a comparative study of costume and Iron Age textiles*. Publication of the National Museum, Archaeological-Historical Series Vol. XXI, Denmark.

Jensen, L.V. (1989) 16-1700-tallets hvalfangerepoke på Svalbard – hvalfangerbeklædningen set i en kulturhistorisk kontekst. In Herning Museum (ed.), *Nordisk Symposium om tekstile teknikker 1989*. Herning, 110–126.

Kjellberg, A. (1977–79) Tekstilmaterialet fra Oslogate 7. In E. Schia (ed), *De arkeologiske utgravninger i Gamlebyen, Oslo. Vol. 2*. Oslo: Alvheim & Eide, 83–104.

Lorenzen, E. (1975) *Folks tøj i og omkring Århus ca. 1675–1850*. Århus: Jysk Selskab for Historie, Universitetsforlaget Århus.

Mannering, U. (2017) The Textile from Tvis in Denmark. *Archaeological Textiles Review* 59, 82–84.

Mannering, U., Possnert, G., Heinemeier, J. and Gleba, M. (2010) Dating Danish textiles and skins from bog finds by means of ^{14}C AMS. *Journal of Archaeological Science* 37, 261–268.

Nockert, M. (1997) *Bockstensmannen och hans dräkt*. Halmstad & Varberg: Stiftelsen Hallands Länsmuseer.

Rast-Eicher A (2008) *Textilien, Wolle, Schafe der Eisenzeit in der Schweiz*. Basel: Antiqua 44. Archäologie Schweiz.

Ryder M L (1983) *Sheep and man*. London: Duckworth.

Skals, I. Gleba, M., Taube, M. and Mannering, U. (2018) Wool textile and archaeometry: testing reliability of archaeological wool fibre diameter measurements. *Danish Journal of Archaeology*, https://doi.org/10.1080/21662282.2018.1495917, 1–19.

Skals, I., Mannering, U. and Andersson Strand, E. (forthcoming) Wool quality in Danish prehistoric textiles. 3000 years of sheep wool and textile production.

Vedeler, M. (2007) *Klær og formspråk i norsk middelalder*. Acta Humaniora 280. Oslo: Unipub Oslo.

Waagepetersen, C. (1974) To gange vendt og så syet om til læredrengen. *Arv og Eje 1974*, 87–104.

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.

Østergård, E. (2004) *Woven into the Earth. Textiles from Norse Greenland.* Aarhus: Aarhus University Press.

Østergård E. and Walton Rogers, P. (2006) Tekstiler, reb og snor. In J. Kock and E. Roesdahl (eds), *Boringholm. En østjysk træborg fra 1300-årene*. Jysk Arkæologisk Selskabs Skrifter 53. Aarhus: Aarhus Universitetsforlag, 191–204.

Authors:
Ulla.Mannering@natmus.dk
Charlotte.Rimstad@natmus.dk
Irene.skals@livermore.dk

Fragment no.	Image	Size	Edge
C37593, Fragment 1 On one side attached to C37594 F1 & F2		Shoulder to bottom: 57 cm Width: 59 cm Shoulder seam length: 18 cm Back seam length: 35 cm Sleeve bow length: 42 cm Bottom bow length: 57 cm Front seam length: 45 cm	7 mm folded edges Back seam: folded Traces of hem stitch along the lower edge and shoulder seam Torn at the front edge Sleeve bow: Fold, traces of stitches
C37593, Fragment 2 On one side attached to C37594 F3, F4 & F5		Shoulder to bottom: 62 cm Width: 46 cm Shoulder seam length: 16 cm Shoulder seam top: 6 cm Back seam length: 34 cm Back diagonal: 11 cm Sleeve bow length: 32 cm Bottom bow length: 50 cm Front seam length: 47 cm	
C37593, Fragment 3 Small fragment with diagonal edge		Length: 33 cm Width: 9 cm Bow: 12 cm Largest long edge: 34 cm Small long edge: 24 cm Top: 1 cm Tip: 2 cm	Fold on the upper edge, 1.5 cm All other edges have stitch holes
C37593, Fragment 4 Small fragment with arch-shaped edge		Length: 32 cm Width: 11 cm Bow: 15 cm Largest long edge: 33 cm Smallest long edge: 23 cm Top: 2 cm Tip: 2 cm	Fold on upper edge, 1.5 cm with seam All other edges have stitch holes

Table 1. Technical details of the light brown 2/1 wool twill fabric

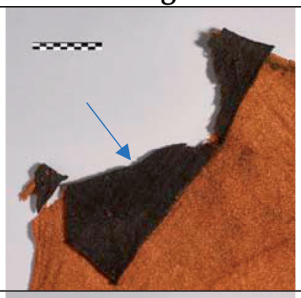
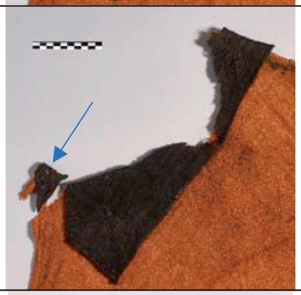
Fragment no.	Image	Size (mm)	Edge
C37594, Fragment Fragment 1 Attached to C37593, F1 with a leather string		Length: 42 cm Shoulder seam 9 cm Back seam: 6 cm Diagonal small edge: 8 cm Sleeve bow edge: 36 cm	
C37594, Fragment Fragment 2 Small triangle Attached to C37593, F1 with a leather string		Diagonal seam: 8 cm Height: 6 cm Top: 2 cm Sleeve edge: 4 cm	
C37594, Fragment Fragment 3 Large fragment Attached to C37593, F2 with a leather string		Length: 23 cm Small lower edge: 7 cm Back edge: 12 cm Shoulder diagonal edge: 5.5 cm Shoulder edge: 12.5 cm Full shoulder edge: 19 cm	
C37594, Fragment 4 Small upper piece Attached to C375943, F2 with a leather string		Length: 6 cm Width: 2.5 cm	
C37594, Fragment 5 Small lower piece Attached to C37593, F2 with a leather string		Length: 7 cm Width: 2.5 cm	

Table 2. Technical details of the black wool tabby fabric

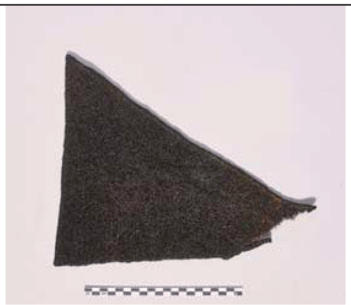
Fragment no.	Image	Size (mm)	Edge
C37594, Fragment 6 Large, rectangular fragment		Length: 43 cm Width: 12 cm Longest edge: 41 cm Lower edge: 10 cm Upper diagonal: 15 cm Upper top: 2 cm Smallest long edge: 32 cm	Longest edge has a seam, probably hem stitch
C37594, Fragment 7 Triangular piece		Length/bottom edge: 37 cm Width: 23 cm (tip to bottom) Edge a) 27 cm Small edge: 12.5 Edge b) 21. 5	Hem stitch along the sides
C37594, Fragment 8 Long fragments with bow		Length: 39 cm Width/height: 17,5 cm End: 5 cm Folded edge: 17 cm End tip: 9 cm Edge: 17.5 cm Width on the middle: 7 cm Fold: 2 cm	Seam along the edges
C37594, Fragment 9 Small fragment with arch		Length: 31 cm Width: 10 cm Lowest edge: 5.5 cm Smallest long edge: 14 cm Bow: 23 cm Longest long edge: 31 cm	
C37594, Fragment 10 Small rectangular piece		Length: 9 cm Width: 5.5 cm Upper edge: 5 cm Longest edge: 9 cm Lower edge: 2 cm	Fold on the widest edge.

Table 2. Technical details of the black wool tabby fabric

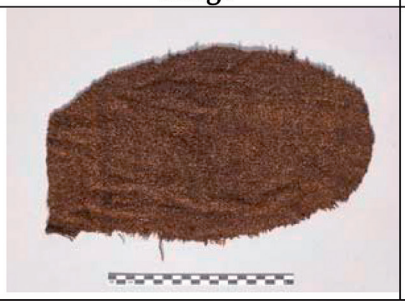
Fragment no.	Image	Size	Edge
C37595, Fragment 1		35 x 20.5 cm	All edges are cut The straight edge is 13 cm long

Table 3. Technical details of the brown 2/2 wool twill fabric

Sample	% ≤ 24.49	% ≥ 25.5 ≤ 40.49	% ≥ 40.5	Range	Min.	Max.	Cat	No. of fibres
S.1 (warp)	64	27	9	14-29, 31-35, 37-41, 43-46, 51-53, 64	14	64	CD	160
S.2 (weft)	35	21	44	14-31, 33-59, 61-63, 71, 86	14	86	EE	169

Table 4. Fibre analysis of textile C37593 with the statistical results given in microns

Sample	% ≤ 24.49	% ≥ 25.5 ≤ 40.49	% ≥ 40.5	Range	Min.	Max.	Cat	No. of fibres
S. 1	38	55	8	14, 17-36, 38-39, 43-45, 47-48, 57	14	57	C	120
S. 2	44	41	15	12-31, 33-35, 37-39, 41, 43-46, 48, 52, 55, 61-62, 73	12	73	D	102

Table 5. Fibre analysis of textile C37594 with the statistical results given in microns

Sample	% ≤ 24.49	% ≥ 25.5 ≤ 40.49	% ≥ 40.5	Range	Min.	Max.	Cat	No. of fibres
S. 1	59	24	17	10, 13, 15-35, 37-40, 42-43, 45-52, 56-58, 61, 63, 65, 86, 96	10	96	D	160
S. 2	59	28	12	13-31, 33-34, 37, 39-46, 50-51, 53, 57, 59, 61	13	61	CD	137

Table 6. Fibre analysis of textile C37595 with the statistical results given in microns

Anna Nørgård

Reconstructions revived:
a handweaver's personal perspective

Abstract
Reconstructing ancient clothing has a long tradition in Scandinavian archaeology and during her professional career as a hand weaver, Anna Nørgård has produced many items of prehistoric clothing and sails for various museums in Denmark and abroad. For her, a reconstruction is a tool, a way to gather new knowledge. Nevertheless, only on rare occasions has she been asked to produce a report and document her work. This implies that most museums are not aware of the scientific potential that the reconstruction process itself offers. In this article, she shares some of her thoughts and experiences with Scandinavian Iron Age textile technology gathered while working on reconstructions of finds such as the Lønne Hede and Huldremose clothing, the Skærsø textile and multiple metres of sail cloth.

Keywords: reconstructions, experimental archaeology, textile history, museum exhibitions

Introduction
Reconstructing ancient clothing has a long tradition in Scandinavian archaeology. From the middle of the 19th to the beginning of the 20th century, the National Museum of Denmark was enriched with an unparalleled collection of more-or-less complete garments from the Early Bronze Age (1800 BC to 1100 BC) oak coffin graves and Early Iron Age (500 BC to 501 BC) bog finds (Broholm and Hald 1940; Hald 1980). These precious objects inspired the desire to know more about how they were made and used. When Denmark participated in the 1889 World Exhibition in Paris with the exhibit *Golden Horns and Amber Bears*, the sprang hairnet from Borum Eshøj, which was found in 1871, was reconstructed by handweaver Petra Godskesen (fig. 1) at the request of the National Museum curator, Sophus Müller (Gram 1891, 101).
Interest in the recreation of prehistoric textiles from the collections of the Danish museums continued in the late 1920s when Margrethe Hald was engaged by Hans Christian Broholm to produce a reconstruction of the Early Bronze Age clothing from Egtved, excavated in 1921, for the National Museum of Denmark (Broholm 1961, 48). Later, a reconstruction of the woman's clothing from Skrydstrup, excavated in 1935 and dated to the Early Bronze Age (Broholm 1961, 37) was also made, as were several of the Old

Fig. 1: The sprang cap from the Early Bronze Age woman's oak coffin burial Borum Eshøj C, east Jutland, Denmark (Image: Lennart Larsen, National Museum of Denmark)

Fig. 2: Reconstruction of the Egtved clothing made by Gustav Rosenberg in 1924 (Image: National Museum of Denmark)

Fig. 3: Lise Fenger posing in a copy of the Egtved clothing in 1938 (Image: National Museum of Denmark)

Norse garments from Herjolfsnæs in Greenland dated to the Medieval period (Østergård 2004, 29). The main objective of these reconstructions was to make them resemble the excavated originals as closely as possible. The process by which this was achieved was not considered important. Although it is known that Hald had problems obtaining suitable yarn in the appropriate colours for these reconstructions, this work was done so skilfully that, even today, it is difficult to ascertain the difference between the originals and the reconstructions.

The Egtved clothing in particular has been reconstructed and reinterpreted several times since its discovery in 1921 (Demant 2017). Thanks to photographs and drawings, it is possible to follow the influence of contemporary fashion on these

Fig. 4: Reconstruction of the Egtved clothing, drawn for Das Kostumwer in 1941. There is no evidence for the ankle-length linen skirt added under the string skirt (Image: after Bruhn and Tilke 1988, 21)

Fig. 5: Model posing in the Egtved clothing in 1951 (Image: after Lauring 1972)

Fig. 6: Belly dancer Anni Brøgger wearing reconstructed Egtved clothing in 2006 (Image: Flemming Kaul)

reconstructions and thus add to our understanding of ancient clothing.

In my opinion, the best and most vivid interpretation was made during or immediately after the excavation by the conservator Gustav Rosenberg at the National Museum of Denmark: the model has a bare midriff with the skirt hanging low on the hips (fig. 2). In a photograph taken in 1938, we see the secretary of the First Department at the National Museum of Denmark, Lise Fenger, in the same clothing but posing without displaying her midriff with the skirt reaching to her knees (fig. 3). Changes in the perception of the clothing were slowly happening, and in a drawing for the book, *Das Kostumwer* from 1941, an ankle-length linen skirt was added beneath the string skirt (Bruhn and Thilke 1988, 21). Obviously, it was unthinkable for them to see the string skirt worn on its own (fig. 4). In another photo from 1951 (Lauring 1972, 103), the Egtved model is shown with a rather short skirt and one of her hands placed coquettishly behind her neck. No doubt women's emancipation was beginning to take effect (fig. 5). However, all the above-mentioned examples are in strong contrast to the sensational belly dancer (fig. 6) from 2001 (Brøgger 2003). Thus, the history of the reconstruction of the Egtved clothing demonstrates that, even though this is an almost completely preserved outfit, a reconstruction cannot and will never be truly objective. The purpose of a reconstruction and contemporary customs will always influence perceptions of the clothing, and it is easily changed depending on, among other things, pose and hairstyle. Therefore, it is necessary to update reconstructions regularly.

The Lønne Hede clothing

There is an even bigger challenge when an ensemble has to be reconstructed on the basis of fragmented textile finds. The well-known Danish Lønne Hede clothing (Munksgaard and Østergård 1988) is one of the more complex reconstructions I have made. In a grave dated about 100 CE, more than 300 textile fragments were recovered during excavation in 1969 with the largest measuring 124 x 23 cm. The textiles were initially analysed by conservator Else Østergård, and the complete scientific analyses and interpretation of all the Lønne Hede graves are currently in their final stage (Munksgaard and Østergård 1988; Demant et al. 2021). In 1971, a reconstruction of the clothing was made for a preliminary publication, based on the position of the jewellery and the technical details of the various textiles (fig. 7) found in the grave (Lomborg 1971; Nordquist and Ørsnes 1971). This reconstruction was made in collaboration with conservator Dorthe Ørsnæs who also participated in the excavation, and curator Elisabeth Munksgaard from the National Museum of Denmark. As the textiles are highly degraded and fragmentary, it was very difficult to obtain a clear understanding of how the clothing must have originally looked; for example, the length of the skirt is not known. Nor is it clear whether or not the upper part of the clothing had sleeves. In the reconstruction, the upper part was interpreted as having been worn draped around the torso and kept in place by the fibulae on the shoulders. However, it is still uncertain how this reflects the way the original may have looked.

During a long professional career as a hand weaver, I have produced 12 Lønne Hede outfits for various museums in Denmark and abroad. The first was made more than 40 years ago. This reconstruction was very

Fig. 7: Reconstructed clothing from the woman's grave in Lønne Hede excavated in 1969 (Image: Henning Ørsnes, after Nordquist and Ørsnes 1971, 14)

exciting to produce in spite of the many uncertainties. I was fascinated by the information about the textile craft, which became clearer during the working process. However, the last Lønne Hede reconstructions were more like mass production. Hardly any new information about the find has been added over the years, and this is a problem when the first and only attempt to reconstruct it is accepted as the one true solution without any new questions being posed. A reconstruction should be a tool offering a way to gather new knowledge and build on past experiences. A reconstruction such as the Lønne Hede clothing provides invaluable information about ways of dressing that can be extremely difficult to extract from the textiles themselves. Likewise, the creation process itself and the techniques used can be deductive (Nørgård 2008, 45–52). The great challenge is to produce a textile of the same high quality as our forebears and accomplish this by using tools used during prehistoric times. By spinning the yarn and weaving the textile using the appropriate tools, it is possible to gain an insight into the level of original craftsmanship, which is otherwise hidden from view. The knowledge gained can be, for example, the amount of time it took to produce the garments, thus providing an evaluation of the social status and economic capacity of the owner of these clothes.

Experience shows that when a reconstruction is to be made, it is important to have a clear idea of the intended purpose and what exactly is to be reconstructed, because these decisions influence the working processes. Is it going to be placed next to the original fragments in an exhibition or is it intended for teaching purposes or use in theatre or role playing? The former is arguably more complicated and challenging to make, but it also results in the greatest input to our knowledge of the past. The latter involves more practical questions, such as how strong and durable the reconstructions need to be. As a craftsperson, there is a preference for choosing the most accurate method, whereby as much as possible is done by hand. But it is, of course, also a more time consuming and thus expensive solution than working with modern tools.

Today, specialised investigations of fibres and dyes make it possible to go into the very core of a textile and extract information which cannot be obtained by eye alone. The analyses can show whether a textile was made of naturally pigmented or dyed fibres, although they cannot as yet always reveal the exact hue or source of the colour. It is also possible to reconstruct textiles in such a way that wear and tear caused by their former owners can be reconstructed, as in, for example, children's clothing made of reused adult garments or the Gunnister man's garments (Ciszuk and Hammarlund 2013). Use and reuse is thus an important aspect that needs to be addressed before a reconstruction is planned.

Spinning

When reconstructing prehistoric garments, it is most appropriate to use a drop spindle or a spinning hook for producing the yarn with which to weave a textile. The spinning wheel is a tool first introduced in the Medieval era. Until recently, these three spinning tools were used concurrently for different purposes. *Die Leine-, Baumwolle- und Damastweberei*, written for professional textile craftspeople, contains a meticulous description of how to spin with a drop spindle (1858, 39). Most weavers of this time still preferred to use warp yarn which was spun on a spindle. As this tool could be used while walking or standing still it was an attractive and efficient tool (Hoffmann 1991, 65–68). Up until the mid-19th century, travelling people on the heaths of Jutland spun yarn on the simplest spinning tool, the spinning hook, using naturally shed sheep's wool (Hansen 1947, 32), while in certain areas of Norway, hand spinning on a drop spindle was practised alongside spinning on the wheel well into the 1920s (Hoffmann 1991, 67).

Expert spinning is a skill that takes many years of practice to acquire and cannot be learned in a few days. Grace Crowfoot describes how until the 1930s in Sudan, children of five to six years learned to spin by hand using a spindle (Crowfoot 1931, 42). Moreover, the spinning of thousands of metres of thread with the same speed and quality cannot be sustained for many hours. This applies to spinning on a spindle as well as a spinning wheel. Nowadays, only a few spinners are able to produce hand spun yarn comparable in quality to Iron Age yarn. A trained spinner can more easily adjust the fineness, thickness and firmness of the thread on a spindle than on a spinning wheel, and this is probably the reason why the European textile guilds forbade the spinning of warp yarn on a spinning wheel for a long time (Hoffmann 1991, 68). The production of warp yarn that is strong enough to withstand tension during weaving requires greater expertise than the spinning of weft yarn. In her description of the Sudanese children, Crowfoot adds: "First they had to learn how to spin weft yarn and some never got any further" (Crowfoot 1931, 42).

It comes as a surprise to many that, today, it can be difficult, if not impossible, to obtain wool of a quality that matches that of the prehistoric textiles. Although considered more primitive than specialised modern sheep breeds, the prehistoric sheep varieties had a

Fig. 8: Detail of the original Skærsø blanket (Image: Roberto Fortuna)

larger and more varied range of wool fibres that could be sorted into different qualities. The wool quality of modern sheep breeds is developed to fit mass production, which is not always equivalent to prime quality, and this in turn affects textile quality. Wool of a different quality can completely transform the drape and look of a reconstruction. Likewise, the speed with which one can spin depends to a large extent on the wool quality, as well as the thickness of the thread and the number of twists per centimetre it requires. It is also difficult to provide an exact estimate of the length of time people in the Iron Age spent spinning yarn, using the criteria available today. However, there can be no doubt that, aside from the production of the raw materials including sorting and combing the wool, spinning was a very time-consuming process.

In 1992, I made a reconstruction of the Skærsø textile (fig. 8) for the Museum of Koldinghus in south Jutland (Hald 1980, 66–68). More than 30 years of exhibition had caused severe degradation of the original textile. It was decided to make a reconstruction that would replace the original in the exhibition (fig. 9). During the entire reconstruction process, a working journal was kept and numerous technical details noted, which has subsequently been useful for comparison with other reconstructions (Nørgård 2010).

The yarn of the Skærsø textile is made of a very fine evenly spun wool without any hair – typical for the Danish Early Iron Age (Skals and Mannering 2014). To obtain information on wool quality, a few threads were sampled for analysis and the results compared with modern wool. Based on this, it was decided to make the reconstruction using a coarse merino or Shetland wool, both of which have slightly thicker fibres than the wool of the original textile. The thickness of the z/s twisted yarn in the original textile is about 0.5 mm, with a hard to very hard twist angle (45 to 50 degrees). A similar kind of yarn but with a different twist direction is used for warp and weft, whereas the warp yarn in the tablet-woven edges is slightly thicker. A yarn with such a high twist angle easily becomes stiff and hard unless it is spun of very fine fibres. It was decided to use yarn spun on a spinning wheel for the reconstruction for financial reasons. This work was performed by a highly skilled spinner, Ella Biedilæ Steffensen, who was born in the late 1920s near Kirkenæs in Norway in a small community of fishermen and farmers. She was trained in spinning from childhood, and spun all the different kinds of yarns used by her self-sufficient family. She spent 100 hours spinning the 10,232 m of yarn that was needed for the weaving of the textile; 0.13 g of wool was used per metre. Biedilæ Steffensen was given threads from the original textile to match the thickness and twist. The result was a very fine and strong yarn, which was one of the best yarns I have ever worked with.

An exception from these evenly spun yarns is seen in the 2/2 twill scarf from Huldremose I (Hald 1980, 47–54; Mannering 2010). The textile is woven in multiple colours of naturally pigmented yarns ranging from white to light to dark brown. Three-quarters of the weave is patterned in a uniform way, but the last part differs with a change in colours and

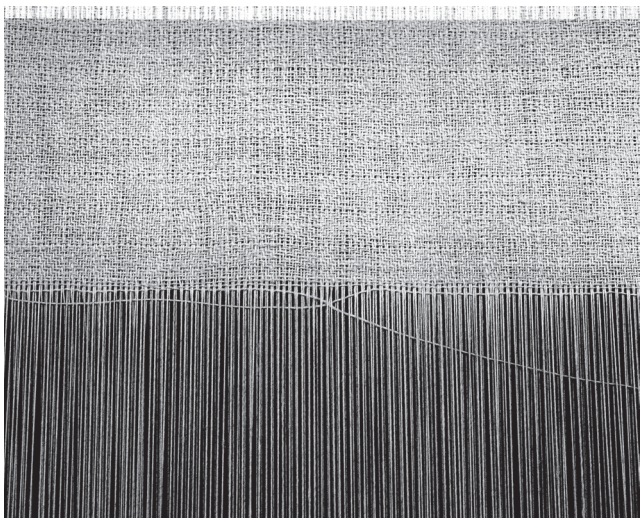


Fig. 9: The reconstructed weave of the Skærø blanket with the two wefts crossing each other. The photograph shows the hand spun yarn and the open weave which contracted after it was taken off the loom (Image: Roberto Fortuna)

yarn dominance. Here, the white colour dominates, and the white yarn is thicker and more unevenly spun. The entire appearance of the textile is as if the weaver did not have enough yarn for the planned textile pattern, and had to use whatever leftover yarns were available, which were most likely produced by a less skilful spinner. The Huldremose scarf is an excellent example of how difficult it is to make a replica of an ancient textile. If one were to spin yarn and weave an exact copy of this textile, it would be necessary to have studied the original carefully, as well as measuring the reproduced yarn equally carefully in order to ensure the small variations were incorporated into the yarns. This task would be extremely time consuming, if not impossible. In 1991 to 1992, a reconstruction of the Huldremose scarf was made using the same machine-spun yarn throughout the entire weave, which was given an extra twist using a spinning wheel (Nørgård 2008, 52–53). The colour pattern followed the original. This kept the costs of the reconstruction within the budget (Nørgård 2008, 46–48).

In 1999, for another reconstruction for the Viking Ship Museum in Roskilde, Denmark, three test weaves of 2/1 wool twill sailcloth were made using yarn spun on a spindle. The wool was from Villsau and Spelsau sheep, which are old Norwegian sheep breeds resembling the present-day Icelandic and Faroese sheep in terms of fibre quality. The wool was separated and sorted thoroughly using wool combs; the outer coat was used for the warp yarn, while the underwool mixed with the short hair was used for the weft yarn. Including this preparation time, I could spin 30 m in one hour for the first two samples. The warp yarn weighed 0.6 g/m and the weft yarn weighed of 0.8 g/m. The width of the textile was 69 cm and a total of 897 m of yarn was used for weaving 1 m of textile. This adds up to a total of 30 hours of spinning per woven metre. The samples were woven on a warp-weighted loom and the time spent was 20 hours per metre. For the third sample, Spelsau wool only was used, but as the wool was new and recently cut, and it was of a better quality than that used in the first two samples. In this case, it took only an hour to spin 48 m of warp yarn. The underwool was so fine that it could be spun without combing. Thus, 60 m of weft yarn was spun in an hour. The quality of the wool considerably increased the quantity of yarn that could be spun in an hour (Nørgård 1999).

Historical sources suggest the time spent on textile production was significant. In the 1760s, an investigation was conducted on how the rural population in Härjedalen in Sweden spent their time through the year. It transpired that the women spent eight months of the year keeping house and producing clothes for the family (Magnusson 1986, 238). This testifies to the amount of work and effort that was put into the production of textiles and clothing in this period. It is very reasonable to believe that a similar working pattern would have been valid for people of the Iron Age.

The weaving

In Scandinavian prehistory, it is possible to document the use of at least two different loom types: the warp-weighted loom and the two-beam loom with a tubular warp (Hald 1980). The evidence comes from archaeological textiles and finds of loom weights. On a two-beam loom with a tubular warp, the warp is set up directly on the loom, whereas the warp for the warp-weighted loom is produced separately and then mounted on the loom. At first, it might seem that the two-beam loom is a simpler tool to handle. However, in reality, it is more difficult to maintain the same tension in the weft threads than when weaving on a warp-weighted loom. Working with the warp-weighted loom is preferable, as it provides more space between the layers of warp threads and it allows a more comfortable working position (Hoffmann 1964). An important advantage in weaving on the two-beam loom with a tubular warp is that it is possible to weave on the entire warp. On the warp-weighted loom in

Fig. 10: Weaving on the warp-weighted loom constructed for the reconstruction of the Skærsø textile in 1992 (Image: Roberto Fortuna)

contrast, there will always be leftover warp, and this is pertinent for a society in which spun thread is of great value. Yet, the leftover warp can always be used for sewing thread or other purposes. The warp-weighted loom provides the possibility of weaving very long textiles since the length of the warp is not restricted by the size of the loom. This is a great advantage if one is to weave, for example, sailcloth where each textile piece can be up to 12 m to 15 m long for a sail of about 100 m^2 (Nørgård 1999, 2016).

The above-mentioned Skærsø textile is a complete 2/2 diamond twill piece measuring 150 cm by 206 cm with tablet-woven borders on all four sides. Based on technical details observed in the textile, it was most likely woven on a warp-weighted loom. Therefore, the reconstruction made in 1992 was also woven on a warp-weighted loom, which was especially constructed for this purpose. The width of the loom was made large enough to allow room on both sides of the textile for the shuttle to clear the sides of the loom. The height of the loom was adjusted to my height, so that I could stand on the floor during the entire working process (fig. 10). However, this had the unfortunate consequence that only approximately 30 cm could be woven before the textile had to be rolled onto the cloth beam and the loom weights moved down. As the finished length of the textile was to be 2 m, this process had to be repeated seven times during the weaving.

In 1999, at the same time as the above-mentioned samples of 2/1 wool twill sailcloth for the Viking Ship Museum were being woven, another loom was constructed based on the finds of loom parts from an Old Norse settlement in Greenland and the 18th-century warp-weighted loom from the Faroe Islands in the collection of the National Museum of Denmark in Copenhagen (Østergård 2004, 59 and 54). The height of this loom was 2 m. This made it necessary to stand on a bench during the initial stages of weaving and immediately after the textile was rolled onto the cloth beam (fig. 11). However, this height also enabled 70 cm to be woven before the textile had to be rolled onto the beam and all the loom weights moved. If this loom had been used in the weaving of the reconstruction of the Skærsø textile, it would only have been necessary to roll this textile three times (as opposed to seven), and much time could have been saved. This demonstrates that, it is not only the skill of the weaver that affects the production speed, but also the tool itself.

Information of this type can be used when we discuss the function of the Iron Age pit house. It has become an accepted hypothesis that pit houses are especially

Fig. 11: Weaving sail cloth on a tall warp-weighted loom in the exhibition at the Viking Ship Museum, Roskilde (Image: Werner Karrasch, Viking Ship Museum)

suitable for the weaving of linen due to the supposed humidity in this type of dwelling. However, this statement is hard to believe. The subterranean part of a house is not necessarily damp, even though it is below ground level. In addition, who wants to work in a humid basement? A linen warp does not have to be damp while weaving it. If a weave or warp is covered by a damp piece of cloth, when not weaving, this will provide enough moisture to keep the threads supple. Thus, it seems more logical that by lowering the floor level in the pit house, it is possible to make room for a high loom without using extra materials for high walls or roof construction (Bender Jørgensen 1986, 165–166; Bender Jørgensen and Eriksen 1995, 26–29; Østergård 2004, 60). Therefore, I suggest that the main reason why the pit house is dug into the ground is to make room for especially high looms that can produce longer lengths of cloth without or before the textile is rolled onto a cloth beam and the loom weights moved. The Skærsø textile has 12 to 16 threads/cm in both directions. In the reconstruction, it was woven with 13

threads per cm in both directions and it took 265 hours to weave the required 2 m, including the tablet-woven bands. A total of 2,574 wefts went into the weave, on average 9.7 wefts per hour, as there was a significant variation in how much could be woven per day. After a week, 12 wefts could easily be put in during the first working hours, but it was never possible to reach 60 wefts in 5 hours, which was the maximum number of hours of weaving per day. Likewise, the weaving of the last 30 cm of the textile was very time consuming as the warp became less mobile. When the desired length was achieved, the remaining warp was 56 cm to 58 cm long. Had the warp been 25 cm longer from the beginning, this problem would not have occurred. However, the longer warp would have required 80 g more wool and 6 more hours to spin the 600 m of extra warp yarn, if spun on a spinning wheel, and even longer on a spindle. As the warp ends on the Skærsø textile are cut off and finished in a tablet-woven border, it is not possible to know how the weaver solved this problem in the original textile.

In 1985, I participated in weaving a reconstruction of the textile from the Huldremose II find (Hald 1980, 53–54). Based on the technical details of the textile, we know that this piece was woven using a tubular warp, a technique well attested in the Early Iron Age. The Huldremose II piece is a fully preserved textile measuring 256 cm by 173 cm and the weaving of the reconstruction took 400 hours. The woven width was 170 cm, which is slightly wider than the Skærsø textile. The thread density was six s-twisted threads/cm in both systems, which is half the number of the Skærsø textile. Altogether, 1,427 wefts were put in, giving on average 3.6 wefts per hour. At best, it was possible for two weavers working simultaneously to weave 20 wefts in an hour, equalling the speed of the weaving of the Skærsø textile, which, at its optimal point, was 12 wefts per hour for one weaver.

In a second experiment in 1986, weaving a new reconstruction of the Huldremose II textile, the average speed was doubled, primarily due to accumulated working experience. Here, only 209 hours were used in weaving 1,586 wefts, giving an average of 7.5 wefts per hour. This result was obtained in spite of the width of the weave being increased by 15 cm. It may be instructive to weave more pieces of this textile in order to see if the time spent on weaving could be reduced even further.

Experiments like these are necessary to provide qualified estimates as to how fast weavers could work with different tools. They also offer information on how two or more weavers could have been working on the same loom, as the crossings of the weft threads in the original weave indicate. Weft crossings are a feature observed in many of the Danish Early Iron Age bog textiles such as the Huldremose II textile (for more examples, see Hald 1980). The common interpretation of this feature is that several people wove simultaneously, each with a separate shuttle. If there is one cross, two weavers were involved, with two crosses, three people may have been weaving simultaneously, and so on. It is easy to imagine an experienced weaver working in the middle part of the weave to guide the process and teach the "apprentices" working on the side pieces, but the weft crosses do not always appear in exactly the same place and are usually staggered throughout the weave to make them less visible. In the Skærsø textile, crossing wefts occur in the middle of the textile, indicating that it was woven using two weft yarns at a time. During the reconstruction work with the Skærsø textile, I worked alone using two shuttles (see fig. 8). As the working range for each shuttle was 70 cm to 80 cm, two 50 cm long sticks were chosen, around which the weft yarn was wound. Likewise, the shuttle had to be so thin that it could be passed through the shed without touching the warp threads. With these shuttles, the parts of the textile where they had to be guided through the warp became very small. If the shuttle had been shorter, this process would definitely have been much more time consuming.

Based on experience, it cannot automatically be stated that the presence of crossing wefts proves that several weavers were working together on the piece. An alternative interpretation is that weaving with several weft yarns simultaneously was done in order to use yarns from different spinners at the same time. No two individuals spin alike. By distributing the work of two or more people on several shuttles and weaving with several of these shuttles at a time, a more uniform weave can be achieved despite any disparity in the yarn quality. Several examples of narrow (60 cm to 70 cm), single- coloured textiles are known from the Middle Ages, where two weft threads cross in the selvedge. It is difficult to imagine any other explanation for this feature than this (Nørgård 1999, 3; Østergård 2004, 65).

Conclusion

The enormous interest in the reconstruction of prehistoric clothing often derives from a desire to make the past come alive. To a non-specialist, it can be difficult to understand or visualise how our ancestors lived and dressed based on some brown textile fragments in a museum exhibition showcase. It is a complex and time-consuming process to reconstruct ancient clothing, and, before a reliable interpretation

of the studied clothing items can be presented to an audience, it is necessary to have basic research documentation of the objects in focus.

Today, the work of reconstructing ancient clothing is a professionalised occupation and involves specialised knowledge of textile crafts, production of raw materials, and mastery of long-forgotten techniques. Reconstructions can be made for many reasons and different purposes: to try out the clothing, to test prehistoric techniques, to use it in exhibitions or simply to gain new knowledge of prehistoric life (Nørgård 2008). Moreover, if the reconstruction is successfully completed, it has great educational value, which makes it worth the effort.

The majority of reconstructions I have made over the years have primarily been for museum exhibitions. Others were produced for teaching purposes in museums or historical workshops. Very few, such as the sailcloth samples for the Viking Ship Museum in Roskilde, were produced as a scientific experiment in order to gain more information of and insight into the craft. This suggests that many museums are not aware of the scientific potential that the reconstruction process itself offers. Only on rare occasions have museums asked for a report and documentation of the work, although this is almost always available. This practice is slowly changing. Museum visitors are no longer satisfied with merely looking at objects in showcases. It is my experience that they are very interested to see craftspeople at work and may even wish to try the ancient crafts for themselves.

Whenever I weave sailcloth at the Viking Ship Museum in Roskilde, I always try to do the weaving in the exhibition area, so the visitors are able to follow the process. This certainly delays the weaving but when we look at the feedback and public interest, and all the questions the visitors ask, especially about the loom, the tools and the time involved in weaving a sailcloth, it is obvious that the onlookers receive a new and different impression than hitherto of the value of textiles in prehistoric society and why our ancestors took such good care of them. The visitors gain respect for the craftsmanship, and a new perspective and understanding of the craftpersons themselves. As some of the reconstructed boats belonging to the Viking Ship Museum use wool sailcloth produced according to ancient traditions, the visitors can go straight from the demonstration of how to weave sailcloth to the harbour where they can sail in boats with similar sails – and actually experience for themselves that this kind of textile is equally functional as modern sailcloth. This also means that the museum is active in the testing and evaluation of the sailcloth, which is of crucial importance to the scientific outcome of sailcloth reconstruction and experimental testing in general.

It is possible to gain knowledge of the entire process of textile production from fibre processing to stitching the finished textile, as well as the skills, techniques, errors and choices made by the craftspersons creating the textiles through reconstruction of well-preserved textiles from the Danish Early Iron Age. The most reliable reconstructions are achieved when the work is undertaken by skilled textile technicians in cooperation with scholars, thus benefiting from the deductive process of comparing the original and its reconstruction.

Bibliography

Anon (1858) *Die Leine-, Baumwolle- und Damast-Weberei wie auch die Spinnerei.* Ulm.

Bender Jørgensen, L. (1986) *Forhistoriske textiler i Skandinavien*. Copenhagen: Det Kongelige Nordiske Oldskriftselskab.

Bender Jørgensen, L. and Eriksen, P. (1995) *Trabjerg: en vestjysk landsby fra vikingetiden.* Aarhus: Jysk Arkæologisk Selskab.

Brøgger, A. (2003) *Egtvedpigens dans*. Copenhagen: Forlaget Mammut.

Broholm, H. C. (1961) *Bronzealderens Dragt*. Copenhagen: Nationalmuseet.

Broholm, H. C. and Hald, M. (1940) *Clothings of the Bronze Age in Denmark*. Copenhagen: Nyt Nordisk Forlag, Arnold Busck.

Bruhn, W. and Tilke, M. (1941/1988) *A Pictorial History of Clothing*. New York: Praeger.

Ciszuk, M. and Hammarlund, L. (2013) The Gunnister Man Project II: Weaving, Cutting, Sewing, and Finishing. In J. Banck-Burgess and C. Nübold (eds), *The North European Symposium for Archaeological Textiles XI*, 13–13 May 2011 in Esslingen am Neckar. Rahden/ Westf.: Leidorf, 77–84.

Crowfood, G. M. (1931) *Methods of Hand spinning in Egypt and the Sudan*. Halifax: F. King & Sons LTD.

Demant, I. (2017) Making a Reconstruction of the Egtved Clothing. *Archaeological Textiles Review* 59, 33–43.

Demant, I., Frandsen, L. B., Knudsen, L. R., Lorange, T., Scharff, A. B., Vanden Berghe, I., Skals, I., Lund Hansen, U. and Mannering, U. (2021) Lønne Hede – an Early Iron Age burial site with well-preserved textiles. *Bericht der Römisch-Germanischen Kommission* 99/2018.

Gram, B. (1891) Undersøgelser af Archæologisk Materiale udførte i Prof. Steins Laboratorium. *Aarbøger for Nordisk Oldkyndighed og Historie*, 97–119.

Hald, M. (1980) *Ancient Danish Textiles from Bogs and Burials*. Copenhagen: National Museum of Denmark.

Hansen, H. P. (1947) *Spind og Bind.* Copenhagen: Ejnar Munksgaards forlag.
Hoffmann, M. (1964) *The Warp-Weighted Loom*. Oslo: Universitetsforlaget.
Hoffmann, M. (1991) *Fra fiber til tøy*. Oslo: Landbruksforlaget.
Lauring, P. (1972) *De byggede riget*. Møde med Danmarks Historie 1. Copenhagen: Gyldendal.
Lomborg, E. (1971) Kontakt-Behov. *Skalk* 2, 18–25.
Magnusson, G. (1986) *Lågteknisk järnhantering i Jämtlands län*. Jernkontorets Berghistoriska Skriftserie 22, Stockholm: Stockholm University.
Mannering, U. (2010) The Huldremose find. An Early Iron Age woman with an exceptional costume. *Fasciculi Archaeologiae Historicae* XXIII, 15–24.
Munksgaard, E. and Østergård, E. (1988) Textiles and Costume from Lønne Hede, an Early Iron Age Burial. In L. Bender Jørgensen, B. Magnus and E. Munksgaard (eds), *Archaeological Textiles, Report from the 2nd NESAT symposium 1.-4.V.1984*. Arkæologiske Skrifter 2. Copenhagen: Arkæologisk Institut, Københavns Universitet, 53–64.
Nordquist, J. and Ørsnes, D. (1971) Pigen i blåt. *Skalk* 3, 9–15.
Nørgård, A. (1999) *Weaving samples of sailcloth on a warp-weighted loom*. Transl. Amy Lightfoot, The Viking Ship Museum in Roskilde, Denmark.
Nørgård, A. (2008) A Weaver's Voice: Making Reconstructions of Danish Iron Age Textiles. In M. Gleba, C. Munkholt and M.-L. Nosch (eds), *Dressing the Past*. Ancient Textiles Series 3. Oxford: Oxbow Books, 43–58.
Nørgård, A. (2010) *Rekonstruktion af et jernaldertæppe. Arbejdsrapport fra 1994. Reconstruction of and Iron Age Blanket. A report from 1994*. Vikingeskibsmuseet i Roskilde.
Nørgård, A. (2016) Store og små sejl – tidsforbrug ved spinding og vævning. In M. Ravn, L. Gebauer Thomsen, E. Andersson Strand and H. Lyngstrøm (eds), *Vikingtidens sejl*. Arkæologiske Skrifter 14. Copenhagen: Saxo-Instituttet, Københavns Universitet, 69–86.
Skals, I. and Mannering, U. (2014) Investigating Wool Fibres from Danish Prehistoric Textiles. *Archaeological Textiles Review* 56, 24–34.
Østergård. E. (2004) *Woven into the Earth*. Aarhus: Aarhus University Press.

Author:
anna_noergaard@hotmail.com

Ulrikka Mokdad and Morten Grymer-Hansen

Margrethe Hald: the quest for the tubular loom

Abstract
The aim of this paper is to shed light on the research and travels of the pioneering Danish textile researcher Margrethe Hald regarding the rare and ancient warping technique known as the tubular loom. It retraces Hald's steps on her quest for the tubular loom from the study of Danish bog finds through Egyptian textile remains to surviving weaving traditions in Syria and South America. Hald's method of combining archaeology, ethnology, textile craft, and art history in her research created new understandings of past and present textile traditions and paved the way for modern interdisciplinary research. By revisiting Hald's published and unpublished work on the subject, as well as letters and notes, this paper demonstrates how archival studies can improve understanding of the work carried out by early textile researchers.

Keywords: tubular loom, tubular weaving, archival studies, Denmark, Syria, South America, women in archaeology, interdisciplinarity

Introduction

Thanks to a grant from the Agnes Geijer Foundation, the research project *Margrethe Hald: the Life and Work of a Textile Pioneer: new insights and perspectives* began in September 2020 at the Centre for Textile Research (CTR), the Saxo-Institute, University of Copenhagen. Since the CTR opened in 2005, researchers have continued to use Hald's groundbreaking work as inspiration, and her doctoral thesis *Olddanske Tekstiler* (Ancient Danish Textiles) still represents a cornerstone for the research carried out at the centre (Hald 1950a).

Margrethe Hald

Margrethe Hald (1897-1982) was a Danish weaver and textile researcher who worked as a curator at the National Museum in Copenhagen from 1947 to 1967. As a young woman, Hald had learned to weave during stays at Vrigsted Højskole and Askov Højskole. During her studies at Tegne- og Kunstindustriskolen for Kvinder (School of Applied Arts for Women), she was encouraged by her teacher Elna Mygdal (1868–1940), a researcher of traditional Danish folk embroidery and the first female curator at the National Museum of Denmark in Copenhagen, to study the National Museum's textile collection.

Hald began her career with the National Museum of Denmark as a weaver hired to reproduce archaeological textiles in the late 1920s and early 1930s. She made reproductions of the textiles from the Egtved Girl and Skrydstrup Woman finds for exhibitions. Hald's investigations and analyses formed the basis for her first published work "Brikvævning i danske Oldtidsfund" (Tablet Weaving in Danish Antiquities), 1930. In 1935, she published the book *Danske Bronzealders Dragter* (Costumes of the Bronze Age in Denmark), which was followed by *Skrydstrupfundet. En sønderjydsk Kvindegrav fra den ældre Bronzealder* (The Skrydstrup Find) in 1939, both co-authored with lifelong friend and collaborator H. C. Broholm (1893–1966), keeper at the Department of Danish Antiquities at the National Museum.

The finds at Skrydstrup were made in 1935 and it was

while working with this material that Hald discovered inconsistencies between the woven fabrics and the suggested weaving technique of the warp-weighted loom. In 1937, she was sent to Berlin by the National Museum to study Egyptian textiles and make comparisons to the Danish finds of the Bronze Age. This marked the first of several travels abroad Hald made on her quest for what would later be named "the tubular loom".

Over the decades, her quest would lead her as far as the Middle East and South America, and her research was to be collected and published in a book on the subject, which unfortunately she did not get to finish. The unfinished manuscript remains in the National Museum of Denmark to this day. The aim of this article is to retrace Hald's steps in her quest for the tubular loom and to present her published results as well as some of her unpublished research and observations.

Source material and archival studies

The source material for this article consists of a number of publications by Hald and a number of unpublished archival sources stemming mainly from Hald and to a lesser extent from her sister Anna Hald Terkelsen (1894–1982). After Hald's death in 1982 her belongings were administered by her nieces Inge Hald Jensen and Else Hald Sørensen and by the textile researcher Karen-Hanne Stærmose Nielsen, who undertook a distribution of the material. The main recipients were the Danish National Archives and the National Museum of Denmark, where Hald's correspondence, notebooks and manuscripts are kept. Several smaller portions of the material were given to a number of institutions and private persons or kept by the family. The Centre for Textile Research (CTR) received a collection of articles, books, diapositives, transcripts of letters, and objects from South America, in the 2000's from Hald's niece, Inge Hald Jensen, which make up the Margrethe Hald Archive at CTR. A number of books from Hald's private library have also been donated to CTR since the original distribution of her belongings.

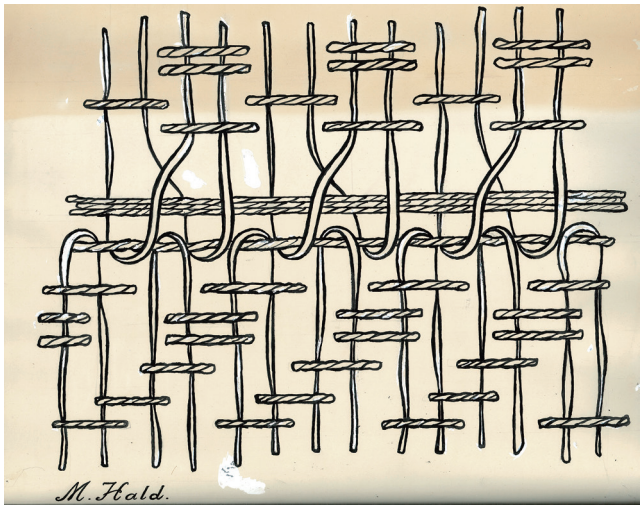


Fig. 1: This image illustrates the warp-lock from the Borremose C cloth. Original illustration painted by Hald, showing a tubular warp set up for 2/2 twill. (Hald 1955, 11, Fig. 12)

The Danish National Archives hold a personal archive for Margrethe Hald (the Hald Archive) as well as one for her sister and her sister's husband: Anna Hald Terkelsen and Frede Terkelsen (the Terkelsen Archive). The two personal archives consist of several boxes of written material and documents relating to the sisters, where the letters are of particular interest in relation to this article. The Hald Archive contains eight boxes of correspondence, including postcards and letters, mostly written to Margrethe Hald but also a number of drafts for letters written by Hald on a typewriter and usually corrected and annotated by hand. These drafts are very important, as they give us an idea of how Hald replied to the letters she received, and as the corrections made to the typewritten drafts are very minor, it may be presumed that these more or less represent the finished letters. This archive also contains actual letters written by Hald to her mother, Marie Pedersen. These letters were probably returned to Hald sometime after the death of her mother in 1947.

The Terkelsen Archive is not yet open to the public but, fortunately, we were granted access to part of it in December 2020 before the Danish National Archives closed down as a result of Covid-19. Box 17 contains letters from Margrethe Hald to her sister during her extensive travels in South America in 1965–1966 and the Middle East (mainly Syria) in 1960 and 1961, to study the extant tradition of tubular weaving. A transcription of the letters from South America made by Inge Hald Jensen is in the archive at CTR.

The National Museum of Denmark's department for Ancient Cultures of Denmark and the Mediterranean holds in its archive a number of original manuscripts of Hald's books and some unpublished material, as well as some notes and notebooks (a greater number of notebooks are in the Hald Archive at the Danish National Archives) and a few letters and miscellanea.

The technique of tubular weaving

Remarks on terminology

During our research for this article, we have noticed that the concept of the tubular loom and tubular weaving requires a thorough explanation of not just

the technical aspects of this ancient warping method but also of the terminology used.

According to Strömberg et al. 1967 (first edition of *Nordisk Tekstilteknologisk Terminologi* (NTT)) the Danish term 'rundvæv' corresponds to the fabric produced on a loom set up for tubular weaving and the corresponding English term is 'circular fabric', while according to the latest version the term is 'tubular fabric' (Strömberg et al. 1979). 'Rundvæv' meaning tubular loom does not have a separate entry, as it is not a distinct loom but rather a set up for a two or three-beam loom (for further explanation please see the following section on the technique of tubular weaving). Even though Hald was one of the editors of the first edition of NTT in 1967, her writings on tubular weaving do not reflect the definition given in this work. Instead, she uses the terms 'rundvæv' and 'rundvævning' in Danish and 'tubular loom' and 'tubular weaving' in English. 'Rundvævning' is used to refer both to the technique and the fabric produced (Hald 1952, 196; Hald 1964, 95). It is thus very likely that the English terms originated with Margrethe Hald as translations of her preferred Danish terms. She probably chose the Danish terms to better differentiate between the weaving device (rundvæv) and the technique/fabric produced (rundvævning) because of the ambiguity of 'væv'. In Danish, the word 'væv' means both weave/fabric and loom, which is not the case in Norwegian or in Swedish, where vev/väv means fabric and vevstol/vävstol means loom. The Swedish term 'rundväv' meaning tubular fabric can thus not be confused with the term 'tubular loom', and the corresponding Norwegian term 'rundvevd tøy' rules out any misunderstanding by adding 'tøy' (fabric). It is thus only the Danish term 'rundvæv' that leaves room for confusion as to whether it refers to a weave/fabric or a loom. Furthermore, it is interesting that Hald's use of the English terms, using 'tubular' rather than 'circular', precedes the NTT definition (Hald 1962b), and that this definition later replaced the one from 1967 completely as evidenced by the 1979 version of NTT.

The English terms used by Hald are not direct translations of the Danish; the Danish terms' literal meaning are "round loom" and "round weave". It seems the Danish terms may come from the process of weaving around a two-beam loom, whereas the English term describes the fabric produced, which is in Danish also often referred to as tubular (rørformet). The entry from NTT 1967 does, as mentioned, show an alternative English synonym: circular fabric. The word 'rund' (round) in Danish may also be understood as 'circular'.

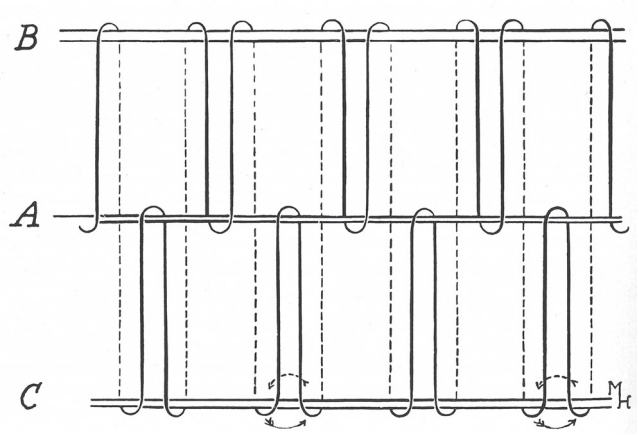


Fig. 2: The principle of a tubular warp set up according to the looping method (Hald 1980, 166, fig. 174)

As mentioned, tubular woven fabrics were not produced on a round loom or a loom shaped as a tube, but rather on a vertical loom with at least two and sometimes three horizontal beams and a warp mounted for tubular weaving. The use of the term 'tubular loom' is thus problematic, as it does not in reality refer to a specific loom type. This may be the reason why several misunderstandings concerning the concept of tubular weaving have appeared in articles on textile research over the years.

The term 'tubular loom' has, however, been used by both Hald and later textile researchers. Hald seems to have been aware of the problems concerning the designation, and either explains the tubular loom to be a 'weaving device' rather than a loom (Hald 1962b, 11; Hald 1967, 10), or names it as 'the so-called tubular loom' (Hald 1964, 105), so that the term 'tubular loom' in this case does not designate a specific loom, but a device prepared for tubular weaving. The term 'tubular loom' has, however, been used by later scholars without Hald's caveats, which may lead to the misunderstanding that this is a specific type of loom and not a certain way of setting up a two or three-beam loom. This problem has been raised by Stærmose Nielsen, who argues that the term is misleading and must be avoided (Stærmose Nielsen 2005, 133). The term does, however, serve a practical purpose of simplifying the arguably more correct but much more complex description 'a two-beam loom set up for tubular weaving', which may very well be the reason for Hald to use the term 'tubular loom'.

In this article we have chosen to adopt Hald's designations, as she is the author of the source material, and even though the term 'tubular loom' may be seen as imprecise or even problematic, it does

allow for a better flow. Stærmose Nielsen's suggestion of avoiding this term may be problematic in itself, as it can leave the work of Hald (and others) even more confusing for modern readers, as they may not have come across the term or its usage before. Therefore, the most sensible solution seems to us: to use the terms used by Hald with clear definitions of these terms in order not to cause further confusion about the meaning of 'tubular loom' and 'tubular weaving'.

The technique(s) of tubular weaving

The Margrethe Hald Archive at CTR includes a copy of an incomplete and hitherto unpublished manuscript for a book that Hald worked on for many years. The original manuscript belongs to the National Museum of Denmark's department for Ancient Cultures of Denmark and the Mediterranean.

The manuscript is for a book which would probably have been entitled either "Tubular Weaving around the Globe" or "The Tubular Loom – A Comparative Study in Primitive Weaving" (CTR: 1984-85, 1). The book should have dealt with the use of a prehistoric warping method that Hald refers to as "the Huldremose Technique" in a letter from Colombia to her sister Anna in 1966 (NA2 1966). Hald refers to the warping technique as "the tubular loom" or just "tubular weaving".

It is in fact neither a distinct form of loom, nor a special weaving technique or a particular binding, but an unusual way of warping. Among weavers it is common knowledge that the way the warp is mounted is of immense importance to the final result. According to Hald, there were two methods of setting up the warp for tubular weaving: the loop method (also type A) and the spiral method (type B). This ancient warping method is especially remarkable because, when setting up the vertical two-beam loom by the loop method, the warp yarn is passed round the loom and back, the turning loop being anchored by a thin rod or strong cord the width of the loom. The warp thread is passed so it alternately loops the cord or stick from above and from below resulting in a row of loops, which face each other alternately along the stick or cord. The cord works as a "warp-lock" to keep the tubular warp together both during weaving and afterwards (figs. 1–2).

This method of warping the vertical loom has the advantage that it enables the weaver to produce a much larger piece of cloth than a usual set up on a two-beam loom without revolving beams. The usual set up allows just one layer of warp between the upper and lower beams, but with the warping method of tubular weaving the warp will be twice as long as the distance between the loom's upper and lower beams. If a third horizontal beam is brought into play, the length of the tubular warp can be increased considerably - as Hald experienced during her stay in a tent weaver's workshop in Syria, 1960 (Hald 1961a, 111; Hald 1962b, 41–46; Hald 1964, 93, 105).

Another advantage for the prehistoric weaver is the fact that working with the tubular warping system, there will be no waste of warp thread at all because the warp is not fastened to the beams but only to the warp-lock. Thus, the horizontal beams only serve to hold the warp threads taut during work.

When a fabric woven utilizing this warping method is entirely finished and removed from the two-beam loom, the weaver will have a tube of fabric open in both ends ready to serve as a dress or funeral shroud without any cutting or sewing if the warp-lock is not removed from the fabric. This is named the primary state.

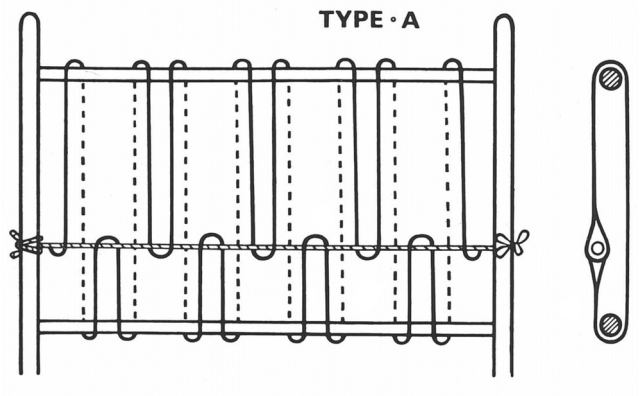


Fig. 3: The principle of a tubular warp set up according to the looping method including a cross section of a two beam-loom (Hald 1980, 211, fig. 213)

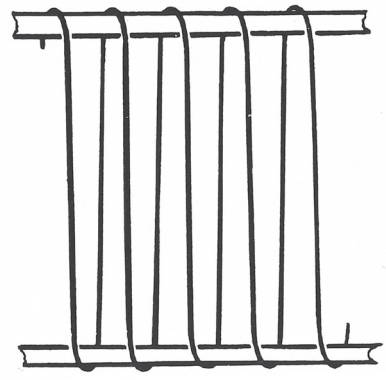


Fig. 4: The principle of a tubular warp set up according to the spiral method (Hald 1980, 213, fig. 216)

When the warp-lock is pulled out of the tubular fabric, the tube will be turned into a flat piece of fabric with four closed edges. This is named the secondary state.
In this way, tubular woven fabrics can be used in both their primary (tubular) state and in their secondary (square) state. In Antiquity, Hald points out, a tubular fabric could be used first in its primary state with the warp-lock still in place and then later, if a square fabric was needed instead of a tube, the warp-lock could be drawn out and the fabric could serve another purpose in its secondary state. Once the warp-lock had been removed from the tube, it could not be put back (Hald 1955, 32; Hald 1962a, 72).
An important point is that the warping principle for tubular weaving, the so-called loop method or type A method described above, was not the only way of tubular weaving studied by Hald. In her 1942 article on looms in the Ethnographic Collection of the National Museum of Denmark, she describes a different warping method that also results in a tubular fabric. This is what she defines as the "spiral method" or type B method (Hald 1960, 224, 240–242; Hald 1962b, 11–13; Hald 1967, 15) which has been practiced by, for instance, the Navajos of North America for weaving narrow bands on a loom which is made out of a forked branch and a few sticks (Hald 1942, 52–55).
There are several differences between the loop method and spiral method and their results:
The spiral method of tubular weaving is produced with a warp thread running spirally around the two beams of the loom in one direction as shown in figs. 3 and 4.
If a tubular fabric made with the spiral method method in its primary, closed state is desired, it must be removed from the loom without cutting the warp threads, just like tubular fabrics produced by the loop method method. If, on the other hand, a rectangular fabric lying flat is desired, it is necessary to cut the woven tube open as there is no warp-lock to remove.
Hald's fascination with the different techniques of tubular weaving seems to have arisen many years before her journeys to the Middle East and South America, most probably during research for her doctoral dissertation *Olddanske Tekstiler* (Hald 1950) which she defended in 1950. She discovered that the renowned Huldremose dress, which was excavated in 1896, had an almost invisible unifying cord that held the fabric together as a woven tube (fig. 5) This discovery led her to work out that the Huldremose tubular dress and several other finds from the Danish Iron Age must have been woven utilizing the loop method described above.
Not only did Hald come to understand how the tubular woven textiles from Danish prehistory were produced, but she also realized that they must have been produced on a type of loom other than the warp-weighted loom: the vertical two beam-loom.

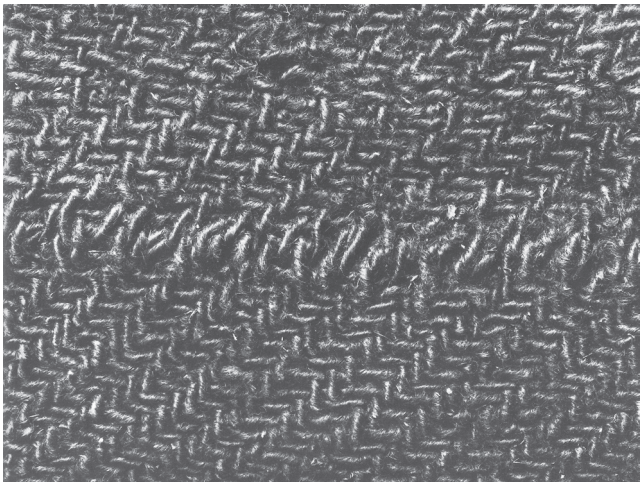


Fig. 5: Photograph showing the warp-lock from the Huldremose Dress (Hald 1980,165, fig. 172.)

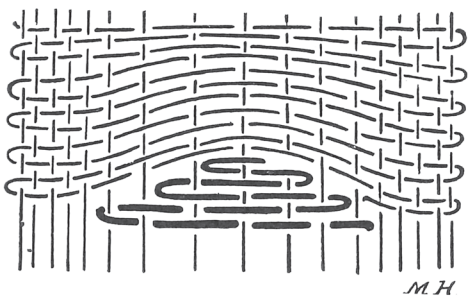
No fragment of such a loom has been found in a Danish archaeological site so far, and it is only the surviving textiles that prove that it was in use during the Iron Age.
The vertical two beam-loom consists of two upright posts to which two horizontal beams are secured thereby creating a frame. In prehistory, all pieces of the loom were made of wood and therefore not preserved due to the humid climate.
The warp-weighted loom, on the other hand, with only one horizontal beam to hold the warp has left us numerous clay loom weights as evidence of its existence and use in the area of what is now Denmark.
In the 1940s, at the time when Hald began systematically studying the principles of tubular weaving, not much had been published on the subject. Furthermore, she did not always get to know about publications relevant to her own research, maybe due to the German occupation of Denmark 1940–45.
An example is the article published in 1941 by Grace Crowfoot. This article dealt with the vertical looms of Palestine and Syria, which were warped according to the loop method of tubular weaving (Crowfoot 1941). In her article, Crowfoot does not use the terms "tubular loom" or "tubular weaving" but explains the warping method in detail. Crowfoot states that a third beam placed somewhere behind the two horizontal beams, but not connected to the side posts, was a defining feature for the loom in Syria and Palestine (Crowfoot 1941, 141–142). However, it has been suggested that the

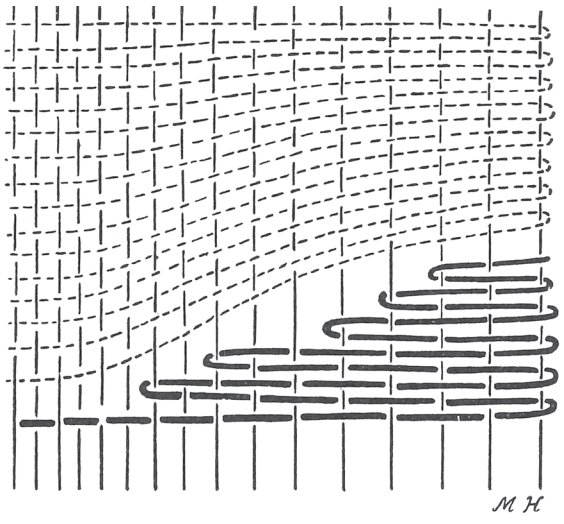
third beam would be a possible addition to the loom but not necessarily a defining feature for the tubular weaving of the Middle East (Stærmose Nielsen 1999, 123).
Hald briefly mentions Crowfoot's article in the post scriptum of *Olddanske Tekstiler* in 1950 and points out that the author's illustrations on setting up the vertical loom correspond well with her own conclusions.

Journeys abroad
Over the many years Hald worked at the National Museum of Denmark in Copenhagen, she came into contact with the principles of tubular weaving a number of times, both while analysing the archaeological textiles in the museum's collection, but also during her trips to foreign museums, such as the Ethnographical Museum of Sweden and Schleswig-Holsteinisches Landesmuseum für Vor- und Frühgeschichte. According to her article entitled "Dragtstudier" (Hald 1961b), Hald visited the latter in 1959, 1961 and 1962 in order to study Iron Age textile fragments.
In the 1960s Hald embarked on three major study trips to the Middle East and South America. During her travels, she had the opportunity to observe the ancient warping methods of tubular weaving practiced by local weavers and experience the surviving tradition of "the tubular loom" in authentic surroundings.

How it all began. Wedges and loops in the Bronze Age and a trip to Berlin
In 1935, Hald mentions irregularities in the woven fabrics of the Bronze Age, which she calls wedges and double-wedges (Broholm and Hald 1935, 310–311). In her doctoral treatise she writes: "When these are found within the fabric's surface and are forming pointed ends towards both edges, I call them double wedges (…)[fig. 6]; when they begin in one side of the fabric and forms a pointed end towards the rest of the surface, I call them single wedges (…)[fig. 7](Hald 1950, 154)."
A single wedge is created when a varying number of wefts beginning from one of the edges turn somewhere across the width of the fabric instead of passing from selvedge to selvedge. A double wedge is created by passing wefts back and forth somewhere on the width of the fabric without going from selvedge to selvedge. The reason for weaving single and double wedges into the fabric is to make up for either a group of warp threads with uneven tension which result in poor sheds or to make up for groups of warp threads which are pulled too closely together thereby making it difficult to beat down the wefts equally over the width of the cloth. The overall goal is to enable the weaver to pass the wefts in a straight line from edge to edge avoiding getting the cloth wobbly and/or crooked.
In 1939, she presented the argument that these wedges indicated the use of a loom other than the warp-weighted loom (Broholm and Hald 1939, 83–84). This unknown loom, she theorized, would have been a two-beam loom in order to explain the high frequency of wedges in the woven textiles. If a warp-weighted loom had been used, there would have been several other ways to combat the irregularities occurring in the fabric due to 'tightening' and thus leave the high-frequent occurrences of wedges unexplained. The two-beam loom was well-documented elsewhere but its existence in Northern Europe was yet to be proven. The Skrydstrup find was excavated in 1935 and its contents studied by Broholm and Hald in the following years. As part of these studies, Hald was sent to Berlin by the National Museum of Denmark in the summer

Figs. 6a and 6b: The so-called single wedges and double wedges that Hald found both in the fragments of Danish Bronze Age textiles and in Egyptian textiles at the Kaiser-Friedrich-Museum in Berlin. (Hald 1950a, 155, figs. 146 and 147)





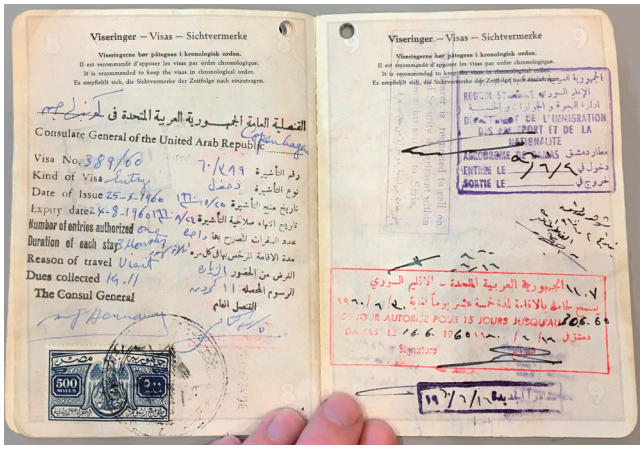


Fig. 7: Hald's passport with her visas for the United Arab Republic and Lebanon, 1960 (NA 1 1963)

of 1937 to identify possible comparisons in Egyptian textile finds. In a letter to her mother written during her stay in Berlin she eagerly shares her findings:

> *Yesterday was the highlight of the trip with regard to academic benefit. I found the same cross and wedge-weavings in some Egyptian tabby fabrics, as the one we have in Danish Bronze Age clothes – I found it to be one of the most interesting finds in the examinations and it is very amusing, that I am now able to detect the same features in the Egyptian fabric (NA1: 1937).*

It seems likely that these findings in Egyptian textiles are what made Hald present the idea of the existence of another loom in Bronze Age Denmark, her find of the so-called wedges being the onset of her studies on tubular weaving. Some of her notes made in Berlin can be found in the archive at the National Museum of Denmark alongside a letter from Dr. Helmut Schlunk, Kaiser-Friedrich-Museum, today the Bode-Museum, who seems to have acted as a host and collaborator for Margrethe Hald, where he states that he sends her some drawings she had forgotten.

In the publication *Skrydstrupfundet* from 1939, Hald deals with several irregularities in the woven Bronze Age fabrics. She examines the fabrics' thread counts, selvedges and fringes thoroughly. She even opens up a few fringes of *Trindhøjtæppet*, and discovers that the warp ends that form the fringes still have loops (Broholm and Hald 1939, 74–77). If the textile had been produced on a warp-weighted loom, the loops on the end of the warp threads would have been cut up in order to create the two large sheds necessary for weaving plain weave on this type of loom. Hald therefore comes to the conclusion that some of the textiles might not have been produced on a warp-weighted loom.

Travels to the Middle East and South America

In the summer of 1960 Margrethe Hald left for the first of three major study tours in search of the tubular loom. A travelling visa for entering the United Arab Republic (fig. 7) was issued for Margrethe Hald valid from 25 May until 24 August 1960, and she left Denmark for Syria on 3 June 1960 (NA1: 1963). Here she was housed by the Danish hospital in the small town of Nebk. (The United Arab Republic was a political union between Egypt and Syria from 1958 until 1961, when Syria left the union. Afterwards Egypt was known officially as the United Arab Republic until 1971).

According to an article published the following year (Hald 1961a, 108), Hald had chosen Syria as her starting point, after a woman told her that she had observed looms similar to the tubular loom described by Hald in her doctoral treatise on a recent trip to Syria. Hald was, as mentioned, already aware that the tubular loom had been observed by Grace Crowfoot in Palestine and Syria before the Second World War but she was intrigued to learn that the tradition might still be alive some 20 years later (Hald 1961a, 108; Crowfoot 1941). Fortunately, Hald found that this was indeed the case, and on 8 June she wrote to her sister Anna: "Dear Anna! Well – now I am well on my way. Already on the 2. day of Pentecost I was with the family in a town, which lies c. 80 km north. There we found a loom of "my type", and I immediately began photographing(...) (NA2: 1960a)."

During this trip Hald was introduced to Michael Arbash, a weaver of tent-canvas in Yabroud (NM: 1960). Their first meeting probably happened between the 12 and 15 June, on the latter date Hald wrote to her sister: "We have been to 2 desert towns and gone for 3 days. We saw a lot of things, but the best was a weaver of tent-canvas in Yabroud (NA2: 1960b)." Hald later bought a vertical loom with three beams and a warp of goat's hair mounted for the loop method of tubular weaving from Arbash (NA2: 1960c). The loom was sent to the National Museum of Denmark, where today it is registered in the Ethnographical Collection as item F.853 (fig. 8). Objects collected by Hald during her journeys to the Middle East and S. America were part of Hald's final exhibition at the National Museum entitled *Oldtidsvæve* (Archaic Looms) in 1967 (Hald 1967; Paulli Andersen 1967). These were finally registered under her name by a guest scholar at CTR, Susanne Klose, and Inge Damm from the National Museum of Denmark in 2012. From her letters, it can be gathered that Hald spent several days in June in Arbash' workshop in Yabroud getting acquainted with the weaving process. In a draft for an unpublished

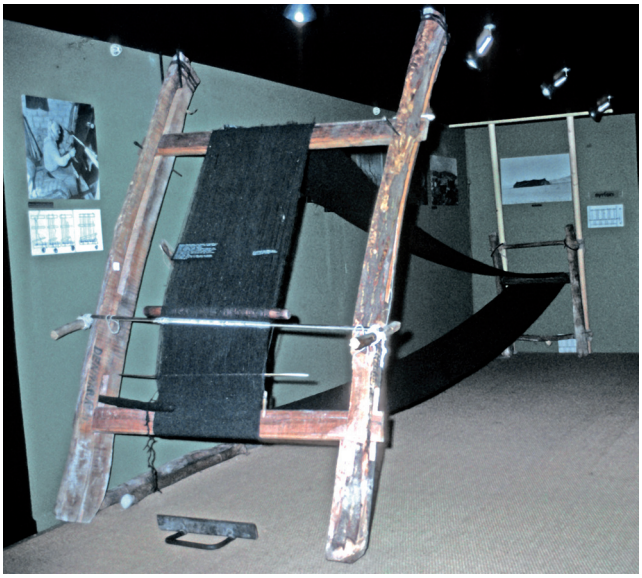


Fig. 8: Three beam-loom loom set up with a tubular goat hair warp for tent canvas. The loom was acquired by Hald in Syria in 1960 and belongs to the National Museum, Copenhagen, where it was exhibited in 1967. (Slide no. 550 in CTR's collection)

article about the trip, Hald wrote about her time with the weaver: "The weaver in Yabroud was a very careful and helpful teacher, who did not just demonstrate his work with all its subtleties for me but also allowed me to try my hand with the tools (NM: 1960)." On 9 July 1960 Hald returned to Denmark, and the following year, she wrote: "I had moved 3–4000 years back in time – and among living people. Did time stand still here in the shadow of Lebanon (Hald: 1961a, 116)?"
The year after, she published her article for *Nationalmuseets Arbejdsmark* 1961 in which she thoroughly described all stages of work for production of the famous black bedouin tents, from the spinning of goat's hair and setting up the loom for tubular weaving to the knotting of leashes and the weaving itself (Hald 1961a). Hald referred to her research in the Middle East a number of times in her publications and lectures, one of the last times was in 1981, where she described the methods of spinning goat hair at the Syrian tent weaver's workshop (Hald 1981).
In October 1965 Hald embarked on the last and longest of her tours in search of the tubular loom. The trip lasted five months and took her through Peru, Bolivia, Ecuador, Colombia, and Guatemala, before she returned to Denmark on 16 March 1966 (Grymer-Hansen and Mokdad 2021). Hald had already turned her eyes towards South America around the same time she travelled to the Middle East, as she published an article on a tubular woven fabric in the Swedish Ethnographical Museum in 1962 (Hald 1962b). The first four months Hald did not observe the tubular loom in use in South America and instead focused her attention towards band weaving and the looms used for this work. She was, however, able to buy a costume made from tubular woven fabric in Peru in November 1965 (NA2: 1965). In February the following year, she

Fig. 9: Women from the Colorado tribe wearing tubular woven skirts. Picture taken by Hald in Ecuador, 1965. (Slide no 305 in CTR's collection)

Fig. 10: Two beam-loom set up for tubular weaving. The loom was acquired by Hald in Ecuador in 1965 and belongs to the National Museum, Copenhagen, where it was exhibited in 1967. (Slide no. 524 in CTR's collection)

Fig. 11: Guambiano woman in Silvia, Colombia weaving a tubular skirt at her two beam-loom (Slide no 376 in CTR's collection)

visited the Colorado tribe in Ecuador, who wove on a tubular loom, which was probably set up with a warp of the spiral/B type (figs. 9–10; NA2: 1966a). Hald and her small group had a hard time trying to buy one of the looms, which they eventually did, but something went wrong, however, and they were followed to a river crossing by the tribe's shaman, who stared at them from the other side of the river (NA2: 1966a).

In March, Hald finally found an example of the 'right' type of tubular loom in use, the A type, when she visited the Guambianos people in Colombia (figs. 11–12). Here she was able to procure two looms for the National Museum (Grymer-Hansen and Mokdad 2021). On 2 March 1966 she wrote to her sister:

[I] Have now been on a lovely trip down South West in Colombia – 2 hours by plane and 2 days of planning – 2 hours drive out into the country. Found with the help of a teacher (Indian), a woman teacher [Da. lærerinde] (mulatto) 2 looms – tubular looms with loops from the warp gathered across a string, i.e. Huldremose-technique – bought them, though it was difficult, also got 1 piece with the lock preserved, that is cylindrical – 2 women skirts – open and 1 man's poncho made from 2 pieces of tubular fabric. This is what I have been looking for but have not seen until now. Now N.M. [the National Museum] will get 2 "Huldremose-looms" (NA2: 1966b)!

The looms that Hald collected on her travels were included in her last exhibition at the National Museum in Copenhagen: *Oldtidsvæve* (Archaic Looms) in 1967 (Hald 1967). The exhibition's centerpiece was the so-called Huldremose-peplos, a tubular woven fabric with the warp-lock intact, which was exhibited among a number of other textile finds from Danish bogs (Hald 1967, 3). Since no remnant of an ancient tubular loom has been found in Denmark, Hald's observations on tubular weaving as it survives around the world, was of paramount value for textile researchers and archaeologists in order to understand the European textile finds. The exhibition illustrated the different sizes, techniques, and forms of tubular looms around the world, and it is a prime example of Hald's combination of ethnology, archaeology and textile craft in her research and dissemination projects.

Concluding remarks

"Your works on folk traditions, whether you have found them in your own country or outside Europe where you learned to weave on the tubular loom or to make David's sling, have delighted me very much. We have experienced the joy of meeting living people, not just products from distant times. I regard that as a great privilege. It has also – I believe – heightened our understanding of the old techniques" (NA1: 1981).

The above quote is from a letter written by the Norwegian textile researcher Marta Hoffmann to Margrethe Hald. It demonstrates the urgency, also expressed by Hald, in documenting the surviving ancient techniques across the world before they die

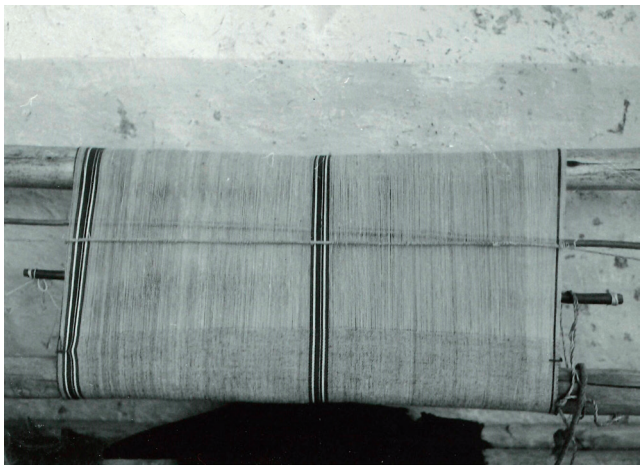


Fig. 12: Tubular warp for Guambiano man's poncho, Colombia, 1966. Photograph from CTR's Archive

out in order to understand the archaeological textiles in European collections. Hald's efforts in this regard were crucial to the correct identification of tubular fabrics of the Danish Iron Age, as well as to better comprehension of the production methods of ancient textiles in general.

In this article, we have demonstrated how published and unpublished sources when combined can enlighten and revitalize the work of one of the early pioneers in the field of textile research. It is our sincere wish that our efforts have proved that archival studies can serve as a valuable contribution to the field of textile archaeology.

Suggestions for further reading: Hald's publications on tubular weaving

In a number of her publications through the years, Hald dealt with the subject of tubular weaving accompanied by drawings and photos. Since Hald's research on the subject is spread across many decades and publications, we have elected to bring a summary of these publications as a guide for scholars, who wish to continue the study on the tubular loom. Most of the publications are in Danish, but quite a few of her articles were published in both Danish and English. Several of her Danish articles have summaries in English.

1942: The first time Hald mentions tubular weaving in a publication is her article "Væve i Etnografisk Samling," where she very briefly presents a small band loom from the Navajo tribe of North America. This band loom is set up with a tubular warp utilizing the spiral method (Hald 1942, 52–55).

1950: *Olddanske Tekstiler, Komparative tekstil- og dragthistoriske Studier paa Grundlag af Mosefund og Gravfund fra Jernalderen*. Copenhagen: Gyldendal. In her doctoral treatise, Hald for the first time published her research on the "tubular-woven fabrics," the dress from Huldremose and another tubular fabric without provenance. She raises the question of what kind of loom was used for weaving these curious tubes of fabric – and concludes that it must be a loom with two horizontal beams: the two beam-loom. She also reveals that several other Iron Age bog textiles in the National Museum's collection must have been produced the same way though they appear flat (because their warp-locks have been removed after weaving). Text in Danish pp. 1–409 and English summary pp. 409–486 (Hald 1950a).

1950: After the publication of her doctoral treatise in 1950, she writes a 10 page summary of it entitled "Gamle Textiltekniker" which is published in *Tidskrift for Textilteknik*. In the summary, she briefly explains the loop method of tubular weaving (Hald 1950b, 104–105).

1955: Her article "Olddanske Tekstiler. Fund fra Aarene 1947–55" is published in *Aarbøger for Nordisk Oldkyndighed og Historie* in 1955. The Huldremose dress and a textile fragment from Borremose with a warp-lock still in place are described and the loop method of tubular warping is explained in detail. The article is written in both Danish pp.1–44 and in English pp. 44–60 (Hald 1955).

1960: Another article entitled "Nogle Bemærkninger om de danske Mosefund. Svar til Dr. Birket-Smith" is published in *Aarbøger for Nordisk Oldkyndighed og Historie* in 1960. This article deals with the use of tubular weaving in South America and both principles of tubular warps, the loop method and the spiral method are explained. The article is written in both Danish pp. 223–234 and in English pp. 234–243 (Hald 1960).

1961: Hald published an article on her stay in the Middle East entitled "I Libanons Skygge." She describes her first authentic experiences with the living tradition of "the tubular loom" in a tent weaver's workshop in Syria. The loop method of tubular warping is explained in both photos and drawings (Hald 1961a).

1961: Hald also published an article on archaeological textiles from Northern Germany: "Dragtstudier." Once more, the loop method of tubular warping is explained in detail. The article is written in both Danish pp. 37–76 and in English pp. 76–89 (Hald 1961b).

1962: The National Museum of Denmark publishes a booklet by Hald entitled *Jernalderens Dragt*, in which she presents some of the research and conclusions from her treatise in a popular way. Both the warping systems of the warp-weighted loom and the tubular loom are explained. (Hald 1962a).

1962: The Ethnographical Museum of Sweden published *An Unfinished Tubular Fabric from the Chiriguano Indians, Bolivia*. In this booklet, Hald deals with a loom set up utilizing the loop method of tubular weaving. The loom was brought to Sweden by Erland Nordenskiöld in 1908-09. Hald explains both the loop method and the spiral method of tubular weaving. This booklet is published entirely in English (Hald 1962b).

1964: an article entitled "Vævning over Gruber" was published in 1964. Hald explains the loop method of tubular weaving in the Middle East on looms with either two or three horizontal beams. Text in both Danish pp. 88–101 and English pp. 101–108 (Hald 1964).

1967: An exhibition catalogue is published by Forhistorisk Museum Moesgaard in Aarhus. In

1967, Margrethe Hald curated and organized a large exhibition at the National Museum in Copenhagen on the occasion of her retirement. The exhibition, which afterwards travelled to Forhistorisk Museum in Aarhus was entitled *Oldtidsvæve* (Archaic Looms). A number of looms were shown at the exhibition, among them several looms set up for tubular weaving (Hald 1967).

1980: Hald's doctoral treatise was translated into English and published by the National Museum of Denmark under the title *Ancient Danish Textiles from Bogs and Burials. A Comparative Study of Costume and Iron Age Textiles* (Hald 1980). In the chapter "Woven Fabrics and their Construction" (Hald 1980, 148–186), she thoroughly describes the mounting of several tubular warps which were used for weaving specific Iron Age textiles, such as the Huldremose dress and the Arden checkered scarf. In the chapter Looms and Fabrics, (Hald 1980, 203–225), Hald explains both the loop method and the spiral method of tubular weaving in detail.

All Hald's publications on tubular weaving (except for her doctoral treatise) can be accessed here: https://ctr.hum.ku.dk/research-programmes-and-projects/previous-programmes-and-projects/the-margrethe-hald-archive-digitalization-and-dissemination/

Acknowledgements

The authors wish to thank the project leader Eva Andersson Strand and the project advisory board, especially Susanne Lervad and Anne Drewsen for valuable comments and helpful suggestions to this contribution.

Unpublished sources

NM = National Museum of Denmark
NA = National Archive of Denmark
CTR = Centre for Textile Research

NM: Department for Ancient Cultures of Denmark and the Mediterranean
Boxes II-III:
Presentation of journeys to the Middle East (1964).
Notes from Berlin (1937a).
Letter from Dr. Schlunk (1937b).
Fra en Rejse i Syrien 1960 (1960). Draft for an article. Undated but as it only mentions Hald's first trip to Syria it was probably written in either 1960 or 1961 before her second journey.

NA1: Personal archive for Margrethe Hald
Box 1:
Passport (1963). Valid until 15 September 1963.
Box 9:
Letter from Berlin to MH's mother (1937). Dated "Berlin, Sunday evening". Probably 5 September 1937.
Letter from Marta Hoffmann to MH (1981). Oslo, 24 September 1981.

NA2: Personal archive for Frede Terkelsen and Anna Hald Terkelsen
Box 17:
Letter from Syria (1960a). 8 June 1960.
Letter from Syria (1960b). 15 June 1960.
Letter from Syria (1960c). 1 July 1960.
Letter from Pucallpa, Peru (1965). 5 November 1965.
Letter from Quito, Ecuador (1966a). 12 February 1966.
Letter from Bogota, Colombia (1966b). 2 March 1966.

CTR: the Margrethe Hald Archive
Stærmose Nielsen, K.-H (1984-1985). Report from Stærmose Nielsen's research on Hald's incomplete manuscript.

Bibliography

Broholm, H. C. and Hald, M. (1935) *Danske Bronzealders Dragter.* Det kgl. nordiske Oldskriftselskab. Copenhagen: Gyldendal.
Broholm, H. C. and Hald, M. (1939) *Skrydstrupfundet, en sønderjydsk Kvindegrav fra den ældre Bronzealder*. Nordiske Fortidsminder, Vol. 3(2). Gyldendalske Boghandel and Nordisk Forlag.
Broholm, H. C. and Hald, M. (1940) C*ostumes of the Bronze Age in Denmark.* Copenhagen: Nyt Nordisk Forlag Arnold Busck.
Crowfoot, G. M. (1941) The Vertical Loom in Palestine and Syria. *Palestine Exploration Quarterly* 73(4), 140–152.
Grymer-Hansen, M. and Mokdad, U. (2021) Tekstilforskeren Margrethe Hald og arkivets mørke stof. *Dragtjournalen* 15(19), 49–56.
Hald, M. (1930) Brikvævning i danske Oldtidsfund. *Aarbøger for nordisk Oldkyndighed og Historie*, 277–301.
Hald, M. (1942) Væve i Etnografisk Samling. *Fra Nationalmuseets Arbejdsmark* 1942, 48–59.
Hald, M. (1950a) *Olddanske Tekstiler. Komparative tekstil- og dragthistoriske studier på Grundlag af Mosefund og Gravfund fra Jernalderen*. Copenhagen: Gyldendal.
Hald, M. (1950b) Olddanske Tekstiler. Summary by the author. *Tidsskrift for Textilteknik*, 99–110.
Hald, M. (1955) Olddanske Tekstiler. Fund fra Aarene 1947–55. *Aarbøger for nordisk Oldkyndighed og Historie*, 1–61.
Hald, M. (1960) Nogle Bemærkninger om de danske Mosefund. Svar til Dr. Birket-Smith. *Aarbøger for nordisk Oldkyndighed og Historie*, , 223–243.
Hald, M. (1961a) I Libanons Skygge. *Nationalmuseets Arbejdsmark*1961, 108–117.
Hald, M. (1961b) Dragtstudier. *Aarbøger for nordisk*

Oldkyndighed og Historie, 37–89.
Hald, M. (1962a) *Jernalderens Dragt.* Copenhagen: The National Museum of Denmark.
Hald, M. (1962b) *An unfinished tubular fabric from the Chiriguano Indians, Bolivia*. Monograph Series 7. Stockholm: The Ethnographical Museum of Sweden (Statens Etnografiska Museum).
Hald, M. (1964) Vævning over gruber. In Ole Klindt-Jensen and Poul Kjærum (eds), *KUML* 1963, 88–108.
Hald, M. (1967) *Oldtidsvæve*. Aarhus: The Prehistoric Museum.
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.
Hald, M. (1981) Spinning Goat's Hair. In M. Flury-Lemberg and K. Stolleis (eds), *Dokumenta Textilia Festschrift für Sigrid Müller Christensen*. Forschungshefte vom Bayerischen Nationalmuseum. Munich: Deutscher Kunstverlag, 19–23.
Strömberg, E., Geijer, A., Hald, M. and Hoffmann, M. (1979) *Nordisk textilteknisk terminologi: förindustriell vävnadsproduktion: definitioner på svenska och synonymer på danska, isländska, norska och finska samt på engelska, franska och tyska*. Oslo: Johan Grundt Tanum Forlag.
Paulli Andersen, M. K. (1967) Udstillingen af oldtidsvæve på Nationalmuseet. Arrangeret af dr. phil. Margrethe Hald/Archaic Looms. Exhibition at the National Museum, arranged by Margrethe Hald, Ph.D. *Haandarbejdets Fremme* 4, 1966–67, 30–39.
Strömberg, E., Geijer, A., Hald, M. and Hoffmann, M. (1967) *Nordisk Textilteknisk Terminologi: Vävnader: med engelska, franska och tyska paralleltermer enligt*. C.I.E.T.A. Oslo: Johan Grundt Tanum Forlag.
Stærmose Nielsen, K-H. (1999) *Kirkes Væv. Opstadsvævens historie og nutidige brug*. Historisk-Arkæologisk Forsøgscenter Lejre.
Stærmose Nielsen, K-H. (2005) A Preliminary Classification of Shapes of Loomweights. In F. Pritchard and J. P. Wild (eds), *Northern Archaeological Textiles – NESAT VII: Textile Symposium in Edinburgh, 5th–7th May 1999*. Oxford: Oxbow Books, 129–136.

Authors:
umokdad@gmail.com
mgrymer@hum.ku.dk

Chiara Spinazzi-Lucchesi

EgYarn: Unravelling the thread:
textile production in New Kingdom Egypt

The EgYarn project focuses on the study of the textile industry of New Kingdom Egypt (1550 BCE to 1070 BCE), one of the most well known and famous periods of the almost three millennia of Pharaonic history. It will consider the Theban area in particular, the capital, and the site of Gurob (Medinet el-Ghurob) which housed a royal harem.

In Ancient Egypt, textiles were used for numerous purposes including dressing pharaohs and queens, adorning gods' statues, and protecting mummies beneath multiple layers of bandages. For centuries, treasure hunters have torn open funerary shrouds and wrappings to steal precious items concealed beneath. Archaeologists have often collected these fabrics without giving them the proper attention because they were considered less informative than statues or *stelae*. However, textiles have information about ancient technology, social structures and economy woven into their fabrics. They bear witness to changes in fashion and the wealth, power, and the identity of individuals, while tools and workplaces provide clues about the available natural resources and social organisation. New Kingdom Egypt (1550 BCE to 1070 BCE) is a perfect case study to understand Ancient Egyptian textile production since several sites yielded tools as well as textiles.

The project EgYarn will provide a new perspective on New Kingdom social and economic organisation by demonstrating how textiles were produced, using which tools, by whom, and for whom. Starting from a piece of fabric, it will unveil the various stages of its creation, from the raw fibre to spinning and weaving, to focus on the hands that prepared it. In addition, by means of careful analysis of cases studies, such as Gurob and Deir el-Medina, social contexts and the economic aspects of textile production will be investigated.

The project will create a comprehensive and up-to-date information base, recording the details of New Kingdom textile traditions and locating them in the Late Bronze Age production landscape between the Mediterranean basin and the southern reaches of Nilotic Africa.

Textile tools used for spinning and weaving fibres as well as a careful selection of representative textiles will compose the dataset. Technical analysis of each object will provide an understanding of how it was used and what could be produced with it. Complete measurements of tools are required, as well as examination of fibres with a digital microscope. A large number of the textile tools are made of wood. An extensive analysis of the different species used will provide clues about the operators and the resources available in a community (using high-quality wood would have probably cost more than locally available materials).

The primary focus is on objects excavated at two key sites, Deir el-Medina and Gurob during the 19th and 20th centuries. These are stored in several European collections; to these, it would be necessary to add minor collections of objects excavated at other New Kingdom sites, such as Thebes and Abydos, to give as wide a picture as possible. This project offers the opportunity to reunite tool assemblages which have been spread across different European institutions and to provide information about their current locations. Material kept in Egypt from recent excavations will also be analysed in order to acquire data about discovery contexts. A literature review focusing on ongoing investigations and better-documented assemblages,

Fig. 1: Spindle 526.a, Manchester Museum (Image: Chiara Spinazzi-Lucchesi)

such as Tutankhamon's fabrics (Vogelsang-Eastwood 1999; Pfister 1937; Crowfoot and Davies 1941) and finds from Tell el-Amarna (Kemp and Vogelsang-Eastwood 2001) will complement the data collection.
Experimental archaeology will be necessary to fully comprehend the objects under scrutiny, especially the wooden spindles and other tools for fibre processing:
1) Exact copies of the wooden spindles used in New Kingdom Egypt will be made to test them and to try to understand the thread qualities that could be obtained from each spindle type, and the associated advantages and/or difficulties.; and
2) The main source of fibres in Ancient Egypt was flax; the appearance of surviving Egyptian flax fibres is quite different from that of modern fibres even those treated with traditional methods of retting and heckling which have been used since Roman times at least. Ancient Egyptian flax fibres may have undergone a different preparation process. Experimental archaeology will help to understand which methods are closest to those adopted by the Ancient Egyptians, without being influenced by later traditions.
One of the goals of the research is to understand who produced the textiles and where. The comprehensive analysis of a large data set combining archaeological and written sources will help to test past hypotheses and offer a better understanding of the economic system linked to textiles. Deir el-Medina appears to offer a fascinating case-study of local manufacture and state-controlled redistribution, while Gurob will provide data about production tightly connected with the royal court. Specific documentary sources will be used to understand who produced the textiles and with what aim.
The combined analysis of archaeological and textual sources will provide answers to fundamental questions: Where and how were textiles produced? Is it possible to differentiate between domestic and institutional production? Did the consumption of home-produced textiles extend beyond the family sphere? And what relationship did the Egyptian textile tradition have with Mediterranean and African traditions? Decoding the New Kingdom's textile industry will create a new understanding of a fundamental aspect of the Ancient Egyptian economy in its heyday.

Acknowledgments
EgYarn is a Marie Skłodowska Curie fellowship (MSCA 890144), thanks to the support of the European Union's Horizon 2020 Research and Innovation Program, and is hosted at the Centre for Textile Research at the University of Copenhagen.

Bibliography

Crowfoot, G. and Davies N. de G. (1941) The Tunic of Tut'ankhamūn. *The Journal of Egyptian Archaeology* 27, 113–130.
Kemp, B. and Vogelsang-Eastwood, G. (2001) *The Ancient Textile Industry at Amarna*. London: Egypt Exploration Society.
Pfister, R. (1937) Les Textiles Du Tombeau de Toutankhamon. *Revue Des Arts Asiatiques* 11(4), 207–218.
Vogelsang-Eastwood, G. (1999) *Tutankhamun's Wardrobe : Garments from the Tomb of Tutankhamun*. Rotterdam: Barjesteh van Waalwijk van Doorn.

Author:
chiara.spinazzi@gmail.com

Karina Grömer, Silvia Ungerechts and Hans Reschreiter

Knowledge sharing:
a newly found 2,700-year-old tablet-woven band from Hallstatt, Austria

Introduction

Currently, more than 70 fabrics with twined structures consistent with tablet weaving are known from the first millennium BCE in central Europe (Saunderson 2020). Some have been woven as separate decorative bands, others as starting borders on larger fabrics. The colourful bands found in the Hallstatt and Dürrnberg salt mines in Austria are well known (Grömer et al. 2013; Grömer and Stöllner 2011). More than 20 tablet-woven items have been excavated in total from both sites. The new artefact presented here comes from the salt mine at Hallstatt.

Tablet-woven bands are also known from grave contexts, where they are usually mineralised and only rarely has any information on colour been available. The most prominent ensemble of tablet-woven artefacts is Eberdingen-Hochdorf (Banck-Burgess 1999; Ræder Knudsen 1999) with more than 20 different tablet-woven fabrics in various positions, e.g. providing a decorative border on one of the tapestries hung on the wall of the chamber and on the gorgeous large cloth hung over the cauldron. Other examples are known from graves in Hohmichele or Glauberg in Germany (Banck-Burgess 1999; Peek 2018), in Altrier, Luxembourg (Rast-Eicher; Vanden Berghe 2015), Apremont and Mardie in France (in Banck-Burgess 1999). Tablet-weaving comes from several sites in Italy, such as the finds in Sante Paloma and Sasso di Furbara (Gleba 2014) as well as Verucchio (Ræder Knudsen 2012). Some of the tablet-woven bands also reveal patterns, such as identifiable significant changes in structure. Some tablet-woven fabrics may have been monochrome with a strict linear cord design.

The discussion and presentation of the newly found tablet-woven band from Hallstatt may inspire weavers, makers, and creators to share their ideas on this ancient handicraft, and how the structure and design of this band was made in addition to their own creative works with tablet weaving using the motifs.

Citizen science in textile archaeology at the Natural History Museum Vienna

Some elements of a citizen science approach such as including the broader public in reproducing and understanding archaeological artefacts has long roots in textile archaeology. As long ago as the early NESAT conferences in the 1980s (for example, Bender Jørgensen and Tidow 1982), active cooperation between handweavers and archaeologists was welcome and resulted in fruitful discussions. The World Wide Web has added impetus here, as information on archaeological artefacts is more easily available and enthusiasts for ancient handicrafts can be reached across the globe. Formal citizen science projects in historical textile techniques such as *Knitting in Early Modern Europe* (KEME) (Malcolm-Davies and Mearns 2018) or *Spiral Textiles: Ancient Textiles – Modern Hands* have involved people in scientific processes and the recreation of artefacts, thus gaining a better understanding of the details of their production. For the Hallstatt textiles, the dynamics of interactions between the scientists providing information and the worldwide community of handweavers, makers, reenactors, and artists have been studied (Grömer 2017). It was interesting to see what people are actually doing with the knowledge about artefacts and their production techniques and even how they sometimes integrate recreated objects into their daily lives or make businesses out of them.

Fig. 1: Natural History Museum Vienna, Citizen Science presentation on "Ancient Weaving" on Deck 50 (Image: Chr. Rittmannsberger, NHM Vienna)

The Natural History Museum Vienna set up a space to share and co-create information called "Deck 50" where people were invited to become involved in scientific research (fig. 1). One of the installations is on "Ancient Weaving". It includes an enlarged tablet- weaving loom, monitors with background information, and a range of interactive tools as a good example of how Iron Age designs and techniques inspire people. Citizen scientists are invited to take an active part in research on tablet-woven bands by joining "(craft) knowledge of the global crowd" at a physical weaving sit-in or through posts on the internet (via Pinterest and Instagram #tabletweavehallstatt). In this way, some research questions can be solved, such as how certain textiles may have been produced, how much time was required for them, and the degree of difficulty of certain pieces compared to other designs. Ultimately, all of this adds valuable information about the importance of textile handicrafts for economic, technical, and social history. In the case of the new tablet-woven band, ideas on the interpretation of the patterns are welcome: are they symbolic content or trial-and-error effects in creative design?

The context of the band: Hallstatt salt mine

The Hallstatt salt mine offers a significant insight into the world of life and work in the Bronze and Iron Ages in Central Europe. Three themes in the interdisciplinary research on Hallstatt are 1) the work processes in the salt mine, 2) the interaction between

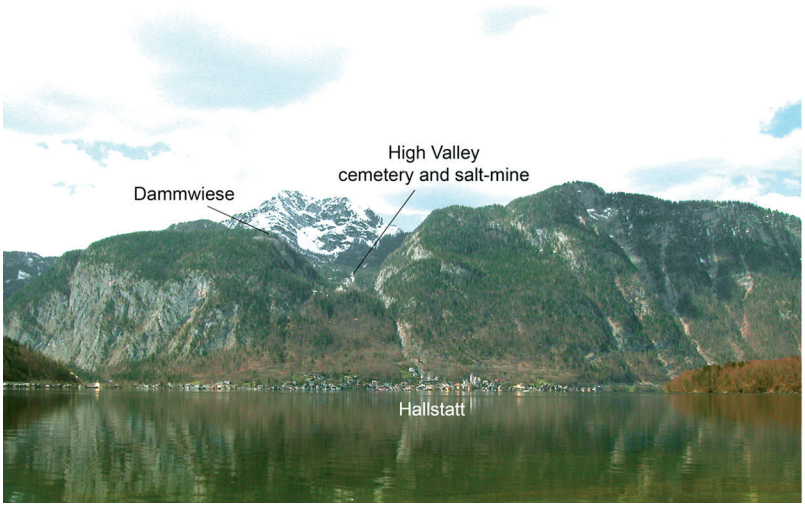


Fig. 2: Find context for the tablet-woven band (inventory number 126520): Hallstatt salt mine – Kilbwerk site and shaft renovation work (Images: D. Brandner, NHM Vienna)

Fig. 3: Tablet-woven band (inventory number PA NHM Vienna 126520) from Hallstatt/Kilbwerk site, excavated in 2019, front and reverse (Image: A. Schumacher, NHM Vienna)

the people and the landscape around it (Kowarik 2020; Reschreiter 2018), and 3) detailed studies of various material groups such as the textiles (Grömer et al. 2013).

Archaeological excavations have been carried out in the mine by the Department of Prehistory at the Natural History Museum Vienna since the 1960s and are still active in some parts of the salt mine. During the excavation season winter 2018/2019, a new tablet-woven band was discovered at the Kilbwerk site during renovation of the mining shafts to ensure the permanent protection of the most important sites in the mine (fig. 2). The Kilbwerk site represents part of a huge early Iron Age mining chamber with a length of approximately 300 m, a width up to 30 m, and a known height of 20 m (Barth and Reschreiter 2019, 36). The prehistoric mining at the Kilbwerk site was active from the period between the middle of the eighth and seventh centuries BCE. It was then interrupted by a huge landslide and some miners were buried during it. One of them was discovered by chance in the year 1734 during mining work at Kilbwerk and became famous as the "man in salt" (Barth 1989; Reschreiter 2020).

The textiles from the Hallstatt salt mine are well known (Grömer et al. 2013) and have repeatedly been the subject of detailed scientific work; for example, on conservation (Gengler 2005; Morelli 2005), dye analysis (Hofmann-de Keijzer et al. 2013), sewing technology (Rösel-Mautendorfer 2011), and experimental archaeology (Grömer 2005; Hartl et al. 2015; Rösel-Mautendorfer et al. 2012). So far, more than 600 individual textile pieces have been discovered since the first finds in 1846. Due to the annual excavations, this inventory is constantly increasing. Some textiles derive from the Bronze Age, but they are mostly from the early Iron Age areas of the salt mine and therefore the textiles in total cover a timespan of approximately 1400 BCE to 400 BCE.

The newly found tablet-woven band

Information on the band was first published in German language and included an initial analysis (Grömer and Reschreiter 2020). The new tablet-woven band (inventory number PA NHM Vienna 126520) is 34 cm long and 0.8 cm wide. It was woven with 14 tablets and consists of a total of 56 threads in the colours blue, purple, red, and orange. The pattern section of the band is framed by three single-coloured stripes

Fig. 4: Detail of the threads (sheep wool warp and horse hair weft) in the tablet-woven band (inventory number PA NHM Vienna 126520) from Hallstatt (Image: A. Schumacher, NHM Vienna)

(from outside to inside: yellow/orange, blue, red). The pattern section is formed by the contrast of a darker background (in blue and purple) with light motifs in orange. The pattern of the band (fig. 3) consists of different variants in a triangular design. Larger areas can be described as interlocking triangles with inner stripes. There are also triangles filled with small or large diamonds, and what are interpreted as bridge-like motifs. In places, there is no distance between the individual motifs and, in others, there are large gaps, made by floating blue and purple threads.

The warp threads consist of Z-twisted plied yarn with a thread thickness of 0.7 mm to 0.8 mm. The fabric is made of sheep's wool in the warp direction. Horsehair (from the tail) was used as weft (fig. 4) to add strength and some stiffness to the band. The use of horse hair for the weft is also known from other bands that have been excavated at Hallstatt: the patterned belt fabric (inventory number HallTex 20) and two tablet-woven bands (inventory numbers HallTex 123 and 136) (Grömer et al. 2013, 55). A further comparable find (inventory number 4470) comes from Dürrnberg (Grömer and Stöllner 2011, Fig. 6).

Experimental reconstruction and ethnographic comparisons with the weaving technique

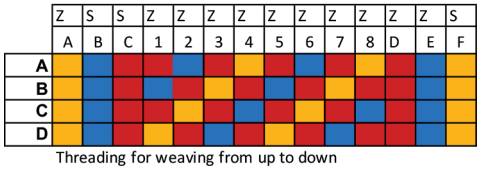
The publication by Grömer and Reschreiter (2020, fig. 4) included an initial experimental reconstruction on the threading of the tablets used to create the new find (inventory number PA NHM Vienna 126520). Following this, specialist tablet weaver Silvia Ungerechts took the same approach to reconstruct all the patterned parts of it (fig. 5).

Comparing the weaving technique of this tablet-woven band with the other ones from Hallstatt shows that the new find is not a border in which each tablet is threaded with a single colour. Neither is it a broken twill like HallTex 123, nor was it done with only two threads per tablet like HallTex152. The new band is unique in terms of threading and patterning: no pattern like this has been found at Iron Age sites according to current literature. It is not common for a band from the European Iron Age or Early Medieval period to be threaded with three colours in the pattern part in that specific order, namely purple – blue – purple – yellow/orange. The closest similarities in the threading of the tablets can be observed in the motifs on the belt of Queen Bathilde of France from the seventh century CE at Chelles (van Epen 2017, 8–10) but it is woven as floatwork. Warp threads of the band float above the woven ground forming its decorative element (Wollny 2017, 388–389).

Only in modern times are motifs with this threading and very similar weaving found. It is a technique called Sulawesi, named after an island in Indonesia where it is commonly used among the Sa'dan Toraja tribe. Bands woven in this way can be found, for example, in the Tropen Museum, Amsterdam, Netherlands (Collingwood 1996, 193, 200; Van Epen 1996, 17–20).

Comparing the Sulawesi technique with the new Hallstatt band, a lot of similarities can be detected: for example, the threading is identical. There is always a dominant pattern colour and two other colours in the background. In the case of the Hallstatt band, blue and purple form the background and the vibrant yellow is the pattern colour. There are slight differences in the weaving process. The tablets are always turned in one direction twice before changing the direction in the Sulawesi technique (Van Epen 1996, 17–39; Wollny

Fig. 5: Silvia Ungerechts reconstructing the band (Image: S. Ungerechts)



Threading for weaving from up to down

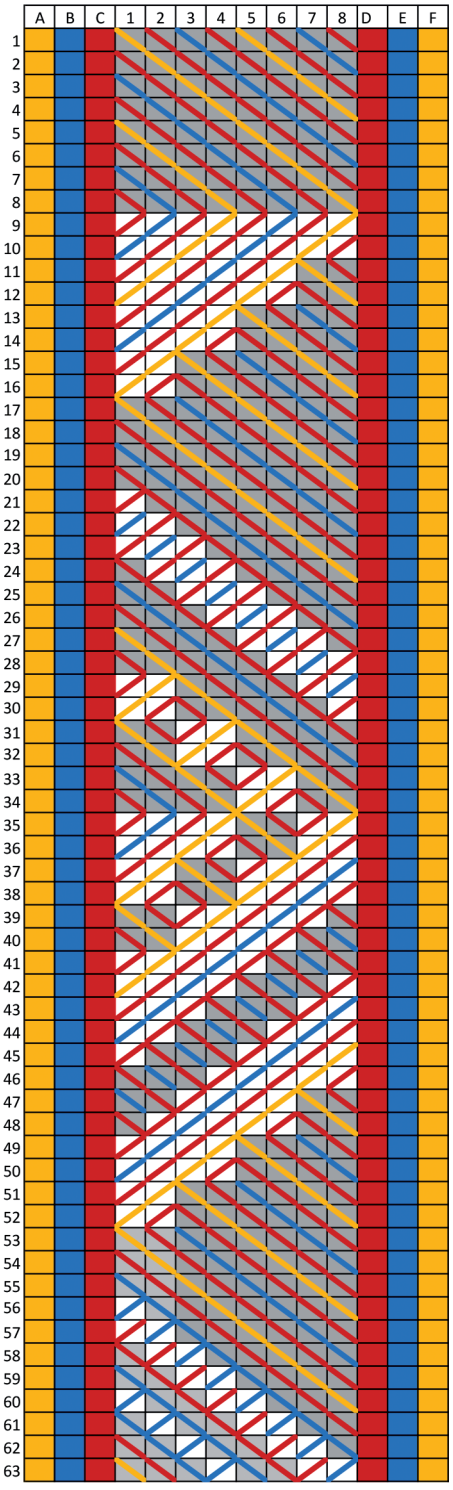
Brettchengewebe Inv. Nr. PA/NHM Wien 126520

Pattern by Silvia Aisling Ungerechts

weaver		A	D
fabric		B	C

S&Z = Thread position

= turn the tablets away
= turn the tablets towards you



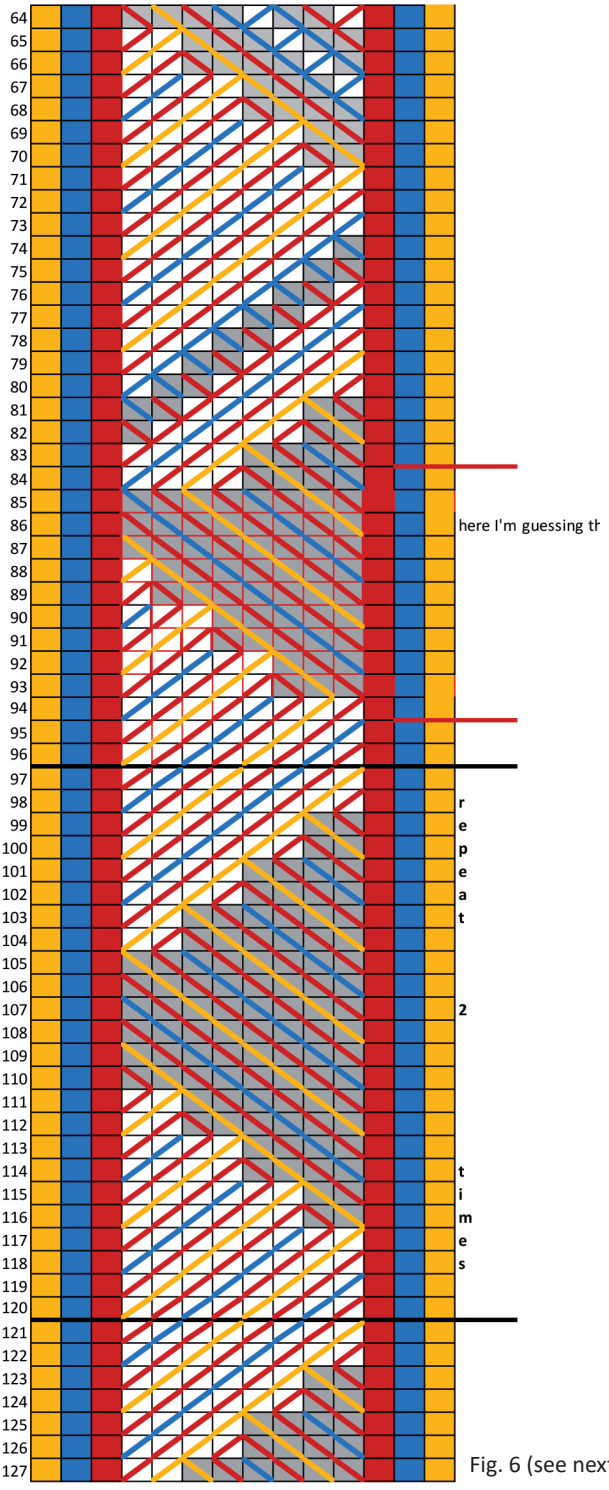


Fig. 6 (see next page)

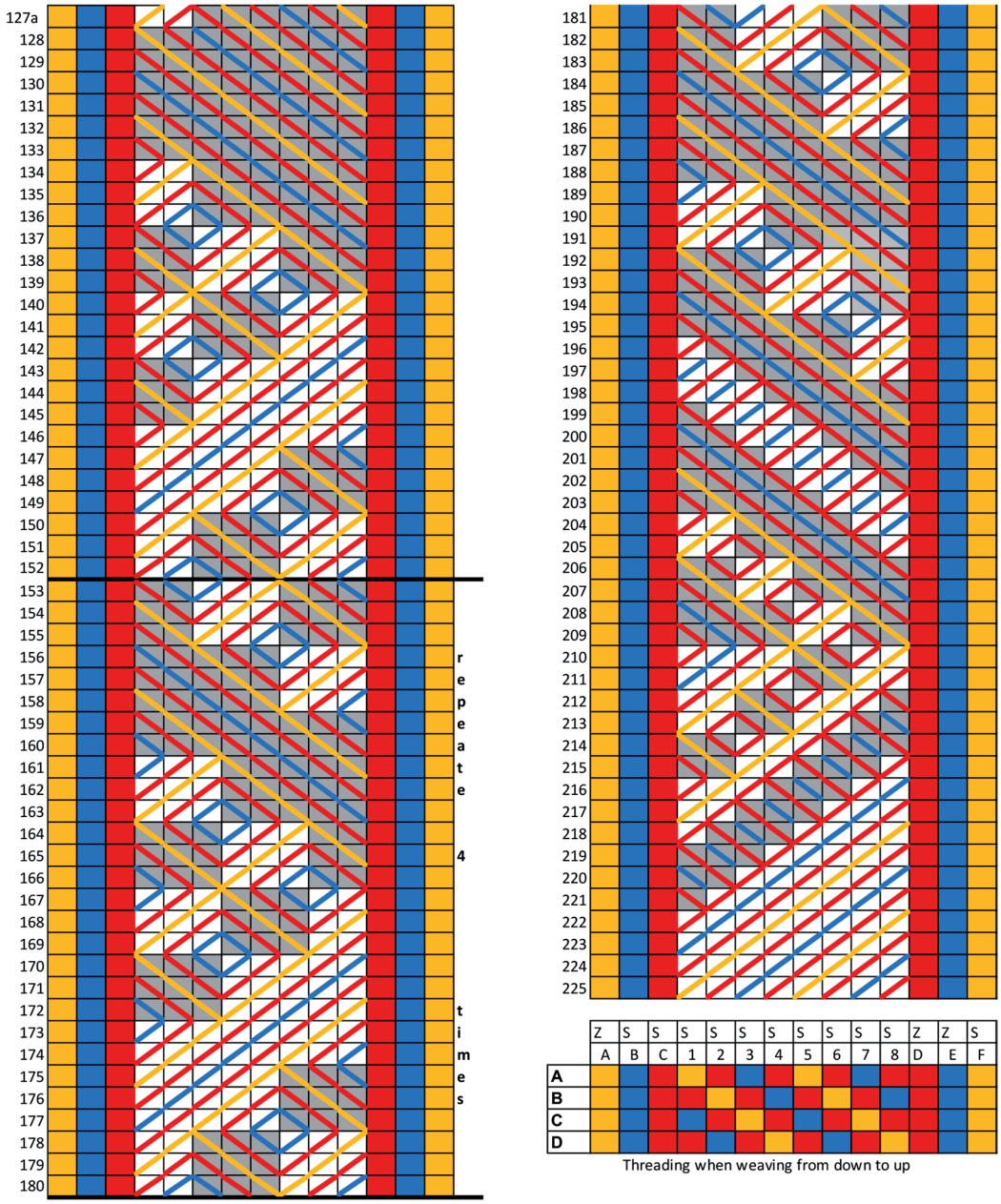


Fig. 6 (previous page and above): Weaving pattern of all sequences in the tablet-woven band (inventory number PA NHM Vienna 126520) from Hallstatt showing lines 1 to 127 on the left and lines 128 to 225 on the right (Image: S. Ungerechts).

2017, 354–387). It works as a type of double faced technique with two tablets treated as one double-faced tablet. The Hallstatt band also features single turns and the tablets are not set in pairs. The starting positions are also different to the modern way of weaving Sulawesi style. As there are no connections between Hallstatt and Indonesia, the similarity of the techniques is coincidental. Today, Sulawesi weaving is a popular modern technique as it is much easier to weave, for example, than 3/1 broken twill.

Drawing the pattern of the new Hallstatt band (fig. 6)

Two sections which were woven using two different techniques have been identified in the band: the selvedge or border section and the patterned section. The selvedge section used three tablets each at the sides. These tablets were turned in only one direction over the entire length of 34 cm. This is common among decorated tablet-woven bands from the Iron Age onwards as it ensures a regular appearance and adds

Fig. 7: Reconstruction of the tablet-woven band with a horse hair weft (Image: S. Ungerechts)

strength to the selvedge. The threads of the two inner tablets are arranged parallel to each other, and those of the outer tablet in the opposite direction.

The patterned section does not have a single significant dominant motif as is the case with many other bands of the time (see discussion below). There are triangular and diamond motifs in several variations. The reconstruction of this band is relatively simple because the colours make it easy to read each thread. An experienced weaver needs only a sketch with two colours (here yellow and blue) to reweave the pattern.

Lines 84 to 94 (fig. 6) were not easy to reconstruct as there was most likely an error made in the original weaving. Alternatively (but not so likely), the blurred lines suggest the band was damaged. Therefore, the reconstruction of this part (lines 84–94) is only a guess. There are several other small variations in the band. It is not that a tablet is turned incorrectly or that the shed has not opened properly but that the weaving sequence varies in tiny details: for example, at lines 133–145. Here, for the specific pattern, three tablets should be turned forwards (away from the weaver), three backwards, and two forwards. However, there are two tablets turned forwards, three backwards, and three forwards. These actions form the whole pattern sequence. Comparison of line 146 with lines 173 to 174 shows two turns instead of one at the turning of the line. In the next step, the weaver came back to the original motif. It is interesting to consider why those irregularities were not corrected. Maybe the wool could not be woven back without damaging the threads or there was no time to correct it. Maybe it was not even seen as a mistake at the time.

In total, the reconstruction of the 34 cm of the new Hallstatt tablet-woven band required more than 300 pattern lines. The instructions have been shortened to approximately 230 lines instead of approximately 340 lines by repeating them without considering the slightly different pattern sequences (by omitting some). In addition, three lines at the end have been altered to make it possible to weave through this pattern without bumpy transitions to get started again.

This description of the weaving sequence of the new Hallstatt band offers an invitation to re-weave it, try it out and recreate it today. It is useful to note the following tips. When weaving through the complete instructions, twisted threads build up behind the tablets because the turning sequences do not balance each other out. This can be avoided by reversing the weaving direction at the end of the pattern and then weaving the pattern backwards so that the threads will untwist. The pattern matches the original band when woven from bottom to top. The motifs are mirrored when weaving from top to bottom.

For the reconstruction of the band presented here (fig. 6 and fig. 7), industrially spun wool dyed with natural dyestuffs was used. So far, no dye analyses have been carried out on the original fabric and so for the experiments, dyes were selected that are already known from contemporary textiles from Hallstatt and other sites (Hofmann-de Keijzer 2016, Fig. 84): kermes, woad and camomile. Naturally pigmented black horsehair from an Icelandic horse was used for the weft.

For the result to be as fine as possible, the threads of the industrial wool for the reconstruction were Nm 28/2. The modern threads still have a width of 1 mm instead of the 0.8 mm in the original band. Even finer material would have been needed to achieve accurate dimensions. The reconstructed band is 41 cm in length instead of the original's 34 cm. The fineness of the original hints at the skills of iron age textile producers. The weaving itself is not as time-consuming as it might seem at first glance and it is possible to weave the whole pattern in a few hours.

Discussion: Creativity, trial-and-error effect or symbolic content

What makes the new band from Hallstatt so interesting is the irregular pattern appearance, albeit the band was carried out skilfully (woven very evenly and the weft threads inserted evenly) and thus seemingly by an experienced person. Iron Age tablet-woven bands from central Europe were usually designed with a regular repeat forming recurring motif sequences. Colourful examples following that design principle (fig. 8) come from the Hallstatt site itself (Grömer et al. 2013) such as: HallTex 123 with filled triangles that alternate with meanders; HallTex 152 with a row of cross-filled diamonds; and HallTex 186 with opposing triangles. A band from Dürrnberg (inventory number 4470) has regular meanders on differently coloured backgrounds, which also follows the same design principle (Grömer and Stöllner 2011).

The principle of regular patterning can also be observed with structural patterns in the design of opposing triangles, as on the cloaks from Verucchio (Ræder Knudsen 2012; Stauffer 2002, 198–207). This grave find is thought to be monochrome, based on current knowledge. Geometric patterns with regular repetitions can also be identified among the tablet-woven items from Sasso di Furbara, Hohmichele and Altrier. Textile 3 from Altrier has a red swastika on a blue background across the whole piece (Rast-Eicher and Vanden Berghe 2015, 121). The regularly repeated motifs found in Eberdingen-Hochdorf (Banck-Burgess 1999) are based on different triangle, diamond, and swastika variants.

There is only one exception to this design rule of a strict pattern repeat (fig. 9) currently known: Kesseltuch 1 from Hochdorf (Kesseltuch 1, Group 1/object 1.42 and 1.45; Banck-Burgess 1999, 182–183, plate 27.2) has a total of five patterned sections. There are two wide ones which are separated or surrounded by narrow ones (with widths of three times 0.5 cm and twice 1.2 cm). In the wide pattern sections, there are horizontally subdivided geometric spaces containing swastikas enclosed by diamonds and zigzag lines. The narrower pattern sections have interesting variants, with various lines, zigzags and angled hooks in irregular sequences on the outside, and various diagonal structures on the inside in the narrow pattern section.

The irregularities in the design of the new band from Hallstatt demand some discussion. The band's overall appearance makes it very likely that a trained person was involved in its production. From a cultural-historical perspective, there are three potential explanations as to why the band looks like it does: are the irregularities due to individual creativity, evidence of trial-and-error in action, or do they carry some symbolic content?

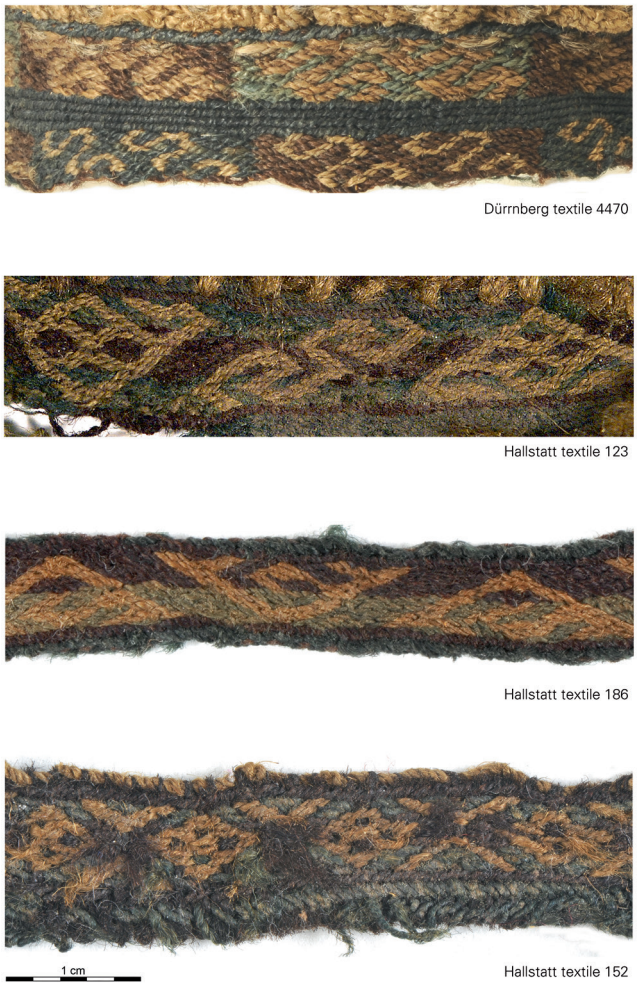


Fig. 8: Tablet-woven bands with regular motifs from Hallstatt and Dürrnberg, Iron Age (Images: Karina Grömer, NHM Vienna and Keltenmuseum Hallein)

Creativity and individuality in design is conventional nowadays and these can be demonstrated in the technique of tablet-weaving, which is used in creative education (Joliet-Van Den Berg 1975, 172–179). There are many tablet weavers' communities on the internet sharing their creativity and designs. Numerous pattern variations are possible in tablet-weaving with a stretched basic warp. These result from different turning sequences for all or parts of the pack of tablets. However, the strict design principles of repeated pattern sequences in the extant evidence suggest that such individualistic design was not very common (or desirable?) in prehistoric Europe.

Evidence of irregularities may not only be interpreted as creative design, it may have been deliberate

Fig. 9: Recreation of the Iron Age band from Hochdorf, Kesseltuch 1 with irregular pattern sequences by Sirko Galz (Image: A. Schumacher), NHM Vienna

experimentation. It is conceivable that the variations in the pattern came about when the weaver tried out something new. It might be evidence of trial-and-error or attempts at new motifs.

Another potential interpretation of the decoration in the new band (inventory number PA NHM Vienna 126520) is that it contains some symbolic content. The material culture of the Hallstatt period often has characteristic designs with mostly geometric patterns in regular repetitions: these appear on textiles (Grömer 2016, fig. 99), wooden objects (Reschreiter 2009), and pottery (Schappelwein 1999). Unlike the textile decoration, the patterns on the pottery often combine variants with different triangles, diamonds, lines, etc. (Preinfalk 2003). Triangles with points on the tops can sometimes be interpreted as abstract representations of people (Dobiat 1982). In recent years, some authors have been working on the interpretation of what at first glance appear to be simple geometric patterns. Examples of abstracted depictions of ships and waterbirds have been identified (Flemming 1998).

Ethnographic comparisons from the Basel Museum clearly show that entire creation myths can be hidden in seemingly simple geometric "patterns" on ceramics or on woven mats (Kümin and Brust 2011, 100–102; Wessel 2011, 150–152). For Swedish traditional costumes, region- and group-specific colour combinations and patterns of braids and belts can be worked out (Porsbo 1999). Such it seems likely that the geometric motifs on the newly discovered tablet-woven band from Hallstatt are to be understood in their symbolic nature and the individual components as well as the number of their repetitions to carry a symbolic meaning. The fact that one of the most prominent Iron Age examples from the cauldron of Hochdorf, also shows a change

of repeat could support this theory. Finally, it has been shown that geometric motifs on Late Hallstatt bronze sheet metal belts can also be used to visualise and identify regional groups (Brandner 2014). However, a certain reading of these symbols and an interpretation of the content are not possible to date.

Likewise, it might be possible that the changing designs and motifs on the newly discovered band from Hallstatt, as well as the Kesseltuch 1 from Hochdorf, have a symbolic meaning that could be read by prehistoric people which are not clear today.

These brief notes recording and interpretating the newly discovered band from Hallstatt are an invitation to tablet weavers, makers, and creators to share their ideas on an ancient handicraft. Please post them or any with creative recreations on Instagram under #tabletweavehallstatt.

Bibliography

Banck-Burgess, J. (1999) *Die Textilfunde aus dem späthallstattzeitlichen Fürstengrab von Eberdingen-Hochdorf (Kreis Ludwigsburg) und weitere Grabtextilien aus hallstatt- und latènezeitlichen Kulturgruppen.* Hochdorf IV. Forschungen und Berichte zur Vor- und Frühgeschichte in Baden-Württemberg 70. Stuttgart: K. Theiss.

Barth, F. E. (1989) *Salzbergwerk Hallstatt, Quellen und Literaturauszüge zum "Mann im Salz".* Hallstatt: Musealverein Hallstatt.

Barth, F. E. and Reschreiter, H. (2019) Prähistorische Bergbauspuren im Kernverwässerungswerk des Salzbergwerkes Hallstatt. In A. Kern, K. Grömer, K. Kowarik and H. Reschreiter (eds), *ArchOn Hallstatt* 1. Vienna: Verlag des Naturhistorischen Museums Wien.

Bender Jørgensen, L. and Tidow, K. (1982) Archäologische Textilfunde: Textilsymposium Neumünster, 6.5. – 8.5.1981. *Textilsymposium Neumünster NESAT 1.* Textilmuseum Neumünster.

Brandner, D. (2014) *Die späthallstatt-/ frühlatènezeitlichen Blechgürtel aus Nordtirol. Unter besonderer Berücksichtigung der Funde vom eisenzeiltichen Heiligtum am Demlfeld in Ampass*. Unpublished Bachelor's Thesis. University of Innsbruck.

Collingwood, P. (1996) *The Techniques of Tablet Weaving.* London: Echo Point Books & Media. 2nd edition (1st edition London 1982).

Dobiat, C. (1982) Menschendarstellungen auf ostalpiner Hallstattkeramik. Eine Bestandsaufnahme. *Acta Arch. Hungarica* 34, 279–322.

Flemming, K. (1998) *Ships on Bronzes. A Study in Bronze Age Religion and Iconography*. Publications from the National Museum Studies in Archaeology & History 3(1) and 3(2). Copenhagen: National Museum of Denmark.

Gengler, C. (2005) Neues Lagerungskonzept für die Textilien aus 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 Int. Series 1351. Oxford: Archaeopress, 77–79.

Gleba, M. (2014) Italian textiles from prehistory to Late Antique times. In S. Bergerbrant and S. H. Fossøy, S. H. (eds), *A Stitch in Time: Essays in Honour of Lise Bender Jørgensen*. Gothenburg: Department of Historical Studies, Gothenburg University, 145–169.

Grömer, K. (2017) There and back again... World wide response on archaeological textile finds – case study Hallstatt. *EXAR Bilanz 2017, Experimentelle Archäologie in Europa, Jahrbuch* 16, 196–207.

Grömer, K., Kern, A., Reschreiter, H. and Rösel-Mautendorfer, H. (2013) *Textiles from Hallstatt. Weaving Culture in Bronze and Iron Age Salt Mines. Textilien aus Hallstatt. Gewebte Kultur aus dem bronze- und eisenzeitlichen Salzbergwerk*. Archaeolingua 29. Budapest: Archaeolingua Publishers.

Grömer, K. and Reschreiter, H. (2020) Ein neues Brettchengewebe mit ungewöhnlichem Design aus dem Salzbergwerk Hallstatt – symbolischer Inhalt oder Probestück? *Mitteilungen der Anthropologischen Gesellschaft in Wien* 150, 267–280.

Grömer, K. and Stöllner, Th. (2009) 2011 Ein abgerissener Ärmel aus dem Salzbergwerk Dürrnberg. Neue Erkenntnisse zur Brettchenwebtechnik in der Eisenzeit in Mitteleuropa. In *Jahrbuch Römisch-Germanisches Zentralmuseum Mainz* 56. Mainz: Verlag des Römisch-Germanischen Zentralmuseums, 105–157.

Hartl, A., van Bommel, M. R., Joosten, I., Hofmann-de Keijzer, R., Grömer, K., Rösel-Mautendorfer, H. and Reschreiter, H. (2015) Reproducing colourful Iron Age ribbons from the Hallstatt salt mine, Austria: an interdisciplinary approach to acquire knowledge of prehistoric dyeing technology. *Journal of Archaeological Science* 2015(2), 569–595.

Hofmann-de Keijzer, R. (2016) Dyeing. In K. Grömer (ed), *The Art of Prehistoric Textile Making – The development of craft traditions and clothing in Central Europe*. Veröffentlichungen der Prähistorischen Abteilung 5. Vienna: Natural History Museum Vienna, 140–168.

Hofmann-de Keijzer, R., van Bommel, M. R., Joosten, I., Hartl, A., Proaño Gaibor, A. N., Heiss, G., Kralofsky, R., Erlach, R. and de Groot, S. (2013) The colours and dyeing techniques of prehistoric textiles from the salt mines of Hallstatt. In K. Grömer, A. Kern, H. Reschreiter H. and H. Rösel-Mautendorfer (eds), *Textiles from Hallstatt. Woven culture from Bronze and Iron Age salt mines*. Archaeolingua 29. Budapest: Archaeolingua Publishers, 135–162.

Joliet-van den Berg, M. and H. (1975) *Brettchenweben. Eine Anleitung zum Bänderweben mit vielen Beispielen textiler*

Strukturen aus Vergangenheit und Gegenwart. Bern-Stuttgart: Paul Haupt.

Kowarik, K. (2020) *Hallstätter Beziehungsgeschichten: Wirtschaftsstrukturen und Umfeldbeziehungen der bronze- und ältereisenzeitlichen Salzbergbaue von Hallstatt/OÖ*. Studien zur Kulturgeschichte von Oberösterreich. Linz: OÖ Landeskultur.

Kümin, B. and Brust A. (2011) *EigenSinn*. Publikation des Museum der Kulturen Basel, Band 1.

Malcolm-Davies, J. A. and Mearns, R. (2018) Investigating 16th century knitting with citizen science: An archaeological experiment into fleece and fulling. *Archaeological Textiles Review* 60, 83–99.

Morelli, M. (2005) Untersuchungen zum Erhaltungszustand der „Hallstatt-Textilien" (Examination of the state of preservation of the Hallstatt Textiles). 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 Int. Series 1351. Oxford: Archaeopress, 73–76.

Peek, C. (2018) Textilien und andere organische Materialien der Bestattungen aus den Grabhügeln 1 und 2 – Identifikation und Interpretation. In U. Recker and V. Rupp (eds), *Die „Fürstengräber" vom Glauberg: Bergung – Restaurierung –Textilforschung*. Materialien zur Vor- und Frühgeschichte von Hessen 29. Glauberg-Studien 3. Wiesbaden: Landesamt für Denkmalpflege Hessen, 361–434.

Porsbo, S. J. (1999) *Samedräkter i Sverige*. Jokkmokk.

Preinfalk, F. (2003) *Die hallstattzeitlichen Hügelgräber von Langenlebarn NÖ*. Fundberichte aus Österreich, Materialhefte A12. Horn: Berger.

Ræder Knudsen, L. (1999) Technical description of the Fragments of the Broad Tablet-woven Band found in the big cauldron from Eberdingen-Hochdorf. In Banck-Burgess 1999, 80–81.

Ræder Knudsen, L. (2012) Case Study: The Tablet-Woven Borders of Verucchio. In M. Gleba and U. Mannering (eds), *Textiles and Textile Production in Europe from Prehistory to AD 400*. Ancient Textiles Series 11. Oxford: Oxbow Books, 254–266.

Ræder-Knudsen, L. and Grömer, K. (2012) Discovery of a New Tablet Weaving Technique from the Iron Age. *Archaeological textiles Review* 54, 92–97.

Rast-Eicher, A. and Vanden Berghe, I. (2015) Altrier (LUX): A fresh look at the textiles. In K. Grömer and F. Pritchard (eds), *Aspects of the Design, Production and Use of Textiles and Clothing from the Bronze Age to the Early Modern Era*. NESAT XII. Budapest: Archaeolingua Publishers, 117–124.

Reschreiter, H. (2009) Fein verziert im Untergrund: Spanschachteln der älteren Eisenzeit. *Mitteilungen der Anthropologischen Gesellschaft in Wien* 139, 115–122.

Reschreiter, H. (2018) Hallstatt – Heritage in the Dark. *World Heritage* 88, 74.

Reschreiter, H. (2020) Der Salzmann aus Hallstatt und die Erforschung seiner Welt. *Begleitband zur Ausstellung im DBM Bochum*, 61–66.

Rösel-Mautendorfer, H. (2011) *Genähtes aus dem Hallstätter Salzberg. Prähistorische Textilfunde aus Hallstatt im Vergleich mit eisenzeitlichen Gewanddarstellungen*. Diploma Thesis. University of Vienna.

Saunderson, K. (2020) *Die Funktionen brettchengewobener Bänder der Eisenzeit in Mitteleuropa.* Unpublished Bachelor's Thesis. University of Vienna.

Schappelwein, C. (1999) *Vom Dreieck zum Mäander. Untersuchungen zum Motivschatz der Kalenderbergkultur und angrenzender Regionen*. Universitätsforschungen zur Prähistorischen Archäologie 61. Bonn: Habelt.

Stauffer, A. (2012) Case Study: The Textiles from Verucchio, Italy. In: M. Gleba and U. Mannering (eds), *Textiles and Textile Production in Europe from Prehistory to AD 400*. Ancient Textiles Series 11. Oxford: Oxbow Books, 242–253.

Van Epen, M. (1996) *Special Tablet Weaves*. Rotterdam: De Kaart Publications Gelselaar.

Van Epen, M. (2017) *Kaartweeftechnieken patronen met Kettingflottering*. Rotterdam: De Kaart Publications Gelselaar.

Wessel, A. (2011): E*igenSinn.* Publikation des Museum der Kulturen Basel, Band 1, 150–152.

Wollny, C. (2017) *Tablets at work. The Book of Basic Tablet Weaving Techniques.* Hürth: Claudia Wollny Edition.

Internet sources

Knitting in Early Modern Europe https://ctr.hum.ku.dk/marie-sklodowska-curie-projects/previous-marie-sklodowska-curie-projects/knitting/ (accessed 31 August 2021)

Spiral textiles https://www.onb.ac.at/forschung/forschungsblog/artikel/ancient-textiles-modern-hands (accessed 31 August 2021)

Authors:
karina.groemer@nhm-wien.ac.at
aisling@gmx.net
hans.reschreiter@nhm-wien.ac.at

Elsa Yvanez

Unravelling Nubian funerary practices:

textiles and body wrappings in ancient Sudan

Introduction

Attitudes towards death have taken a great many forms through history and across the globe. Research has nonetheless shown the existence of a few universal behaviours, including the desire to first hide the dead body and then recreate it as the deceased. Textiles play a prominent role in these processes, as is illustrated in ethnological studies but often ignored in archaeology. Rarely recorded together *in situ*, textiles are removed from the human remains, stored in different locations, and studied by different specialists. In these ways, precious evidence is destroyed and the understanding of funerary events is limited leaving important questions unanswered: How was the body prepared before the funeral? How was it seen and perceived by its relatives and community? What was the religious and social modalities of its transformation into the deceased?

In ancient Sudan and Nubia, no written sources are available to answer these questions. The burial is the only witness: not the skeleton alone nor the sum of its surrounding artefacts but the whole "body bundle" formed by the corpse and its wrappings. Often what is left of the excavation of human remains may be summarised as a pile of neatly arranged bones on a labelled tray, a small cardboard container or a plastic bag filled with mixed textile fragments, and written and photographic archives, as complete as the date of discovery and time for recording permitted. This project aims to bring this evidence together, combining the study of textile wrappings and human remains to help reconstruct past funerary practices in Late Antique Nubia.

The dry climate of the region has permitted very good preservation of human remains, naturally mummified or skeletonised, with their wrappings. However, a comprehensive archaeology of death has not yet emerged in Sudan and current practices tend to focus on biology, often overlooking that the dead are also cultural artefacts. Wrapped, anointed, and laid to rest after complex ceremonies, a body carried multi-faceted social meanings.

This is especially true of textiles. Their physical properties and symbolic significance were particularly significant during funerals. Plainly visible for all to see during the ceremony, textiles could dress or wrap the body, conceal selected areas while leaving exposed portions, cover it entirely or give it a distinct shape. Whether reused items of clothing, luxurious elite garments, shrouds, or assembled rags, all textiles can indicate the social status and cultural identity of the deceased. Pioneering textile studies have showcased the richness of the Nubian material, producing useful catalogues and technical typologies. These studies were usually compiled after the excavations had taken place providing few details of the textiles' precise contexts of use and discovery. In both textile and archaeological research, funerary finds continue to be classified simply as shrouds, a term that is neither precisely defined nor indicative of the diversity of the practices involved.

The goal of this project is to develop a comprehensive textile archaeology in burial contexts, using the untapped potential of textile artefacts to renew the understanding of funerary practices. Through close collaboration between textile experts, archaeologists

Fig. 1: Wrapped human remains of a child at Gebel Adda, approximately 350 CE to 570 CE (Image: Elsa Yvanez; archival photograph courtesy of R. Huber)

and bio-anthropologists, the project will help to reshape approaches to funerary remains: not as a disjointed group of scattered artefacts but as the result of a multi-step and complete practice in which textiles conceal, dress, shape, and protect the body of the deceased, while giving the individual a clear identity in the worlds of both the living and the dead.

Textile research will identify the number of fabrics used in the grave and their characteristics, and track their locations on and around the remains. Detailed analysis will show whether body wrappings were made of specifically woven pieces or reused garments, and how they were combined.

Anthropological data can indicate the original position of the body, identify the age and gender of the deceased, and pinpoint the impact of thanatological processes on the remains.

Funerary archaeology describes the environment of the grave (its content and structure) and relates it to the rest of the cemetery and to current knowledge of funerary beliefs.

Taken together, these methods lead to a dynamic study of burials, with the potential to recognise and interpret preparatory treatments of the body, sepulchral practices, and post-sepulchral events.

Sources are of two different kinds: published material from old excavations and recent finds collected by archaeologists. Case studies will be selected from previously collected data, focusing on analyses and interpretation. Well-preserved naturally mummified skeletonised remains with associated wrappings have been chosen from the material unearthed on the Nubian sites of Aksha, Gebel Adda, Karanog, Old Dongola, Ballana, Sai, Debeira, and Serra East (first century BCE to seventh century CE). Particular attention will be paid to the corpus from Saï Island, for which an ongoing excavation provides access to the best standards of documentation and data access. This work will lead to the creation of a new protocol for the *in situ* study of funerary textiles.

Unravelling Nubian funerary practices' objectives

- To track the different modes of body wrappings through the compilation of a database of published information and more recent material, cross-referencing anthropological textile, and archaeological data.
- To conduct case studies determining the nature and arrangement of wrappings on the bodies, merging anthropological observations with a detailed study of textile fragments. The project will test the potential and limitations of different recording practices (forms, drawings, and photogrammetry) for *in situ* data capture.
- To identify and understand previously unnoticed funerary practices involving the wrapping or dressing of the dead. A typology of the different modes of body wrapping will be created using Late Antique Sudan as an example in order to initiate a discussion of relevant definitions.
- To assess the role of body coverings in funerary rituals by merging archaeology, physical anthropology, social anthropology, and textile studies.
- To establish a protocol for best practices in the excavation, *in situ* analysis, and conservation of wrapped human remains. This protocol will be tested in the field during the winter of 2021 to 2022.

The project hopes to lay the groundwork for an increase – in number and in quality – of *in situ* and collaborative analyses. We aim to provide new and useful tools for future research to: a) enhance archaeological practice in the field; b) improve the chances of optimal conservation of excavated artefacts; and c) advance the understanding of death in past societies.

Acknowledgments
The *Unravelling Nubian funerary practices* project is hosted by the Polish Center of Mediterranean Archaeology at the University of Warsaw and financed by the Polish National Agency for Academic Exchange (NAWA) under the ULAM grant PPN/ULM/2020/1/00246. It is led by Elsa Yvanez, in close collaboration with Magdalena M. Wozniak, and will run from April 2021 to March 2022. It benefits from the help of an advisory panel formed during the starting workshop 'Funerary Textiles In Situ' held at the PCMA on 15–16 April 2021 with Joanna Ciesielska, Barbara Czaja, Francisco Gomes, Karina Grömer, Dawid Grupa, Małgorzata Grupa, Iwona Kozieradska-Ogunmakin, Susanna Lervad, Sanna Lipkin, Robert Mahler, Christina Margariti, Luise Ørsted Brandt, Małgorzata Siennicka, and Robert Stark. The author would like to thank Vincent Francigny of Centre National de la Recherche Scientifique (CNRS) and the team of the Sai Island Archaeological Mission for their collaboration.

Author:
elsa.yvanez@gmail.com

Karina Grömer, Kayleigh Saunderson and Beate Maria Pomberger

Metallic idiophones 800 BCE to 800 CE in Central Europe:

their function and acoustic influence in daily life

Introduction

Metallic idiophones, such as bells, pellet bells and clinking or rattling jewellery, have played an important role in burials and as dress accessories throughout history. Archaeological research has paid little attention to metallic idiophones and their roles in past societies, although they were an important part of everyday life in the past and still are today. This project investigates the archaeological contexts and acoustic effects of metallic idiophones as well as their interplay with textiles and clothing. The aim is to investigate the functions and impacts of metallic idiophones in central Europe in the Iron Age, the Roman Empire and the Early Medieval period (800 BCE to 800 CE). Sound objects are being analysed through psychoacoustics, metallurgy, and the textiles attached to them.

Goals and methods

The project aims to collect new information concerning the use, societal impact, and influence on past peoples' lives of metallic idiophones. An interdisciplinary approach will employ research methods from archaeology, metallurgy, acoustics, ethnomusicology, and psychology, supported by experimental archaeology, as well as studies of written and iconographic sources. This research not only covers the function, typology, date, and metallurgical data, but also includes the sounds of idiophones: the frequency ranges, their timbre, volume, and up to what distance they can be heard (fig. 1). Psychoacoustic aspects will also be investigated in addition to the psychological and physical effects of the sounds on the people who hear them. Psychological studies have shown that listening to appropriate music or sounds at specific times can have stress-reducing effects and increase well-being. The opposite can create a stress-increasing effect.

The textile evidence offers information on the way the sound objects were worn. Metallic idiophones were recreated for the project, as well as whole ensembles of garments in an experimental archaeological approach, using information from textile fragments found in graves together with contemporary pictorial and written sources. This demonstrated how sound objects might have been worn on the body and tested their interplay with movement. In psychoacoustic studies, these recreations are used to investigate the sound effects of the idiophones worn on the body, such as sharpness, roughness, brightness, tonality, and loudness.

This report on work-in-progress provides two case studies of metallic idiophones worn on garments — rattling jewellery from the Hallstatt period in Býčí skála (Moravia) and bells/pellet bells from the Avar period in Komárno (Slovakia).

Idiophones

Idiophones can be worn as accessories, carried as pendants or attached to garments. Metal dress components with rattling pendants and caged pellet bells are common in elite women's burials, especially in the Hallstatt culture (Pomberger et al. 2020, 229). Rattles such as pellet bells, for example, make sounds indirectly by means of a loose item, such as a pebble, on the inside. Bells are percussion vessels that are

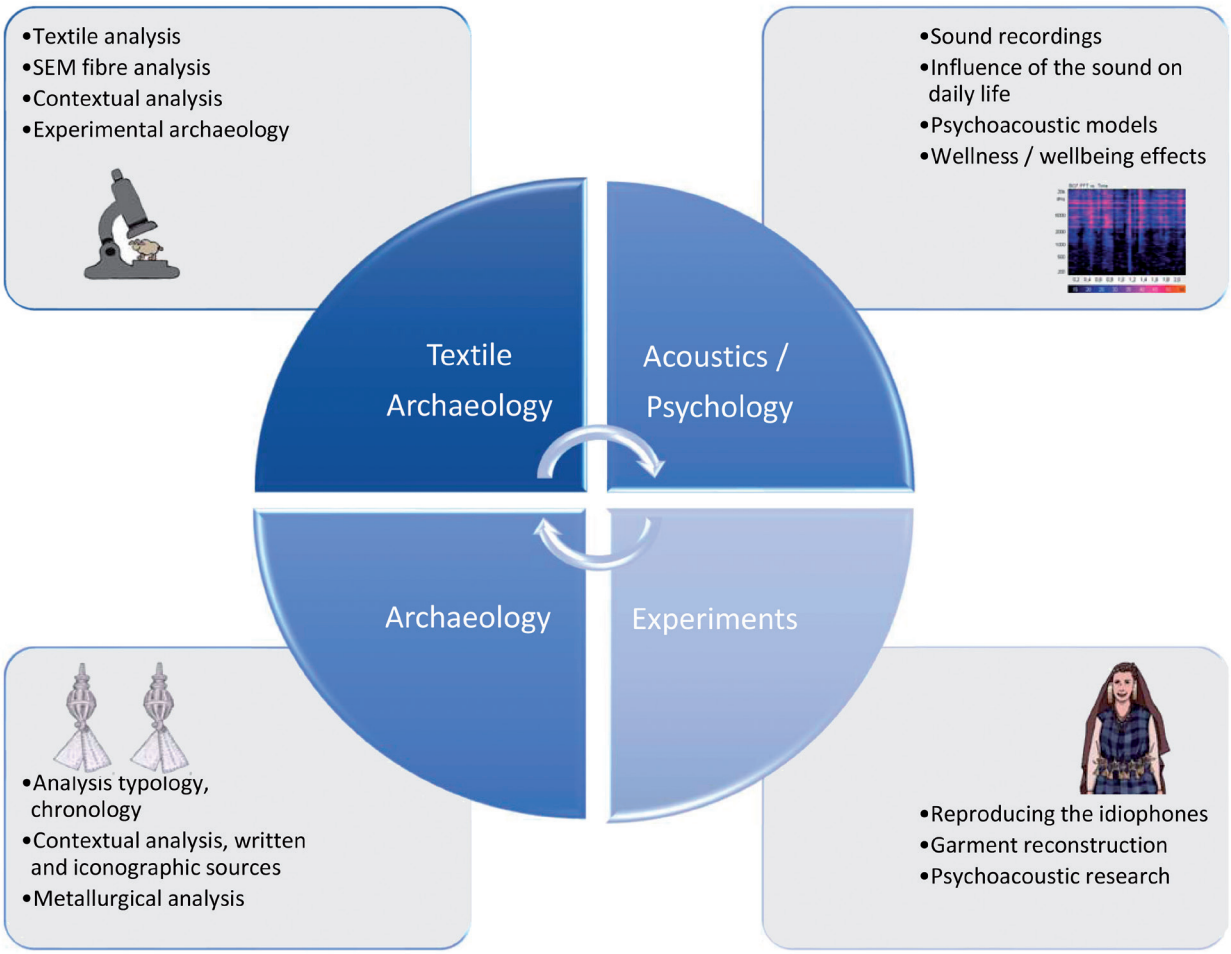


Fig. 1: The interdisciplinary approach of the research project *Metallic idiophones*. Here the focus is on the textile research within the project (Image: Karina Grömer)

beaten directly by a clapper on the inside or a hammer on the outside (MIMO 2011, 5–6).
These items create a specific sound-environment, or sound field, within their society. Each sound field is created from a sound source and its spatial expansion.

Fig. 2: Mineralised textile on an early medieval pellet bell from Zillingtal, Austria (Image: Alice Schumacher, Natural History Museum, Vienna)

They create acoustic fields which have impacts on their environments and people's listening habits. The effects of wearing metallic idiophones can be intrinsic as well as extrinsic: they may be worn for oneself only or for others in the community. Specific acoustic social codes produce acoustic identities which can represent a person's social status. Early Iron Age rattling jewellery could be used to communicate signals or have a representative significance. Some bells and pellet bells may have been connected to apotropaic beliefs since the most vulnerable members of society, such as children and women, have been documented as wearing sounding amulets in antiquity (Pomberger et al. in print).

Research regarding textiles and clothing

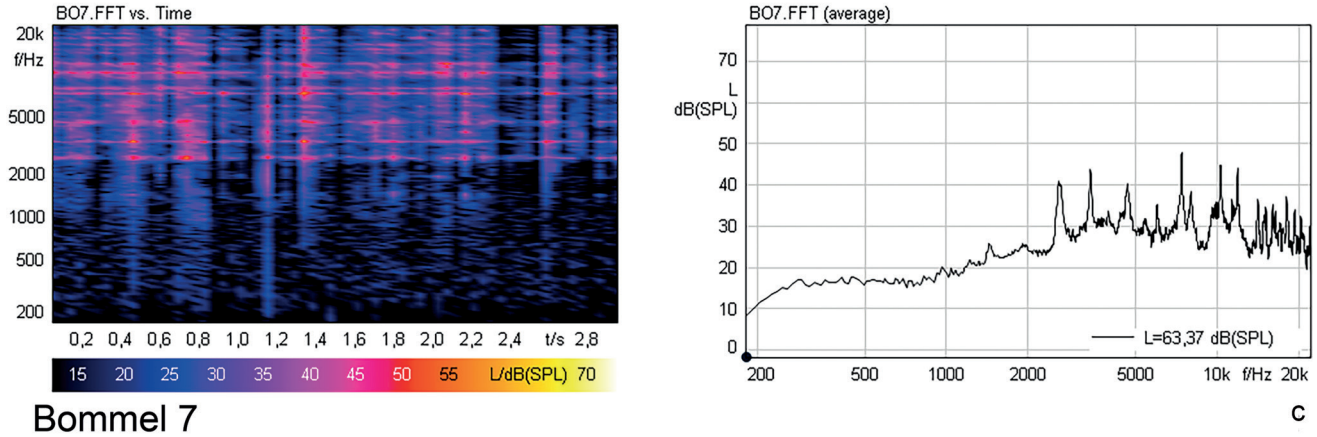
Metallic idiophones were often worn on pieces of clothing making the question of how the sound object and the garment interact an important one. The

remains of mineralised textiles found on the idiophones in burial contexts were analysed to identify the raw materials, and their quality, structure, and production technique. Using this data, it is possible to work out the effect of the cloth on the sound of the idiophones. The analyses of the textiles (fig. 2) were carried out using a digital microscope (DinoLite) with up to x250 magnification, a light microscope (Zeiss SteREO Discovery.V20), and a scanning electron microscope for fibre analyses (Grömer et al. 2015, 51–83). These textile analyses answer such questions as: what is the quality of the textiles worn together with sound objects — coarse or fine? What was their influence on the sound?

To gain a better understanding of the metallic idiophones' context, it is necessary to determine the function of the textile to which it is attached. The exact position on or around the body of the deceased is important, and the stratigraphy of multiple organic layers can offer further information about this. The specific position of the sound object alone can affect the sound it makes (for example, if it is worn on the ankle versus around the neck), as well as the way it is worn (for example, dangling from a string on a belt or sewn onto a garment). Determining the kind of sounds these objects made when the person is moving is an important objective of case study 1.

a

b



c

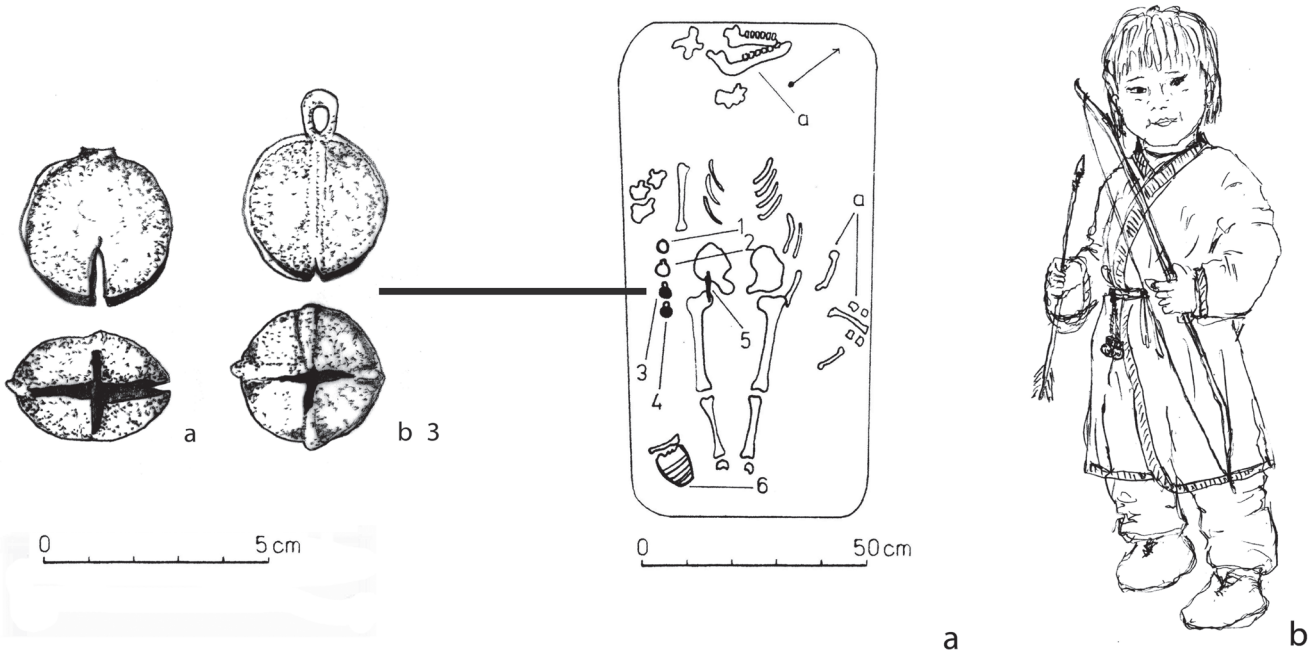
Fig. 3: Finds from Býči skála-cave dated to 600 BCE: a – the rattling plates; b – a recreation of a Hallstatt Period garment with the sound jewellery worn on the belt; c – visualisations of sound recordings including a spectrogram of the sound (Images: Alice Schumacher, Beate M. Pomberger, Jörg Mühlhans)

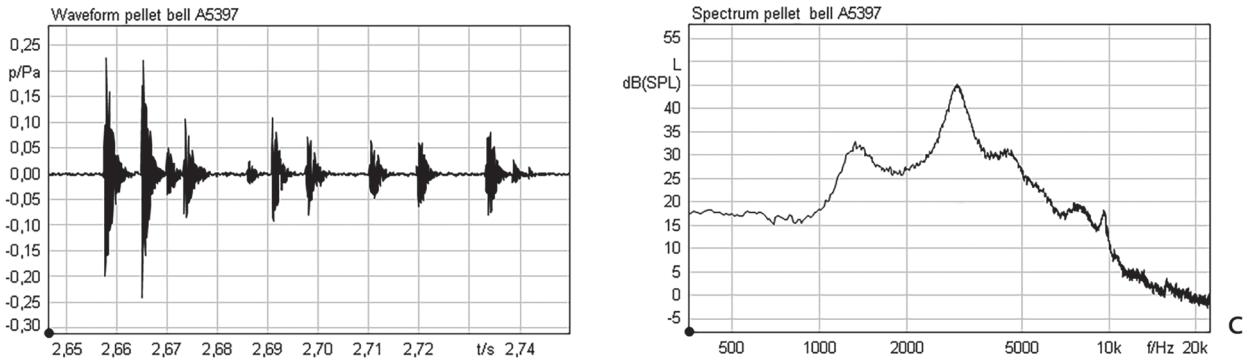
Case study 1: Early Iron Age pendants — Býčí skála cave

A total of 14 pendants with rattling plates were found from the Hallstatt period (800 BCE to 450 BCE) at Býčí skála cave, Czech Republic (Pomberger et al. 2020). They were probably worn on garments, perhaps on ribbons, and produced sounds while the wearer was moving (fig. 3). Using the results of the analyses of the metallic idiophones, experimental archaeology was conducted using reconstructed clothing of the period. Certain movements that are visible in contemporary illustrations were recreated to consider the sound objects which were attached to the garments. These metallic idiophones, together with other pieces of clothing, represented specific visual codes, which could be read and understood by other members of the community. A video of these garments in motion is available on YouTube (see internet sources below).

Case study 2: Avar pellet bells — Komárno, Slovakia

Bells and pellet bells seem to have played an important role in the early medieval Avar period (568 CE to approximately 820 CE). In burials, they have been found on those perceived to be the more vulnerable





artefact	Inv. Nr.	tomb	Fe	Cu	Zn	As	Ag	Sn	Au	Pb	Mn	surface	result
Pellet bell	A-5396	65	93,35	4,22		0,2		1,63	0,35		0,26		bronze
Pellet bell	A-5397	65	31,89	62,98	1,01			2,91	0,4	0,81	0,11	gilded	bronze

d

Fig. 4: Komárno, burial 65: a – pellet bells and positions in grave; b – reconstruction with the pellet bells in wear; c – sound recording of the pellet bell A 5397; d – chemical analyses of both pellet bells (Images: B. M. Pomberger; a after Trugly 1987, 13: 19, 20, fig. 7: 1; b Jörg Mühlhans; c Jan Tírpak)

members of society (women and children) but also on horse trappings. An initial overview of the textiles and clothing in the context of pellet bells at the Avar cemetery in Komárno has been produced (Pomberger et al. 2021). They derive from 15 burials: five of children and ten of horses (buried with men).

The sound level of these pellet bells can provide information about their function: for example, one had a hollow, quiet sound, which could be appropriate for an amulet, whereas others had a brighter, sharper sound, which may indicate their use as signalling objects, with which parents could perhaps locate their child.

The children's pellet bells were found near the hands, hips and upper thighs (fig. 4). This suggests that they could have been attached to ribbons, chains (on belts), sewn onto sleeves or carried in small bags or belt pouches. The pellet bells in the equestrian graves were located around the skull, the chest and the spine. Many of these had been subject to grave robbery, making the exact original locations of the pellet bells uncertain. It can be assumed that they were attached to the horse's tack. Future experiments will investigate metallic idiophones on horses as well as humans including the sounds created through various gait movements.

Further perspectives

Studies in the interplay of dress, idiophones attached to it as accessories, and movement are of great interest. As far as is currently known, sounding jewellery is only found in the graves of the elite. The sound fields they created might be markers in the social hierarchy. However, it is important to note that the idiophones did not create any sound in the grave. Were they therefore worn in daily life or merely as part of the burial. Dress as a way of communication includes sight, sound and other aspects of body movement. Investigation through the lens of a specific kind of movement — dance — may bring further new insights into the cultural and sociological effects of dress and its attached jewellery in prehistoric societies.

The project is led by archaeo-musicologist Beate Maria Pomberger, in collaboration with Karina Grömer. It also involves students from the University of Vienna, including master's research on Avar period textiles, clothing and the metallic idiophones attached to them by Kayleigh Saunderson. It is funded by the Austrian Science Fund FWF, based at the Natural History Museum, Vienna, Austria and runs from January 2020 to the end of 2023.

Acknowledgements

We would like to thank the Austrian Science Funds FWF, Hertha Firnberg (grant number T 1136-G) for funding this project.

Bibliography

Grömer, K. and Rapan Papeša, A. (2015) Simple cloth and stamped leather – Organic finds from the Avar cemetery in Nuštar (Eastern Croatia). [Jednostavne tkanine i žigosana koža – organski nalazi s avarodobnog groblja u Nuštru (istocna Hrvatska)]. *Vjesnik Arheološkog muzeja u Zagrebu* 3/48, 51–83.

Pomberger, B. M., Grömer, K., Mühlhans, J. and Topa, D. (2020) Schlitzbommeln und Anhänger – Klingender Trachtschmuck aus der Býčí skála-Höhle bei Brünn. *Mitteilungen der Anthropologischen Gesellschaft in Wien* 150, 215–242.

Pomberger, B. M., Mühlhans, J., Saunderson, K. and Grömer, K. (2021) Pellet Bells from the Avar Age Cemeteries of Komárno. *Slovenská archeológia* 69(1), 99–131.

Internet sources

MIMO (2011) Revision of the Hornbostel-Sachs Classification of Musical Instruments by the MIMO Consortium http://www.mimo-international.com/documents/hornbostel%20sachs.pdf, 26 p. (accessed 29 June 2021)

Imagination of Dance in Hallstatt Culture (2020) https://www.youtube.com/watch?v=PN5b1OWACPc (accessed 7 December 2020)

Authors:
karina.groemer@nhm-wien.ac.at
kayleigh@saunderson.at
beatemaria.pomberger@gmail.com

Maria Mossakowska-Gaubert

RECONTEXT:
Reconstructing the history of Egyptian textiles from the first millennium CE at the National Museum of Denmark

The aim of the project is to establish a history of the Egyptian textiles collection at the National Museum of Denmark (NMD) by investigating how the objects were acquired, their provenance, as well as their original appearance and shape. NMD holds 114 fragments of textiles from Roman, Byzantine, and Early Medieval Arab Egypt. It is the richest ensemble of Egyptian textiles in Danish collections. The highlights of the collection are fragments identified as parts of tunics of various kinds. The collection has not been systematically studied, and since it has not been published, it remains inaccessible to the academic world as well as the general public.

This one-year project is funded by two Danish foundations: Aage og Johanne Louis-Hansens Fond and Beckett-Fonden (dates of the project: 1/5/2021

Fig 1: A textile purchased by the National Museum of Denmark from Robert Forrer in 1891 (Image: Søren Greve © National Museum of Denmark)

– 30/4/2022). RECONTEXT is hosted by the Centre for Textile Research (CTR), Saxo Institute, at the University of Copenhagen and is conducted in close collaboration with NMD.

NMD acquired the first Egyptian textiles from the art market of the late 19th century. Most of the European museums and collections acquired their Egyptian textiles in the same way. Many textiles were divided and sent to different museums either by the collectors themselves or by the museum staff. Frequently, the most legible, visually appealing part of an ornament has been cut, leaving behind a puzzle with few clues as to the cloth's original overall appearance.

The first items (six fragments in the current collection) were purchased by NMD from 1886 to 1887 from an Austrian antique dealer, Theodor Graf. The most important group (48 fragments) was acquired from a Swiss collector, Robert Forrer. Eventually, in 1936, 16 textile items were transferred as study material from University College London (UCL) to Copenhagen by Margrethe Hald. The London fabrics most likely belong to the collection of Egyptian antiquities sold to UCL by Flinders Petrie. Several textiles were also acquired from the 1930s to 1960s from antiquarians and collectors in Frankfurt am Main, Berlin, Copenhagen, Paris, and Stockholm. Some were donated to the NMD by Danish Egyptologists and archaeologists (Erik Iversen, Hans Ostenfeld Lange, Werner Jacobsen). Finally, the provenance of 15 fabric items has not yet been established.

RECONTEXT makes a crucial contribution to the research field by tracing the history of Danish and European collections of Egyptian textiles. The research results and digital reconstructions of the scattered fabric fragments will be presented on the NMD website as an online exhibition. The project study outcomes will also be presented to an international academic audience.

The team includes project leader Maria Mossakowska-Gaubert, postdoctoral research fellow at the Centre for Textile Research, University of Copenhagen, Anne Haslund Hansen, curator and senior researcher at the NMD in the Department of Ancient Denmark and the Mediterranean, Morten Valner S Grymer-Hansen, Tekstilpioneren Margrethe Halds liv og virke Project Coordinator and Anne Kwaspen, textiles conservator and textile analysis and reconstruction expert, a Marie Skłodowska Curie research fellow at CTR.

Collaborators include: Cäcilia Fluck, curator and senior researcher at Skulpturensammlung und Museum für Byzantinische Kunst, Staatliche Museen zu Berlin, Germany; Anna Głowa, senior lecturer at the Institute of Art History, at the Catholic University of Lublin, Poland; Barbara Thomas, PhD student at Bonn – Cologne University; Stine Schierup, senior researcher in the Collections Department at NMD; and Søren Greve, photographer.

Author:
mossakowska@hum.ku.dk

Susanna Harris & Martin Goldberg

Unwrapping the Galloway Hoard

Unwrapping the Galloway Hoard is a three-year UK Arts & Humanities Research Council (AHRC) project (2021-2024) which aims to challenge current understanding of the process of hoarding through an interdisciplinary study of one of the best-preserved hoards found in Britain to date.

Hoarding – the deliberate collection and burial of objects often made from precious metal – is a well-known phenomenon, primarily studied as buried wealth and popularly conceived as treasure. Associated with periods of social unease, such as the end of the Roman empire and the Viking raids of Early Medieval Britain and Ireland, hoards are often understood as valuable resources buried for security, although this position has been challenged recently (Bland 2015). Usually only inorganic artefacts survive. Buried around AD 900, and discovered in 2014 near Kirkcudbright, Dumfries and Galloway in Scotland, the Galloway hoard is the richest, most varied, and well-preserved collection of precious and exotic objects hoarded together in Viking-age Britain and Ireland (Goldberg and Davis 2021). Unusually, the Galloway hoard contains both organic and inorganic artefacts, and evidence of accumulation with separate bundles and caches. In addition to containing silver and gold, the Galloway hoard is unique in Britain due to the preservation of textiles and leather that wrap the objects, creating multiple caches and bundles within the hoard. The textiles include wool, linen, silk, braids, and embroidery. The technical mastery of the silk items matches the splendour of the other striking objects in the hoard.

The durability of metal objects in hoards as treasure, scrap, bullion, or currency is largely dictated by taphonomy (the effects of burial through both human and natural actions). These processes of decay and differential preservation play a crucial role in hoard interpretation because perishable material rarely survives. Hoarding has the potential to reveal much about the process of collecting and assembling objects, but even well-considered hoards, such as the Staffordshire Anglo-Saxon hoard (seventh century CE), are limited by the survival only of metal and other non-perishable materials (Fern et al. 2019). Intricate wrappings of textiles, leather and braids, and the remains of a wooden box are objects in the Galloway hoard that do not normally survive.

Fig 1: Lid of textile-wrapped silver-gilt vessel from the Galloway hoard (© National Museums Scotland)

Fig 2: Silver bullion of the Galloway hoard (© National Museums Scotland)

The Galloway hoard was buried in four distinct caches: a textile-wrapped lidded vessel (fig. 1) containing multiple textile-wrapped objects; silver bullion within a leather wrapping; three gold objects in a small wooden box tucked in a cluster of silver arm-rings; and a stratigraphically separate, upper cache of silver arm-rings and ingots accompanied by a Christian pectoral cross (fig. 2). This accumulation of artefacts is rare evidence for objects being placed in multiple distinct bundles and caches before they were assembled into the hoard deposit. This remarkable preservation provides a wealth of information about internal structure and accumulation. The containers and wrappings create distinct bundles whereby objects are placed in marked relationships to one another. By connecting certain objects and separating others, bundles have an integrity which establishes relationships within and between object groups in this hoard that would otherwise be lost through taphonomic processes. The parcels, bundles and perishable materials in this hoard allow us to explore much more than the final deposit and to look in detail

at the biography and accumulation of this assemblage (Joy 2016; Zedeño 2008).

The composition and cumulative potency of bringing the Galloway hoard together provides an exciting opportunity to re-examine why, and how, people amassed, curated, and buried objects. Accumulated over many years, with objects originating from near and far, connecting Europe and Asia, and exceptionally preserved with its original textile and leather wrappings, the Galloway hoard provides a unique source of evidence to ask: How, and why, did people assemble and collect objects before burying them, and how does the Galloway hoard, with its unique combination of organic and inorganic materials, change our understanding of hoarding during the Viking Age? By focusing on the process of assembling and collecting this *Unwrapping the Galloway Hoard* project will provide numerous gateways into the wider Viking Age world.

The project is hosted by National Museums Scotland in collaboration with the University of Glasgow and scientific investigators. It builds on the foundation work of conservation and recording already carried out by the National Museum of Scotland and many individuals and organisations involved in securing the find for the nation through the Treasure Trove legislative process.

The AHRC project is led by principal investigator, Martin Goldberg, Principal Curator of Medieval Archaeology and History at National Museums Scotland. The textile and leather research is led by co-investigator, Susanna Harris, Lecturer in Archaeology, with Postdoctoral Researcher Alexandra Makin, at the University of Glasgow. The scientific collaborators include: Caroline R. Cartwright, The British Museum, for the identification of wood and textile fibres using high-powered microscopy; Derek Hamilton, Scottish Universities Environmental Research Centre (SUERC, Glasgow), for the radiocarbon dating programme and Bayesian analysis; Ina Vanden Berghe, Royal Institute for Cultural Heritage, Brussels (KIK-IRPA), for the analysis of textile dyes using high performance liquid chromotography (HPLC); University of Glasgow Polyomics for the identification of leather species using proteomics; and Alice Macente, x-ray computed tomography at the Universities of Strathclyde and Glasgow.

Bibilography

Bland, R. (2015) Hoarding in Britain from the Bronze Age to the 20th century. In J. Naylor and R. Bland (eds.), *Hoarding and the deposition of metalwork from the Bronze Age to the 20th century: a British perspective.* Oxford: Archaeopress, 1–20.

Fern, C., Dickinson, T. M., Webster, L. and Martinón-Torrés, M. (2019) *The Staffordshire Hoard: an Anglo-Saxon treasure*. London: Society of Antiquaries of London.

Goldberg, M. and Davis, M. (2021) *The Galloway Hoard: Viking-Age Treasure*. Edinburgh: NMS Enterprises Ltd.

Joy, J. (2016) Hoards as collections: re-examining the Snettisham Iron Age hoards from the perspective of collecting practice. *World Archaeology* 48(2), 239–253.

Zedeño, M. N. (2008) Bundled Worlds: The Role and Interactions of Complex Objects from the North American Plains. *Journal of Archaeological Method and Theory* 15, 362–378.

Internet sources

The Galloway Hoard (undated) https://sketchfab.com/nationalmuseumsscotland/collections/the-galloway-hoard (accessed 20 October 2021)

Authors:
Susanna.Harris@glasgow.ac.uk
m.goldberg@nms.ac.uk

Ulla Mannering

Fashioning the Viking Age:
status after the first three years

Introduction

In September 2018, the *Fashioning the Viking Age* research and outreach project funded by the Velux Foundation was launched at the Department for Ancient Cultures of Denmark and the Mediterranean at the National Museum of Denmark, in collaboration with the Centre for Textile Research at the University of Copenhagen and Land of Legends in Lejre, Denmark (Mannering 2018). The general aim of the project is to create new and well-founded archaeological interpretations and reconstructions of Viking Age textiles and clothing.

In part one of the project, 'Viking Age Textile Production', headed by Eva Andersson Strand and Ida Demant, reconstructed tools and controlled fibre sorting were combined with spinning and weaving experiments. These were based on a selection of archaeological textiles in order to convey the tactile and visual aspects of Viking Age cloth culture. In part two, 'Viking Age Male and Female Clothing' headed by Ulla Mannering and Charlotte Rimstad, two complete reconstructions of Viking Age outfits for a man and a woman were recreated. In part three, 'Viking Age Clothing Catalogue', the many different sources linked to Viking Age clothing design, including archaeological, iconographic and written sources will be reviewed. This part will be initiated in January 2022 and the results presented in an online open-access catalogue which can be used in future interpretations and reconstructions of Viking Age clothing. This project report summarises the results from parts one and two of the project, which were finished in 2021.

Viking Age Textile Production

A large and varied range of Viking Age textile tools replicas were made and used in the reconstruction of the selected textiles from the same era. The majority of the tools, such as the wood spindles, spindle whorls and loom weights, are based on finds from the Viking Age settlement at Haithabu in northern Germany, while the wool combs with iron teeth are based on a Norwegian find (Andersson Strand 1999, 2003). Clay spindle whorls and loom weights were produced in different sizes and weights: seven different sizes of spindle whorls, weighing from 5 g to 48 g, together with 76 doughnut-shaped loom weights of 200 g, 56 loom weights of 400 g, and 48 of 600 g.

Three textiles from Haithabu in the collection of the Stiftung Schleswig-Holsteinische Landesmuseen Schloss Gottorp in Schleswig in Germany were selected for reconstruction (Hägg 1984). The Haithabu textiles are exceptionally well-suited for reconstruction as they represent a great variety of textile techniques and some of these have also been identified as parts of known garment types, made for everyday use. The selected textiles are:

- Sample I: H14, fragment of a dress in tabby weave
- Sample II: H2, fragment of hose in 2/2 twill
- Sample III: H39AB, fragment of legwear in diamond twill/ herringbone twill

All three textiles were analysed according to modern standards, including fibre analysis performed by Irene Skals. By comparing the wool qualities to samples from modern sheep breeds, it was decided to use Spellsau wool produced by a Danish sheep farmer.

The fleeces were first sorted into outer and undercoat wool, to match the different yarns in the original textiles, and then combed with the reconstructed wool combs. All yarns for the three samples were spun on a

drop spindle selected by each spinner. Depending on the fibres and the thickness of the yarns, the spinners chose whorls ranging from 15 g to 25 g. The spindles were mostly 21 cm long (fig. 1).

In general, the hand spun yarns made for the different textiles had many fiber ends sticking out of the threads. This made the warps on the warp-weighted loom very sticky, and the changing of the sheds for every weft a very slow and time-consuming process. The average weaving speed was 16 to 29 threads per hour – or approximately 3 cm per hour depending on the number of threads per cm in the weave. Each sample was woven to a size of 60 cm x 60 cm.

Altogether, the three finished textile samples have obtained a fascinating close resemblance with their archaeological counterparts. They can therefore be seen as accurate representations of the visual appearance of Viking Age textiles. Although perhaps itchier than a modern person would prefer, the tabby in sample I is light in weight with a good drape, and suitable for a dress, as originally suggested by Inga Hägg (1984). Sample II is a more solid piece, and likely to be appropriate for cold weather. Sample III, which was interpreted as loose legwear, may in fact be the Viking Age "denim".

In the winter of 2020/2021, a fourth textile sample, based on Haithabu H11, a 2/2 twill with 5 wefts per cm, was produced. The aim was to produce a large textile, for which workflow, production time, and wear and tear on the warp threads and the loom weights were to be examined. The sample size was 1 m x 3 m or about 2 ells x 6 ells, which is the equivalent of a legal Islandic Viking Age cloth measure. Since the production of this sample required a larger quantity of yarn, it was decided to use machine spun yarn given extra twist on a modern spinning wheel. The weaving speed for this sample was 10 cm to 15 cm per hour.

All tools and textiles are now gathered in the Textile Tool Box, which is a replica of the Mästermyr chest found on Gotland in Sweden (fig. 2). This wooden chest was originally a smithy's tool box but was chosen for this purpose, as the long weaving swords and the many heavy loom weights made for this project part were difficult to fit into any of the preserved Viking

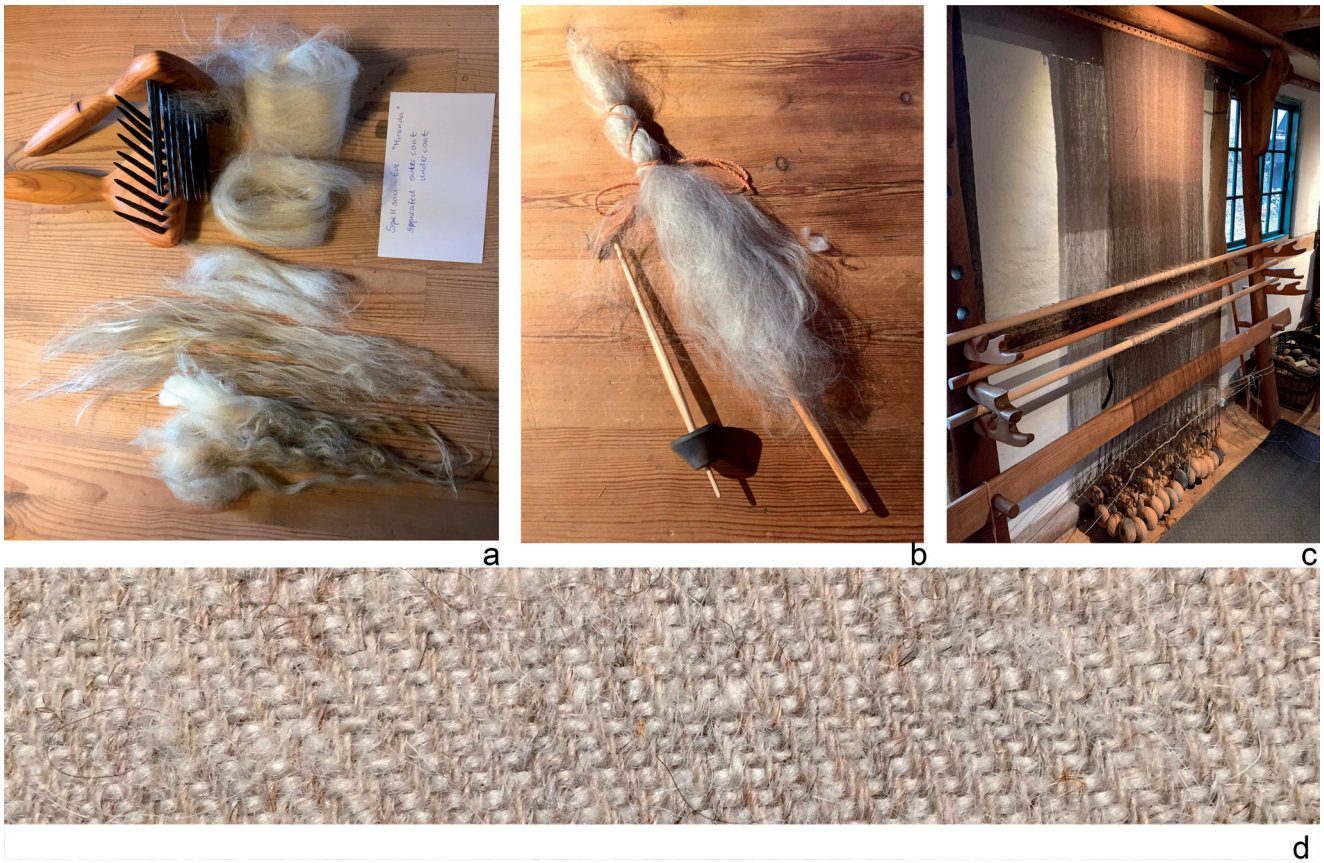


Fig. 1: A range of different reconstructed Viking Age tool were used in the production of Samples I-III: a – sorted and combed wool; b – drop spindle and distaff with the wool ready to spin; c – the warp-weighted loom set-up with Sample I; d – close-up of Sample II, the 2/2 twill (Images: Ida Demant)

Fig. 2: The Textile Tool Box with the reconstructed tools (Image: Roberto Fortuna)

Age textile tool boxes, such as the ones from the Oseberg find.
In addition to the ordinary photo documentation used in all experiments, the production processes of samples III and IV were also documented using a time-lapse camera. Reports on the experiments are currently being written, and a more detailed description of the processes will be published in the forthcoming NESAT XIV publication.

Viking Age Clothing

The reconstructions of the man's and woman's outfits are based on the textile finds from two Danish inhumation graves: the man's grave from Bjerringhøj, dated to 970 CE to 971 CE, and the woman's grave from Hvilehøj dated to the late tenth century. The textiles in both graves are fragmented but still much larger and better preserved than in most Viking Age contexts in Denmark and Scandinavia in general.
The data extracted from the two graves are based on new detailed and scientific analyses. High resolution photography was used to create an overview of all the objects and to reveal disintegrated sewing and embroidery details. All textiles went through technical analyses including measurements of fibre diameters, thread diameter, density, and twist directions. More specialised analyses of skin, fur, feather and down species, tanning methods, tablet weaves, silk samite weaves, glass beads, iron objects, and shoes were made by invited specialists (Brandt and Mannering 2020).
Piecing together the 64 pieces of the embroidered 2/1 wool twill from Bjerringhøj was an especially time consuming but rewarding process. At first, photos of this textile were transferred to Photoshop where all the embroidery yarns were marked with colour codes, giving each pattern its own colours. The photos were then printed on paper and the fragments cut out. This puzzle was used to create the final embroidery design (fig. 3). During this process, the characteristic wolf heads with the decorated collar biting into the roundels of acanthus leaves were identified for the first time.
It was also discovered and proven that the human bones stored in a box labelled "Slotsbjergby" in fact belong to the Bjerringhøj burial (Rimstad et al. 2021). The textiles still adhering to the bones had never been recorded before, and they turned out to contain important new information about the design of the legwear and its colours.
Reconstructions can be made with different degrees of accuracy, depending on how closely they are intended to resemble the original textiles. In this part of the project, it was decided to focus on garment shapes and visual details and to make compromises in the production processes. However, it quickly turned out that several of the required fabric qualities were not commercially available. It was therefore necessary to produce these fabrics too. The yarns for these textiles

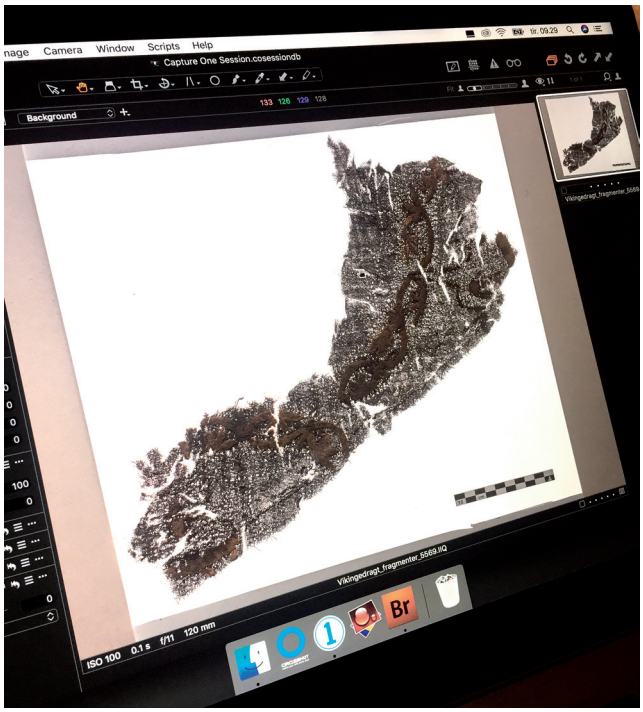


Fig. 3: A high resolution photograph of one of the 2/1 twill textiles from Bjerringhøj taken with light from beneath during the recording of the embroidery yarns (Image: Charlotte Rimstad)

were either spun on a spinning wheel, or a machine spun yarn was given extra twist on a spinning wheel in order to match the very hard twisted threads used in these Viking Age textiles. Fibre analyses of the original textiles also guided the creation of the yarns for the reconstructions. In this way, fibres and other materials match the original ones, even though the production processes in most cases were optimised using modern tools.

The majority (but not all) textiles and fur or skin objects from Bjerringhøj and Hvilehøj were included in the two outfits. The excluded textiles are in most cases interpreted as not being clothing but more likely the wrappings for grave goods or the furnishings of the grave (Rimstad 2019). The textiles and fur or skin objects present only a few construction details, such as seams and signs of reuse or repair that can be related to the design of the original garments. It was decided to use more complete clothing finds from contemporary Scandinavian contexts as inspiration for the design and patterns for the outfits. Dye analyses guided the selection of colours chosen for the many different garments. When no dye results were available, the choice of colour was based on the best aesthetic match with the overall design, adjusted for whichever colours could have been used in this specific context (Vanden Berghe et al. in prep).

The man's outfit comprises: A beaver fur caftan, a linen tunic, a wool kirtle, a belt in wool and silk, legwear, two silk wrist cuffs, and leather boots (fig. 4). The woman's outfit comprises: A pine marten fur cape with beaver fur edging, a linen dress, a red wool tabby dress with woven-in decorations and sewn-on decorations in padded red tabby silk flanked with narrow strips of red samite, a purple 3/1 twill band and a blue silk, silver and gold tablet-woven band, and goatskin shoes with the hair retained (fig. 5). The leather boots and the linen undergarments are not based on data from the Bjerringhøj and Hvilehøj finds but are included to make the outfits comfortable to wear. The garments were sized to fit two volunteer models (Mannering and Rimstad 2021).

Although the textiles from Bjerringhøj and Hvilehøj are some of the best preserved specimens from any

Fig. 4: The final version of the man's outfit based on the Bjerringhøj grave find (Image: Roberto Fortuna)

Fig. 5: The final version of the woman's outfit based on the Hvilehøj grave find (Image: Roberto Fortuna)

Danish Viking Age burial context, there is still a gap between the archaeological finds and the finished reconstructed outfits. The many analyses results have been a great help and invaluable guide for the different production processes and final design – but also somewhat of a hindrance. Once the results of the fibre, dye analyses, and species identifications were ready, they were incorporated into the design of the outfits, regardless of modern aesthetic taste. Other results came after the designs were finalised and could no longer be changed. Therefore, some of the results were not incorporated in the current reconstructions. It is important to state that despite many hours of research, analyses and craft work put into the outfits, the project team stress that they are possibilities, not final truths. The current knowledge base could have been used to produce a range of different outfits. However, the reconstructed high-status outfits match the aim and requirements for the current project. A full report on the design process will be published in 2022.

Fashioning the Viking Age Outreach

From December 2020 to March 2021, the reconstructed man's and woman's Viking Age high-status outfits were included in an online web-exhibition at the Museum of Cultural History in Oslo, Norway. The exhibition was at first planned in a physical format, but quickly changed into a digital format due to the COVID-19 pandemic, during which the museum was closed to the public. During the four months, the outfits had more than 25,000 viewers. In June 2021, the two outfits were included in the new Viking Age exhibition at the National Museum of Denmark in Copenhagen, where they are placed close to the original textile finds. The exhibition will be open until May 2024 and several of the short films produced for the exhibition can also be seen in the museum website (see links below), and the museum's Facebook page. The catalogue made for this exhibition also includes an article about Viking Age sail cloth production (Andersson Strand and Mannering 2021).

The Textile Tool Box is now ready to be used for outreach purposes at universities and museums, in order to give a "hands-on" feeling of Viking Age textiles and textile production. We thank the many excellent researchers and crafts people that have contributed to the project with their invaluable inputs and skilled hands. Without your fantastic contributions this project would not have materialised.
You can follow us on Instagram:
@fashioningthevikingage

Bibliography

Andersson, E. (1999) *The Common Thread. Textile Production during the Late Iron Age – Viking Age*. Lund: University of Lund, Institute of Archaeology Report series No. 67.

Andersson, E. (2003) *Tools for Textile Production* – from *Birka and Hedeby.* Stockholm: Birka Studies 8.

Andersson Strand, E. and Mannering, U. (2021) The sail – A Gigantic Collective Undertaking. In J. Varberg and P. Pentz (eds), *The Raid. Join the Vikings*, Exhibition catalogue. Copenhagen: National Museum of Denmark, 29–44.

Brandt, L.Ø. and Mannering, U. (2020) Taxonomic identification of Danish Viking Age shoes and skin objects by ZooMS (Zooarchaeology by mass spectrometry). *Journal of Proteomics* 231, 104038. https://doi.org/10.1016/j.jprot.2020.104038

Hägg, I. (1984) *Die Textilefunde aus dem Hafen von Haithabu.* Berichte über die Ausgrabungen in Haithabu. Bericht 20. Neumünster: Karl Wachholtz Verlag.

Rimstad, C. (2019) En komfortabel, evig søvn. *SKALK* 5, 12–15.

Rimstad, C., Mannering, U., Jørkov, M.L.S. and Kanstrup, M. (2021) Lost and found: Viking age human bones and textiles from Bjerringhøj, Denmark. *Antiquity* 85, 1–18. https://doi.org/10.15184/aqy.2020.189

Mannering, U. (2018) Fashioning the Viking Age. *Archaeological Textiles Review* 60, 114–117.

Mannering, U. and Rimstad, C. (2021) At rekonstruere de velklædt vikinger. *SKALK* 2, 10–17.

Vanden Berghe, I., Mannering, U. and Rimstad, C (in prep) New dye analyses of Danish Viking Age textiles from the Bjerringhøj and Hvilehøj graves and the Haithabu harbour.

Internet sources

Viking Age clothing at the National Museum of Denmark (2021) https://www.viking.natmus.dk/vikingernes-toej (accessed 16 September 2021)

Fashioning the Viking Age homepage (2021) https://natmus.dk/historisk-viden/forskning/forskningsprojekter/fashioning-the-viking-age/ (accessed 16 September 2021)

Author:
ulla.mannering@natmus.dk

Corinne Mühlemann

All the goods of the earth:
making and marketing in the pre-Mongol marketplace

Introduction

Goods of the Earth: making and marketing in the pre-Mongol marketplace scrutinises the genre of *ḥisba*-manuals. These are Islamic legal sources that contain the rules compiled by the *muḥtasib* or market inspector. The most recent and extensive work on *ḥisba*-manuals presented the information in an accessible way but the author has decided not to engage with relevant artefacts when considering the impact of the manuals on the visual arts and crafts in medieval Islam knowledge (Ghabin 2009).

By investigating the *Kitāb fī ādāb al-ḥisba* (dated to approximately 1100 CE) of al-Saqaṭī, who was the market inspector of Málaga, this project will demonstrate that his warnings contain detailed information about the quality of craft objects as well as their production. It will also show that this genre of legal texts reflects the marketplace, its products, and its artisan-craftsmen (Colin and Lévi-Provençal 1931). The project will explore three aspects of the *ḥisba*-manuals which are of particular interest.

The transfer of weaving technology

The first aim is to discuss how weaving knowledge of lampas, a complex binding technique, was transferred between Baghdad and Spain during the 11th century CE. The lampas technique developed at the end of the 11th century in Iraq, probably in Baghdad, the Abbasid capital at the time (Von Wilckens 1991, 66–68; Schorta 2001, 50). This technique dominated the global production of luxurious silks (closely followed by techniques for weaving velvets) until the middle of the 19th century. The project will scrutinise if and how this weaving knowledge was communicated through patterns and their notation. No material illustrating notation systems for woven patterns containing technical information has yet come to light. These were the mechanisms though which the person who set up the loom would have understood how to do so on the drawloom. Translating a pattern from a two-dimensional surface such as paper to a notation system representing the three-dimensional structure of a drawloom requires mathematical knowledge. This poses questions about the intellectual and social status of the weaver as well as other textile makers within premodern Islamic society.

The intellectual and social role of the weaver

Intriguingly, not only in the *ḥisba*-manuals but also in other legal and theological writings, the profession of the weaver is charged with values (negative as well as positive). It is not clear why stigma was attached to weavers. It adds to the complexity of the topic that some of the early legal theorists were involved in the production of textiles or in related trades. Approximately 22% of religious Muslim scholars of the classical period of Islam were employed in the textile industry (Cohen 1970, 26–28). Furthermore, weaving a lampas woven silk with its complex drawloom and notation system also requires mathematical knowledge. The project's aim is to achieve a more differentiated perception of the weaver and his work as well as the organisation and division of labour within textile production.

Objects making objects

The *ḥisba*-manuals provide evidence of artefacts other than textiles and their making processes in the pre-Mongol marketplace. Objects for everyday life have not attracted much scholarly attention within the field

Fig. 1: Thimble, cast and engraved bronze; height 4.4 cm; diameter (at widest point) 2.4 cm, from Spain, Andalusia; tenth to 11th century CE, David Collection, Copenhagen, inventory number 40/2000 (Image: Pernille Klemp)

of art history. Bread seals, for example, are mentioned in the *ḥisba* of al-Saqaṭī. These fascinating objects have a wide range of patterns and suggest the variety of products that were produced for the medieval marketplace which will be investigated by *Goods of the earth*. Another group of objects of interest are textile tools. These are often single items such as a bronze thimble produced in Spain during the tenth or 11th century, which is preserved at the David Collection in Copenhagen, Denmark (fig. 1). On the lower part of the thimble an Arabic inscription in Kufic script is engraved: "Lasting … and complete blessings to his owner". The owner of this thimble was probably a saddle maker or a cobbler working in one of the marketplaces of medieval Spain. It is a good example of an object which played a role in making other objects.

Exploring the pre-Mongol marketplaces through the *ḥisba* of al-Saqaṭī as well as the writings of other *muḥtasibs*, their products, and artisan-craftsmen will gather new information concerning the transfer of craft knowledge within the premodern Islamic world and will enable a new discussion of art and craft in the field of art history, Islamic art history, the history of science, and the history of textile arts. This project will also demonstrate the importance of the applied arts for the field of art history.

Acknowledgments

This project is funded by a Marie Skłodowska Curie Individual Fellowship (02.2021–01.2023), 118792 EU H20 – 886295.

Bibliography

Cohen, H. (1970), The Economic Background and secular Occupation of Muslim Jurisprudents and Traditionists in the Classical Period of Islam. *Journal of the economic and social history of the Orient* 13, 16–61.

Colin, G-S. and Lévi-Provençal, E (1931) *Un manuel hispanique de Ḥisba, traité d'Abū ʿAbd Allāh Muḥammad b. Abī Muḥammad as-Sakaṭī de Malaga sur la surveillance des corporations et la répression des fraudes en Espagne musulmane*. Paris.

Ghabin, A. (2009) *Ḥisba, Arts and Craft in Islam*. Arabisch-islamische Welt in Tradition und Moderne 7. Wiesbaden: Harrassowitz.

Schorta, R. (2001) *Monochrome Seidengewebe des hohen Mittelalters*. Berlin: Deutscher Verlag für Kunstwissenschaft.

Von Wilckens, L. (1991) *Die textilen Künste: Von der Spätantike bis um 1500*. München: C.H. Beck.

Author:
corinne.mue@hum.ku.dk

THEFBO: the significance of archaeological textiles

24 to 25 February 2021, online conference hosted by Landesamt für Denkmalpflege Baden Württemberg, Germany

The Significance of Archaeological Textiles was the final conference of the THEFBO project. It was held online on 24 and 25 February 2021 due to the Covid-19 pandemic. The content of the conference was aligned with key topics of the THEFBO project, which dealt with the significance of prehistoric textiles in the context of early agriculturally oriented settlements in central Europe. It comprised four thematic sessions, with almost 240 contributors from Europe and far beyond (including Australia, Canada, China, Egypt, India and Russia). The online format was streamed via a conference platform with Q&A panels in a chat channel following each presentation. Options for taking live questions in person via a microphone and camera were also offered at the end of each session.

Claus Wolf, president of the State Office for the Preservation of Monuments in Baden-Württemberg, opened the conference day, followed by a short overview from Johanna Banck-Burgess, THEFBO's project leader. The first session of the day was a presentation by the THEFBO team, outlining the preliminary results from the analysis of Neolithic finds and providing some insights on the scientific studies dedicated to this material. This first paper was presented by Sebastian Million (Landesamt für Denkmalpflege, Hemmenhofen, Germany) and Doris Mischka (University Erlangen, Germany). The second talk in this session was by Johanna Banck-Burgess (Landesamt für Denkmalpflege, Esslingen, Germany) and focused on terminological issues in the discussion of archaeological textiles. The third presentation by Hildegard Igel and Johanna Banck-Burgess discussed the processing of wood bast and linen. Susanna Harris (University Glasgow, UK) delivered the closing paper of this session, which questioned the properties of the raw materials chosen for making textiles at Must Farm, Great Britain.

The second session consisted of four talks dedicated to the raw vegetal material for making textiles. First, Bernhard Gramsch discussed the cords, ropes and nets from Mesolithic-Neolithic Friesack. Secondly, Maria Herero-Otal, Susagna Romero-Bruges and Raquael Pique (Autonomous University of Barcelona, Spain) presented the plant material for fibre-based items at three sites of the Neolithic and Iron Age Iberian Peninsula. The third talk by Oliver Nelle and Elena Marinova-Wolf (Landesamt für Denkmalpflege, Hemmenhofen, Germany) addressed the significance of lime trees in prehistoric European landscapes. The last talk of this panel was presented by Daniel Gross (Museum Gottorf, Germany), Marco Zanon (University, Kiel, Germany), Ulrich Schmolcke (Museum Gottorf, Germany) and Harald Lübke (Museum Gottorf, Germany) and focused on Early Neolithic plant management in northern Germany.

The two sessions of the first conference day were viewed by more than 220 people. There were numerous questions asked after each talk, including the best way to transport a prehistoric textile find; whether ropes and objects shaped with wood bast are classified as textiles; why oak bast is not ideal for making textiles; and was wood bast used at all at Must Farm. Session two, on raw materials, covered the role of cattails in fibre-based crafts: were lime and hazel trees used during prehistory. There were many more interesting discussions at the concluding discussion panel of day one.

Immediately after the end of the discussion the organisers proposed that the online platform be used for informal gathering and chatting around textiles!

Fig. 1: THEFBO conference flyer

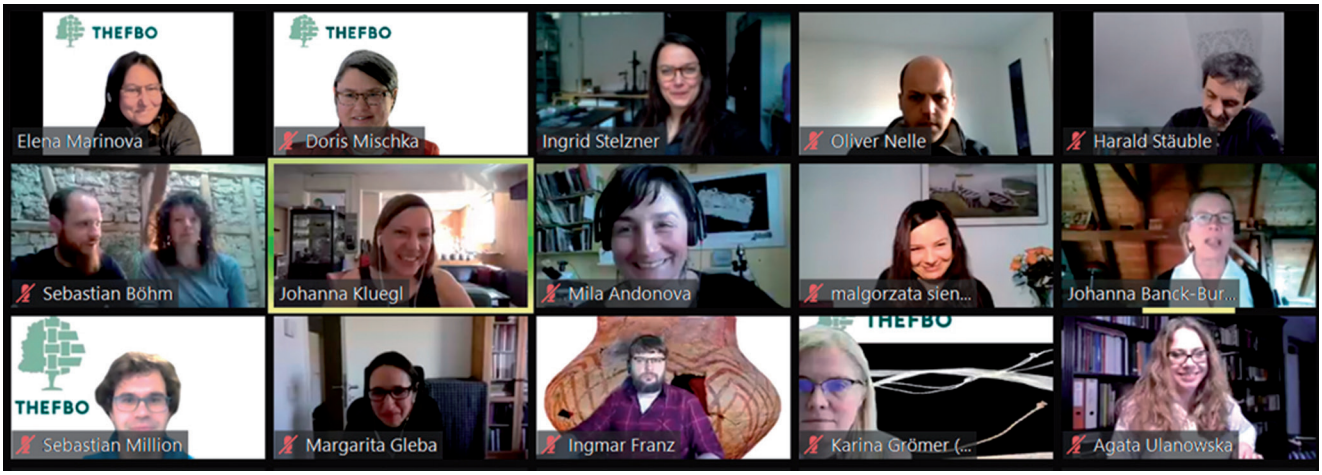


Fig. 2: THEFBO conference, screenshot of some of the speakers (Image: D. Michka)

The second conference day consisted of another two interesting sessions. The first one was the longest in the event and consisted of six presentations. Session three started with Harald Stäuble (Landesamt für Archäologie, Saxony, Germany) and his talk on Early Neolithic wells, their construction and the finds they contained. The session continued with Johanna Klügl (Culture Service of Canton Bern, Switzerland), Giovanna di Petro, Albert Hafner (University of Bern, Switzerland) and their presentation on the remarkable Neolithic bow case from the Bernese Alps. The next talk was delivered by Regula Gubler (Culture Service of Canton Bern, Switzerland) and remained in the same Alpine region but discussed objects of wood, bast and bark retrieved from Alpine ice patches. After the coffee break, session three continued with Ingmar Franz (University Kiel), who discussed basketry skeuomorphism amongst the Neolithic Catalhöyük pottery. Next came Irenäus Matuschik (Landesamt für Denkmalpflege, Stuttgart, Germany) exploring the link between organic containers and pottery shapes along the shores of Neolithic Lake Constance. The closing talk of this session was offered by Karina Grömer (Natural History Museum, Vienna, Austria), who discussed the link between the crafts of cordage and pottery during the Bronze Age in central Europe.

The fourth session, consisted of three talks, starting with Malgorzata Siennicka (University of Göttingen, Germany), who focused on Bronze Age Aegean flax and wool as sources for textile production. The next presentation was delivered by Agata Ulanowksa (University of Warsaw, Poland) on the topic of wool and the Aegean and explored textile imprints on clay sealings. The closing talk was given by Marco Baioni (Museum of the Sabbia Valley, Italy), Margarita Gleba (University, Munich, Germany), Claudia Mangani (Museum of Rambotti, Italy) and Roberto Micheli (Archaeological Service of Trieste, Italy). It discussed the textile finds at Lake Garda in Italy.

Day two of the conference was the longest and offered more opportunities for questions and substantial discussions. For this reason, there was a separate discussion panel offered at the end of the day at which all the questions were grouped into sub-topics and then answered together. Some of the queries included details of the Neolithic wells' construction, insights into the conservation and forthcoming exposition of the Alpine bow case, research strategy at the Alpine ice patches, laboratory approaches for sampling sealing impressions, and many others.

A charming idea for the lunch break was the virtual exhibition of textile finds that have been part of the THEFBO project. This also included a virtual visit to the rooftop of the building. Although it was a challenging task for the THEFBO team to plan and conduct the conference online, with creative ideas and professional technical support by Leipziger Messe GmbH, they managed to produce a wonderful experience for all the speakers, contributors and a worldwide audience.

The papers presented during *The Significance of Archaeological Textiles* will be published later in 2022 in a joint volume as a permanent record of this insightful two-day conference.

By Mila Andonova and Karina Grömer

Textiles and Seals: carving out a new research field and weaving data together

22 to 23 March 2021, University of Warsaw, Poland, and online

The workshop hosts were members of the *Textiles and Seals* project research team, who investigate the complex relationships between textile production and seals and sealing practices in Bronze Age Greece. It aims to explain the use of textiles in sealing practices and the use of seals in the administration of textile production, as well as the possible meaning of iconographic references to textile production on seals. The workshop took place online on 22 and 23 March 2021, with 12 presenters and about 50 online attendees. It was the concluding part of the research project Textiles and Seals directed by Agata Ulanowska and funded by the Polish National Science Centre (reference number 2017/26/D/HS3/00145). The ambitious aim was to confront, compare and merge results from two distinct fields of knowledge in the study of the past: the highly specialised sphragistic study of early administrative practices and the much broader field of textile research with textile tools, fabrics, iconography of dress, and textile terminology. The two research fields study very different sources which are of different yet related materials: textile tools, such as spindle whorls and loom weights made of clay, and seals stamped on clay but themselves made of harder stone or ivory.

Seals and sealings were used widely throughout the Bronze Age Aegean to close, secure, identify and record stored products in domestic houses and palaces alike. The clay sealings were preserved by accidental fires. They could be used to convey the identity of an owner just as clothing relates identity. However, the underlying crafts and technologies seem very different: from the technology employed in sealing practices for administrative purposes through the technology used in carving motifs to the technologies of spinning, weaving and sewing.

Traditionally, sealings have been studied only for the seal imprints from a stylistic and/or economic, administrative perspective. For some time, sealings have also been studied for their reverse sides, where it is possible to see the imprints of cords or fabrics which belong to a container or other surface (such as a basket, pot or door) on which they were applied in order to close and secure it. Academically, there has also been a contrast between the prestige of sphragistics and the study of unique and precious seals with their ties to administration and the masculine domains of society versus the less prestigious (and more overlooked) profile of textile research and its ties to the distaff side of society.

In academia in the past, much focus has been on the functionality of seals, textiles and textile tools. However, this workshop also explored aesthetics, traditions, symbolism and agency. The workshop participants discussed these differences and communalities in material, data, scholarly traditions, theories and methods.

Sophia Vakirtzi of the Hellenic Organization of Cultural Resources Development (HOCRED) presented the types and frequency of motifs on Aegean spindle whorls using material from her wide-ranging study of these textile tools in Aegean contexts. In her paper entitled "Ubiquitous motifs: common designs on spindle whorls and seals of the Aegean Bronze Age", she observed how some of the most common spindle whorl motifs and designs, such as the zigzag, the six-pointed star, concentric circles, chevrons, triangles (often hatched), and dotted borders are also found in the Aegean seals motif repertoire. Vakirtzi suggested that the manufacturers of both spindle whorls and seals drew from a common repertoire of designs and motifs and asked whether it is possible that Bronze Age spinners would own and use seals. She demonstrated that a new understanding can be gained from studying these objects together.

Olga Krzyszkowska (Institute of Classical Studies, University of London, UK) addressed another significant tie between sealing practices and textile tools in the Aegean in "A rare and enigmatic practice: seal-impressed textile tools in the Aegean Bronze Age". In a few cases, there is evidence of stamping of textile tools, which is similar to the rare evidence of stamping pottery. On both, the seals were impressed prior to firing. Therefore, these stamps are better preserved than the more numerous clay sealings that survive only through chance fire destructions.

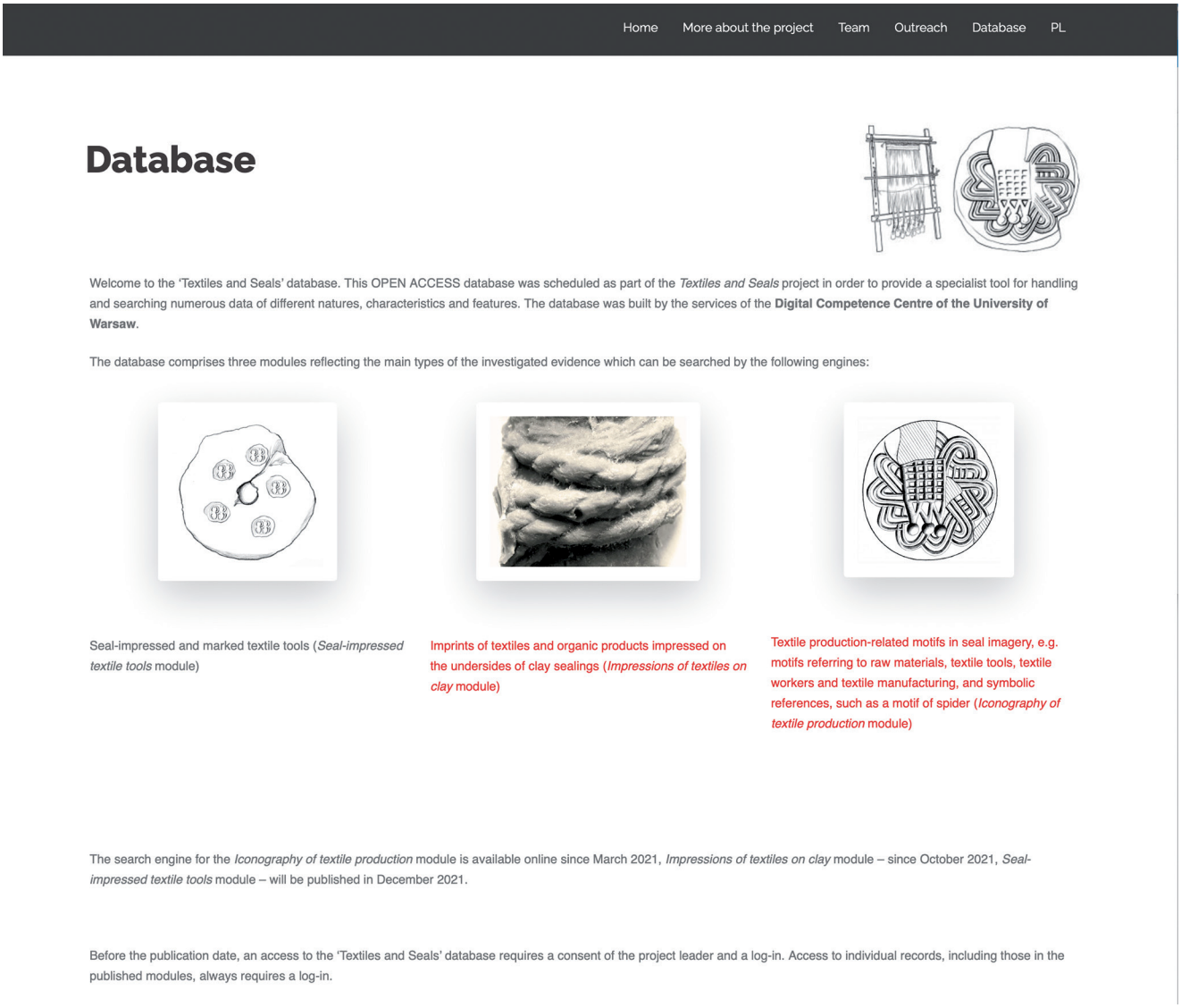


Fig. 3: The Textiles and Seals database enables correlations between motifs, sources and material to be tracked (Image: screenshot of the database homepage).

From the Early Bronze Age, there is a single seal-impressed loom weight from Lerna in the Argolid, and approximately 30 examples of stamped weights at the Early Cycladic II settlement of Skarkos in Ios. According to Krzyszkowska, it seems that the practice of stamping textile tools on the mainland and in the islands virtually disappeared after the Early Bronze Age. In Crete, the practice of stamping textile tools and pottery is likewise sporadic but with most evidence in the Middle Minoan II period from eastern Crete. At Palaikastro, there are more than 40 stamped textile tools. At both Mallia and Palaikastro, 'sets' of loom weights are impressed with the same seal. The seals used to stamp textile tools and pottery are indistinguishable from the types known from impressions on clay sealings and from extant seals, and the stamping of textile tools can therefore be seen as part of a wider glyptic *koinè* prevalent in the Aegean Bronze Age. Krzyszkowska also observed a persistence of the practice of stamping loom weights beyond the Prepalatial period into the Late Bronze Age with stamps of contemporary seals not heirlooms. Lin Foxhall (University of Liverpool, UK) and Alessandro Quercia (Soprintendenza Archeologia Belle Arti e Paesaggio per la Città metropolitana di Torino, Italy) explored the corpus of stamped and marked textile tools from classical and Hellenistic southern Italy. Their paper "Marked, decorated and seal-impressed: on the practice of marking loom weights in the Greek and indigenous communities of south Italy"

used these textile tools to explain interactions between textile producers of the indigenous local communities and those in the Greek settlements. As the abundance of loom weights from domestic sites, sanctuaries and funerary areas clearly attests, both local populations and newcomers used the warp-weighted loom. The south Italian loom weights reflect different female communities and their practices. The extraordinary abundance of marked, incised and stamped loom weights in some communities enabled the speakers to contextualise the motifs among decorations on other kinds of pottery, in architecture, and also to place them in the context of the ideas, culture, and traditions of female and domestic life as well as the self-understanding and identities of the diverse south Italian communities.

Bela Dimova (The British School at Athens, Greece), in her presentation "Stamps and marks on loom weights from ancient Corinth", explored the unique textile evidence of more than 1,300 loom weights from this location. Stamping and marking loom weights in Corinth began in the late sixth century BCE and was extensive during the Classical and early Hellenistic period: more than 500 of the loom weights are stamped and over 300 are marked with letters or other incisions. Some stamps on loom weights even depict loom weights. These appear in the fourth century BCE, often alongside lettered stamps, and are interpreted as loom weight producers' trademarks and branding. Dimova discussed the production and circulation of textile tools and the links between textile and ceramic production. She highlighted how each class of stamps and marks relates to other loom weight characteristics such as shape, size, function and clay. She asked whether it was the Corinthian potter who stamped the loom weights in a set or whether it was the customer who stamped the set she wanted to purchase.

Joanna Smith (University of Pennsylvania Museum of Archaeology and Anthropology, US) presented "Location matters: marked loom weights in ancient Cyprus". She took an original approach to the topic by suggesting how they would have appeared when hung on the loom. The loom weighs in her Cypriot corpus bear seal impressions or, more rarely, inscribed marks, and are dated from Late Bronze Age through Hellenistic contexts. Based on loom weights from the settlements of Palaepaphos (Kouklia), Marion (Polis Chrysochous), and Kourion (Episkopi), Smith demonstrated that during the Classical period, there was a shift from marks that would have been seen during weaving to those that would have been hidden. She suggested that this reflects a change in the meaning and reason for labelling loom weights, and that the marking of loom weights shifted from a technical feature to a personal sign.

Catherine Breniquet (Université Clermont Auvergne, France) and Christoph Moulhérat (Musée du quai Branly-Jacques Chirac, France) gave a paper on "Sealings from Khirbet Derak, Halaf period, Iraq. Material, methodology and results". Studying sealings in the field is difficult and time-consuming as it requires careful observations and technical equipment such as binocular microscope, Dino-Lite and other specialised equipment. In some countries, exporting the archaeological material for closer study is not permitted, and the archaeologist therefore needs to undertake specialised studies in the field. The authors presented such a situation at the Late Prehistoric site of Khirbet Derak in northern Iraq, and discussed how they developed an innovative and low-cost method to study sealings, using smart phones, photographic software and 3D printing. These new methods were easy to use on site without access to more complex technology and equipment. They also enabled the researchers to grasp the whole object, including its reverse side, where imprints of cords or fabrics from the container to which they were fixed (in order to close and to secure it) were identifiable. These new research methods may become even more relevant in periods of confinement without access to material or opportunities to travel.

Romina Laurito's (Villa Giulia Museum, Rome, Italy) "Introduction to the analysis of textile, cord and thread imprints on undersides of clay sealings from Arslantepe" presented new methods for investigating sealings with the aim of reconstructing artefacts and objects made of perishable material, and to understand the knowledge and skills of ancient craftspeople. Laurito presented the clay sealings from the monumental area of the Late Chalcolithic 3-4 period (3900 BCE to 3500 BCE) and the palatial complex of the Late Chalcolithic 5 period (3500 BCE to 3200 BCE). Clay sealings in the Near East contain the seal imprint on one surface and also an imprint of the material (textile, leather, ropes or strings) on the other surfaces. At Arslantepe (southeastern Turkey), the archaeological team has long experience of testing and developing methodologies to combine evidence from the thousands of clay sealings with data from contexts, experimental archaeology, and textile archaeology. This enables them to understand the sealings in a broader societal and administrative context and to gain more knowledge on crafts. In particular, the comparison of textile imprints in clay sealings, archaeological textiles, and textile tools forms a link between seals and textiles in Arslantepe.

Maria Anastasiadou (Institut für Klassische Archäologie der Universität Wien, Austria) presented "Hands at work in Neopalatial Kato Zakros: the documents sealed by the flat-based nodules". In Crete, 480 flat-based clay nodules were recovered in Neopalatial Kato Zakros, where they were mostly concentrated in a small area of one room in House A. Most of them preserve imprints of folded and often tied documents in their bases. By studying the objects closely and by a series of tests and experiments, Anastasiadou offered explanations of how the sealing was done and how the documents were folded and sealed by the nodules. She outlined the work and ways of operating by specific hands/schools, and described the various methods used to create these documents. The study of such folding and sealing techniques can provide an estimate of how many people were involved in the Minoan Neopalatial administration in Kato Zakros.

Sarah Finlayson (Corpus der minoischen und mykenischen Siegel, Heidelberg, Germany) presented "The interweaving of textiles and sealing practices in the Bronze Age Aegean: an overview" which explored the textile imprints preserved as impressions on the underside of the sealings in two case studies from different sociopolitical contexts: Early Helladic IIB (approximately 2200 BCE) Lerna on the Peloponnese and Middle Minoan IIB (approximately 1700 BCE) Phaistos on Crete. Each has yielded large corpora of direct object sealing fragments. Finlayson also presented her observations from experimental tests of different ways to seal textile-covered jars. She addressed how sealings and textiles provide information about the technology of food storage, covering, wrapping and sealing of agricultural produce, for its effective preservation and, ultimately, subsistence.

Iconography of the Aegean Bronze Age is a rich source of information on textile ornaments, both from the seal carvings and from the colourful frescoes on Minoan and Mycenaean walls. This was demonstrated in a paper by Fritz Blakolmer (Institut für Klassische Archäologie der Universität Wien, Austria) entitled "Textiles and seals: their manifold interrelations in the iconography of the Aegean Bronze Age". Decorations depicted on seals can be compared to those on textiles depicted in wall paintings where common motifs appear. The flat meander, running spirals and the rosette depicted on seals have excellent parallels in depictions of dress in figural scenes of Minoan Crete. Another textile and dress link between mural painting and seals is the highly significant ritual of presenting garments as part of the religious festivities of Neopalatial Crete. Examples are the presentation of a flounced skirt to women or a fringed coat to a political ruler, which is then worn by him publicly. A third relevant iconographical textile link between mural painting and seals is the abundant evidence of figural motifs on textiles as shown in Minoan and Mycenaean iconography with motifs such as crocus, swallows and even human figures depicted on the elaborate dress of mostly female figures in large-scale mural paintings. Blakolmer concluded that complex Aegean textiles make a remarkably versatile iconographic medium comparable to seals and signet rings.

Jörg Weilhartner (Universität Salzburg, Austria) addressed the links between scripts, seals and textiles in "The Linear B logograms for textiles and wool: some thoughts on their peculiarities". He presented the Linear B logogram for textile (*159/TELA) and its precedent in the Linear A script. This logogram is rendered with few details, in contrast to many other Linear B logograms, and while many logograms in the Linear B script include the initial syllable of the word of the object in question, the logogram for textile is instead modified by no less than 6 different syllabic signs. In addition, this logogram is specified with names of textiles (whose names are not abbreviated or written inside the logogram). Weilhartner therefore suggests that the Linear B logogram constitutes an 'umbrella term', a generic logogram, quite unique and without clear parallels in the Linear B corpus. The Linear B logogram for wool, likewise, is unique in its design as a monogram, and as far as is known, it is the only Linear A monogram, which survived into Linear B. The Linear A sign was made up of two Minoan syllabic signs that seem to represent the Minoan word for wool (when using Linear B phonetic values for the two syllabic signs).

The team behind the Textiles and Seals project, Agata Ulanowska, Katarzyna Żebrowska and Kinga Bigoraj (Faculty of Archaeology, University of Warsaw) together with Piotr Kasprzyk (Digital Competence Centre, University of Warsaw), presented the *Textiles and Seals* online database, resulting from the past three years of research. The main types of evidence investigated: seal-impressed textile tools, textile impressions on the undersides of clay sealings, and textile production-related iconography, feature different functionalities, parameters, and meanings that require different recording methods. The *Textiles and Seals* database was designed and built specifically for this project with free, open-source online software. The team presented how the database enables correlations between motifs, sources and material to be tracked. The database is available at https://textileseals.uw.edu.pl/database/.

The workshop successfully illustrated how to merge two quite distinct and specialised fields of the study of the past, each with its own set of methods, academic traditions, focus areas, and theories. Some communalities appear, such as the use of experimental archaeology to test hypotheses. Research into textiles and into seals also often revolves around contrasting concepts, such as firing versus not-firing, standardised versus unique, negative versus positive, direct versus indirect, front versus back and representation versus reality. Moreover, for both research fields, the discussion of relative chronologies, heirlooms and memories are important. The workshop, as well as the *Textiles and Seals* project, furthermore, highlighted that when merging two research fields, a new reflection on theories and methods is needed, and new research questions surface. In this workshop, the agency of textile makers, seal owners and users were discussed several times, and the balance between functionalist with art-historical and aesthetic approaches.

By Marie-Louise Nosch

Funerary Textiles in Situ: an interdisciplinary workshop

15 April 2021, The Polish Centre of Mediterranean Archaeology (PCMA), University of Warsaw, Poland, and online

The workshop dedicated to *Funerary Textiles in Situ* had to be organised virtually as with many other events planned in 2021. The event was the outcome of a collaboration between the Polish Centre of Mediterranean Archaeology (PCMA), University of Warsaw (specifically the project *Unravelling Nubian Funerary Practices* with principal investigator Elsa Yvanez, PPN/ULM/2020/1/00246) and the EuroWeb project (Cost Action 19131). The organisers, Elsa Yvanez and Magdalena Wozniak, were based at PCMA in Warsaw, while all invited speakers participated online. Thanks to the financial support of EuroWeb, the event was transmitted live via the EuroWeb YouTube channel and was attended by approximately 100 participants.

The aim of the workshop was to bring together physical anthropologists, archaeologists, and textile conservators to share both experiences and methodology to establish a protocol for best practices in the excavation, conservation, and analysis of funerary textiles from *in situ* findings to advanced tests in laboratories. The workshop presentations were grouped into two sessions: "Textiles and the dead. Case studies from Europe and the Nile Valley" and "Retrieving the dead and its wrappings: diversity of approaches".

The first session gathered nine panellists who presented diverse funerary contexts covering a vast geographical area from Finland to Sudan and a timeframe from 1000 BCE to 1800 CE. In the first presentation, "Textiles in the funeral rite of the Wielbark culture", Magdalena Przymorska-Sztuczka examined fragmentary textiles attached to metal objects from Polish funerary contexts (such as inhumations and cremations). During the conservation of brooches, bracelets, spurs and belt elements from the cemetery of Wilkowo, it appeared that different types of textiles were preserved in layers. All the textiles were made of wool, the most frequent weave being a 2/2 twill. The analysis of the textiles and their localisation in the burials of women allowed researchers to reconstruct the presence of a *peplos*-type dress, made of a thicker fabric and attached with brooches over a tunic with sleeves which was made from a more delicate fabric.

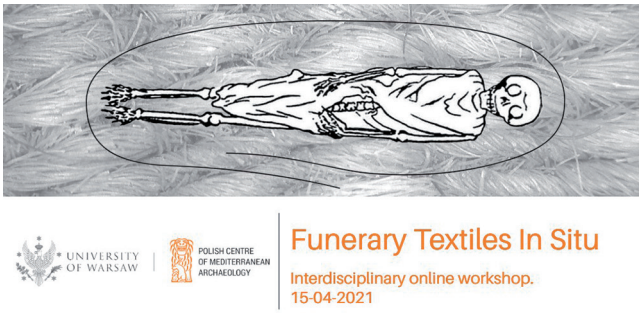


Fig. 4: Logo of the workshop and associated project Unravelling Nubian Funerary Practices hosted by the PCMA, University of Warsaw (Image: Elsa Yvanez)

Fig. 5: Digital set-up with our IT team in the facilities of the PCMA and online participants (Image: Magdalena Wozniak)

Dawid Grupa presented case studies about "Silk textiles in funerary liturgical garments in Poland (17th to 19th centuries CE)". In parochial churches, liturgical garments were usually decorated with reused silks, sometimes quite old, provided by donors (such as individuals or institutions). Some priests were buried in the chasuble they used during their lifetime, as attested by numerous traces of use and repair. At the monastery of Szczuczyn, there is evidence of linen liturgical garments made specifically for funerary use following church prescriptions against opulence. The presence of dyed linen in numerous burials may point to local production.

Malgorzata Grupa discussed a very interesting case of textile remains which were exposed to a very high temperature but not directly burnt by fire. Among the "Textiles from an early medieval settlement in Trzcianka, gm. Janow, Poland", a total of 11 layers of different fabrics were analysed by optical microscopy. The working hypothesis is that a wooden construction fell on people escaping a fire.

Sanna Lipkin prepared a valuable overview of non-invasive documentation in church crypts. Her presentation "Studying funerary textiles *in situ* below Finnish church floors: challenges and successful practices" addressed many technical questions, from ethical and administrative obligations to space, light, and photographic settings. She also discussed the many advantages of CT-scanning.

Karina Grömer offered a thorough analysis of the many levels of interpretation of textiles in funerary contexts in her "General thoughts on different kinds of functions of textiles in graves. Case studies from 1000 BCE to 1000 CE in Europe". Among many pertinent observations, she highlighted the importance of the community's role in the preparation of the body and the selection of clothing in order to restore the social status of the deceased.

Malgorzata Siennicka examined "Two Mycenean textile imprints from the Tomb XXI at Deiras, Argos (Greece)". These were retrieved from a collective tomb, in which the last deposited body was that of a child. The two fragments were sampled from the floor, which was covered by light clay. The textile imprints attest that the clay was still wet when the body was deposited, possibly on a blanket or wrapped in a kind of shroud called a *larnakes*. These modest imprints are a valuable addition to a limited corpus of evidence for the use of textile in Mycenean funerary practices.

Magdalena Wozniak discussed "Wrapping practices in medieval times. Case studies from Gebel Adda (Sudan)." Her analysis was based on archaeological documentation produced during the excavation of elite burials in church crypts in the mid-1960s combined with the study of the preserved textiles. The presence of inscribed shrouds among the layers of precious textiles was also considered.

Robert Mahler and Barbara Czaja presented collaborative work between an anthropologist and a textile conservator in "Textiles and bones on site. Crypts at kom H in Old Dongola (Sudan) and Cemetery A in Naqlun (Egypt)". The paper provided an excellent

example of good communication and effective work organisation in the field even in difficult excavation conditions (such as narrow crypts) as well as the combination of expertise in the interpretation of data.

The last paper of this session, by anthropologists Robert Stark and Joanna Ciesielska, provided an instructive insight into textiles in a funerary context where no specialist is present at the time of discovery. In "Funerary textiles from burial contexts at Ghazali and Old Dongola, Sudan – a bioarchaeological perspective", the authors considered the difficulty of working with desiccated and highly friable textiles. However, in the numerous cases where organic material was well preserved, it was possible for them to distinguish between the outer layers, usually thicker fabrics, and the inner, softer layers of the wrappings. Despite the lack of a textile specialist on site, the team was able to assess the similarity of funerary practices on these two distant medieval sites.

The second session entitled "Retrieving the dead and its wrappings: diversity of approaches" started with a paper presented by Francisco Gomes, who contextualized the presence of textiles in burials devoid of any organic material in "Naked graves? Thoughts on the recording and reconstruction of funerary attire in the Early Iron Age of southwestern Iberia." The presentation highlighted the importance of integrated work to the highest standards in archaeological documentation of the grave content and close collaboration with bioarchaeologists to reconstruct the distribution and function of textiles in ancient funerary practices.

Elsa Yvanez examined the challenge of reconstructing such information when working on well-preserved textiles but with dispersed and incomplete documentation in "Rewinding the thread – archaeology and textile archives from the Scandinavian Joint Expedition to Nubia".

Fig. 6: Organisers Elsa Yvanez and Magdalena Wozniak (Image: Magdalena Wozniak)

Iwona Kozieradzka-Ogunmakin presented "Grave concerns: Complexity in documenting and studying ancient Egyptian burials" with a focus on Old Kingdom and Graeco-Roman burials from Saqqara. She discussed the issues and challenges of documenting and storing great quantities of wrappings and wrapped human remains in various state of preservation and field conditions and expressed the need for guidelines in dealing with textiles and for closer collaboration with textile experts.

Christina Margariti presented a joint paper prepared with colleagues Stella Spandidaki, Maria Kinti and Tina Chanialaki about "Conservation approaches for pyre burial textiles excavated in Greece". Using selected case studies, the team offered an overview of the available techniques such as stereomicroscopy, X-ray fluorescence (XRF), and computer tomographic (CT) scanning, to assess the condition of textiles. They also outlined the steps taken by conservators in studying these fragile fragments to ensure their long-term preservation, not only of their material condition but also the very informative succession of textile layers on the object.

Luise Ørsted Brandt introduced the audience to a very instructive theoretical framework needed to study funerary wrappings. In her paper "More information from funerary textiles – sampling for different natural scientific analyses" she also detailed various possible analyses that can be applied to textiles with a focus on CT-scanning for documenting textile layers, lipid analysis to study resins, oils, and waxes, and protein and DNA-based analyses to identify fibres and skins.

The last paper of this session, "Photogrammetry: introduction to digital recording," was delivered by Piotr Zakrzewski, who examined the many advantages of photogrammetry as a useful and time-saving tool for documenting and reconstructing 3D models of grave contents.

In the concluding remarks to this rich and inspiring day, the organisers expressed their gratitude to all the speakers for sharing their expertise. They also hoped for continuing collaboration. The discussion continued in smaller groups during two half-days, during which all the speakers worked together to create a protocol of good practices for the recording, studying, and preserving of funerary textiles in the field. The proceedings of the whole workshop – methodological papers, protocol, and case-studies, will be published as a monograph in the coming year.

By Magdalena M. Wozniak

The Association of Dress Historians' Annual New Research Conference

7 to 13 June 2021 online

Originally, this international conference was planned to take place in August 2020 at the Röhsska Museum of Design and Craft in Gothenburg, Sweden. After several date and venue changes, the conference finally took place via zoom in June this year.

It was a seven-day event with about 120 presentations of 25 minutes each daily from noon until about 9 pm. The contributions covered a multitude of aspects about dress practices, textile production, textile history, and more - from prehistory to the present, and even with an occasional contribution including post-covid times. Participants came from many countries around the world and from both academic and non-academic environments. Throughout the week, the conference was very admirably and professionally hosted by Jennifer Daley, chair of the Association of Dress Historians, who worked hard to make the conference happen in challenging circumstances.

A majority of the conference presentations were dedicated to the early modern and later historical periods, but some presentations focused on earlier periods in which archaeological and visual evidence are important sources of information. Among the papers with a focus on early or prehistoric periods was one about Aegean headdresses in Bronze Age civilizations 3200 BC to 1100 BC (by Betty Ramé), and one about dressing for eternity in Ancient Egypt (by Elizabeth McGovern). The latter discussed evidence from the tomb of Nebamun from the 18th dynasty (14th century BCE). Paintings from this tomb in the Theban necropolis on the west bank of the Nile, are now in the collections of the British Museum.

Two papers discussed dress in the ancient Greek cultural sphere: one was directed towards the Greek mainland with the focus on clothing as a symbol of gender and class distinction (by Sofia Konstantinou); the other was on dress and crosscultural exchange in ancient southern Italy (by Hayley Stoneham). It focused on this area primarily in the Greek period when a mix of indigenous southern Italian and imported cultural influences from Greece can be identified. Another paper dealt with ancient Rome and, in particular, the dress and public appearance of Roman women (by Lena Larsson Lovén).

Although several papers discussed dress issues and textile history in Scandinavia from later centuries, somewhat surprisingly no presentations were primarily concerned with archaeological textiles from the prehistory of northern Europe, such as Viking age dress or finds from the Danish bogs, which often draw the attention of scholars of dress and textile history. However, Jane Malcolm-Davies reported a pilot project which contrasted conventional methods of dating archaeological and historical textiles (1450 CE to 1650 CE) with radiocarbon analysis using samples from northern European knitted caps.

One of the more sensational textile finds in present-day Sweden, that of the bishop Peder Winstrup in Lund, was presented in a paper by Pernilla Rasmussen. Winstrup died in 1679 and was buried in the cathedral of Lund in a funerary costume made of costly clothing items. The coffin was opened in 2013 and, since then, the dress of the mummified bishop has been thoroughly investigated, as part of a more extensive local project.

All in all, as the conference was organised by the Association of Dress Historians, papers concerning later historical periods were dominant in the programme and strictly archaeological papers were in minority. Still, the conference was a fruitful meeting between history, archaeology and scholars from several other academic disciplines, museum staff, and non-academics. The conference programme offered a varied and generous buffet of textile topics, stretching from a distant past to the present. As is often the case when historical textiles are discussed, the genuine cross disciplinary nature of this field of research is obvious, and this conference was no exception to that. The interdisciplinarity of archaeological and historical textile research is truly one of the great potentials of this field that, roughly over the past three decades, has generated so much new knowledge and understanding of past societies: of gender roles, social values, modes of production, trade, labour, and much more, and often with a distinct continuity into the present. The Association of Dress Historians strongly promotes the many avenues of new research on historical textiles through

conferences and other activities. It is also worth mentioning that the ADH offer grants, fellowships, and awards, and since 2016 the association has a free, online journal The Journal of Dress History with several issues annually. For more information about the association, the full programme of the conference in June 2021, and of upcoming conferences see: https://dresshistorians.org/

By Lena Larsson Lovén

Old Textiles – More Possibilities: the Centre for Textile Research's 15th anniversary conference

14 to 18 June 2021, University of Copenhagen and online

The year 2020 marked the 15th anniversary of the foundation of the Centre for Textile Research, which was originally opened as a Danish National Research Foundation Centre for Excellence and since 2017 has been fully integrated into the Saxo Institute at the University of Copenhagen. The CTR team wished to mark this jubilee in 2021 (after a year's delay due to the pandemic) by celebrating the vibrancy of current textile research. Together with the EuroWeb network (COST action 19131), the CTR team wanted to bring researchers together in a joyous week full of textile topics and discussions, opening future perspectives for textile research in Europe and beyond.

Due to the continuing travel restrictions, the event was hosted on an online platform while a small team was also present in the CTR facilities at Copenhagen. A web portal was built as a hub for the conference combining the lectures, short video presentations, posters and an online 'textile fair' with links to exhibitions and documentaries. As a result, the international programme explored diverse aspects of textile production and usage and transcended historical and geographical boundaries.

The organisational team included Eva Andersson Strand, head of CTR, with Elsa Yvanez, Pernille Højfeld Nielsen, and Klement Needham, together with the chairs and keynote speakers of each session (see below). Particularly warm thanks should go to Pernille and Klement who built and ran the online interface for the conference. A large part of the textile research community was able to converge during that week: altogether 64 speakers and session chairs, 47 video and poster presenters, and 364 members of the audience participated, exceeding all expectations and

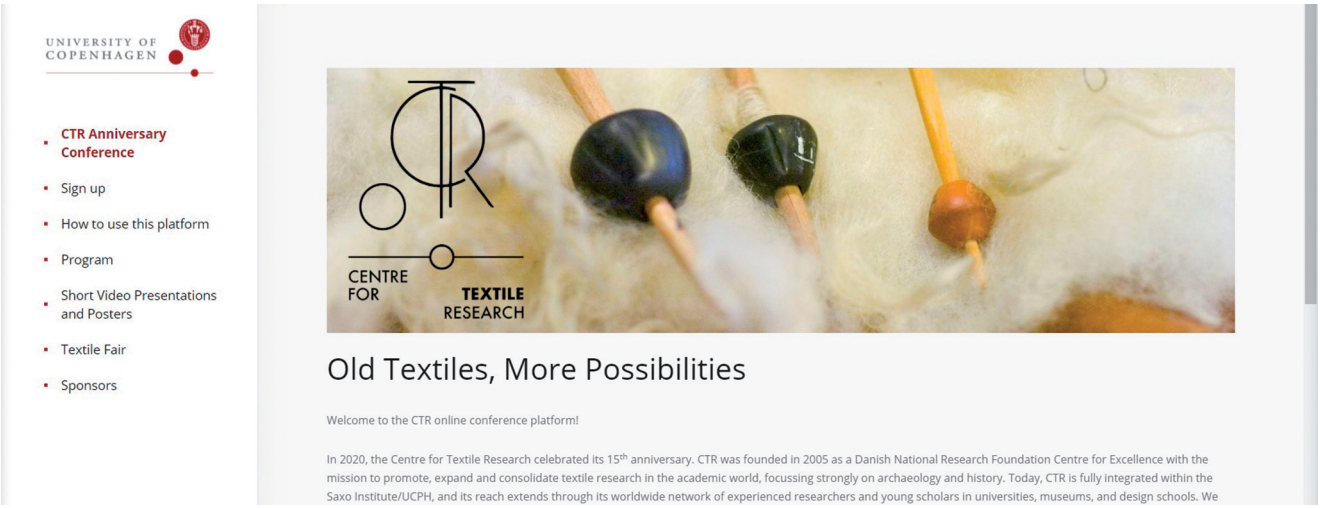


Fig. 7: The conference platform (Image: Pernille Højfeld Nielsen)

Fig. 8: Klement Needham and Vivi Lena Andersen during the 'Reuse, repair, redesign' session (Image: Elsa Yvanez)

proving – if proof be needed – that great developments are and have been undertaken by textile researchers in the last two decades in academia and beyond. The CTR team is very grateful to all audience members and presenters who contributed their time, work, and interests to a rich and full week.

The lectures and video/poster presentations were organised in nine thematic sessions, exploring the past, present, and future of the field. Most sessions comprised a keynote lecture followed by four to six papers, a number of videos/posters, and a discussion segment conducted by the session chair and all participants during the evenings.

The first session was dedicated to setting the scene for today's textile research. Lise Bender Jørgensen explored the discipline of textile archaeology in northern Europe, and Margarita Gleba proposed an overview of the same topic for the Mediterranean area. They both highlighted the great progress made in terms of publications, standardisation, and institutional recognition of the field, and noted the multiplication of current research themes. Some of these were then developed through the seven following sessions.

'Landscapes of textile production' was headed by Karina Grömer, who started by presenting the textile landscape of central Europe between 2000 BCE and 1000 CE exploring technical, economic, and social aspects. Two papers then focused on textiles tools and their use and discovery contexts: a textile workshop of the Roman period in Portugal (Alexandre Goncalves and Ângela Ferreira) and Pre-Columbian graves (Elizabeth Palacios). Textile techniques was the next topic. It was illustrated by the study of Bronze Age sealing practices in Greece (Agata Ulanowska), the reconstruction of Viking pile weaves (Julia Hopkin), and stocking knitting in 16th century England (Lesley O'Connell Edwards). Finally, Tiina Kuokkanen shed light on the gender dimension of textile work by presenting the production of young women in 18th century Finland.

'Deep in the matter: textiles, raw materials and novel scientific methods' was hosted by Laura Viñas Caron and started with a lecture by Luise Ørsted Brandt about current developments in biomolecular approaches to the study of archaeological textiles and leather. It was followed by four papers detailing the new opportunities offered to textile research by palaeoproteomics (Jonas Holm Jæger), Fourier-transform infrared spectroscopy (FTIR) (Christina Margariti et al.), microscopy and computer tomographic (CT) scanning (Krista Vajanto et al.), and thin-layer chromatography (TLC) and high-performance liquid chromotography (HPLC) (Maria Elisavet Samoili), which are especially useful for the better identification of raw materials such as animal and plant fibres and dyestuffs.

'Reuse, repair, redesign', led by Vivi Lena Andersen, took a novel approach by considering the whole lifecycle of textiles, including mending, patching, and repurposing. Ingun Grimstad Klepp opened the discussion by proposing to investigate past textile knowledge to revitalise our conception of textile production and consumption – as valuable and time-consuming commodities – and reduce their impact on the environment. The many phases of repair and recycling of textiles for funerary use in ancient Egypt was the theme of two papers (Anne Kwaspen and Cinzia Oliva) whereas Lena Larsson Lovén focused on the Roman period. More recent perspectives were proposed in the study of reused and readapted textiles in 19th century Latvia (Ieva Pigozne) and traditional quilting techniques in contemporary India (Ritu Jadwani).

'Furnishing burials' was headed by Ulla Lund Hansen and focused on textiles used inside graves, not only to wrap or clothe the body but also to provide the dead with soft furnishings. Marianne Vedeler insisted on the vital importance of textiles in understanding burial practices both on religious and practical levels, and on the role of context information in interpreting such finds within the funerary rites. Funerary beds and other furnishing textiles were explored through Hellenistic iconography (Demitra Andrianou) and Nubian textile remains (Elsa Yvanez). Funerary wrappings were also illustrated through the predynastic burial of an elephant in Egypt (Anne Drewsen) and through the internment of a 17th century BCE child in a wool shroud in Greece (Brendan Burke and Bela Dimova).

Marie-Louise Nosch led 'Weaving sources together' with keynote speaker Corinne Mühlemann, who studied medieval legal Islamic sources to expose the complex relationships between labour, artistic creation, and patronage in the design of textiles. The successful merging of historical, iconographical, and archaeological sources provided the basis for the following papers, resulting in new insights about the production and reconstruction of liturgical gloves (Angharad Thomas), Sogdian textiles and garments in central Asia (Zumrad Ilyasova and Alisher Begmatov, and the role of women in the textile industry of fourth century BCE Athens (Katherine Harrington). Legends and religious texts of the Medieval Ages were also combined with iconography to propose an inspiring reinterpretation of lace (Martha Verleyen) and personal accessories such as small purses (Sarah Randles).

'Sensorystudies in textile research', headed by Audrey Gouy, started with Susanna Harris's keynote lecture, which presented the full range of textiles' sensory qualities and interrogated their significance in past cultural environments. The tactile dimension of textiles and their ways of moving on the body when worn were then the focus of two papers: one about a first century CE skirt from Xinjiang (Ulrike Beck) and the other about medieval liturgical costumes (Julie Glodt). Sight (especially colour) and smell were then explored through people's reception of Graeco-Roman statuary art (Cecilie Brøns). Finally, the sensory aspects of textile production itself were reported by Alexandra Makin with her experiments in the reconstruction of medieval embroideries.

'Ancient dress. Towards a global history of fashion' was chaired by Elsa Yvanez. It began with Mary Harlow on a shopping tour through ancient Rome discovering the many retailers that supplied the city with diverse types of clothing products. The following papers illustrated different kinds of past fashion systems – never static but subject to many changes in material, forms, functions, and meanings – in the Neolithic Aegean and the Balkans (Kalliope Sarri), the Near East in the Bronze Age (Zahra Kouzehgari), the Roman provinces (Zofia Kaczmarek, Amy Place), and Sudan (Magdalena M. Wozniak). Each illustrated the power of dress in proclaiming aspects of personal or group identity. A contemporary example crossing Palestinian costume and diaspora in Scandinavia (Cailin Kwoh) provided poignant resonances to this seemingly universal issue.

The last session was devoted to 'Looking forward: EuroWeb and the future of textile research'. Hosted by the project's leader, Agata Ulanowska, the session

Fig. 9: Online and in-house participants (Image: Pernille Højfeld Nielsen)

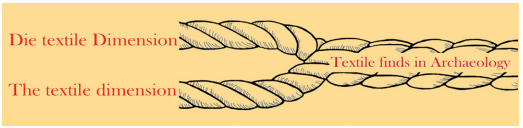
featured all the EuroWeb heads of the COST action's working groups: Christina Margariti, Magdalena M. Wozniak, and Louise Quillien – as well as several key project people in charge of dissemination, training actions, and activities (Marie-Louise Nosch, Karina Grömer, Francesco Meo, Cécile Michel, Francisco B. Gomez, Rina Rammo, Kerstin Droß-Krüpe, and Angela Huang). Together, they presented the objectives of the action, the diverse projects underway, and reflected on the impact of Covid-19 on their activities. Despite the many hurdles, the network has grown and continues to grow as a model of integration joining textile scholars from different countries (31 EU countries plus Israel) and backgrounds. United under a (textile!) banner are archaeologists, historians, conservators, museum curators, craftspeople, and artists.

This session and the whole conference were concluded by a panel discussion between Ulla Mannering, Marianne Vedeler, Susanna Harris, Luise Ørsted Brand, Agata Ulanowska, and Elsa Yvanez. Together with the audience, the panel saluted the many new directions taken by textile research: the growth of sensory studies and experimental reconstructions make it possible to reach past textile consumers at the very intimate level of people's skin, while the fast-increasing body of data on textiles and tools permits the tracing of macro-trends in the production of textiles across vast regions of Europe and the Mediterranean. More and more territories can also be added to our "textile map", including countries in Asia, Africa, and South America, and expanding its chronological coverage two-ways, to far-removed prehistoric times and to closer modern and contemporary periods. Throughout this exponential progress, one of the most

notable trends is the development of interdisciplinary projects combining a growing number of biomolecular analyses and digital techniques with textile archaeology.
Nowadays, textile research seems far better integrated in global historical and archaeological debates through specialised conference sessions and teaching courses arranged within generalist programmes and curriculum. However, the lack of specialised permanent positions throughout academia continues to undermine the long-term career sustainability for many textile researchers. Continuous efforts are still needed to merge our research objectives and scientific outputs within the greater contexts of archaeology and history, through collaborative (international) projects, publications, and teaching.
The CTR conference demonstrated that the field of textile research is now particularly active and diverse. It rests on a solid community of experienced scholars continuously enriched by new students and early career researchers, who together can propel the field through the challenges ahead to a bright future.

By Elsa Yvanez

The textile dimension: textile finds in archaeology



26 to 27 June 2021, Department of Christian Archaeology, University of Bonn, Germany, and online

The conference was hosted by the University of Bonn, department of Christian Archaeology and organised by Petra Linscheid and Sabine Schrenk. The focus was on the value and benefit of textile research for archaeology by highlighting the "textile dimension" both in past cultures and in archaeology, with the aim of encouraging a dialogue between archaeology and textile research. Although much progress has been achieved in past decades, much unused potential remains. There is a need for – as Johanna Banck Burgess pointed out during the conference – more specialists to be engaged in this field.
The theme of the conference was closely related to the textile archaeological research focus of the department of Christian Archaeology at Bonn University. The occasion for the event was the processing of the "Textile Archive Hans-Jürgen Hundt", which is in the possession of the Römisch-Germanisches Zentralmuseum Mainz (RGZM), Germany. It is due to the pioneering work of Hans-Jürgen Hundt (1909 to 1990) that textiles are increasingly recognised in archaeology in Germany. A cooperative project between the RGZM and the Department of Christian Archaeology at the University of Bonn is currently making this large body of textile archaeological data available in a database. In accordance with Hundt's research, a broad temporal and geographical perspective was chosen for the conference: it covered Prehistory to the Early Middle Ages as well as European and Mediterranean regions.
At the conference, a total of 16 speakers from eight countries presented case studies on fruitful collaboration between archaeology and textile research. Johanna Banck-Burgess (Landesamt für Denkmalpflege Baden-Württemberg, Germany) introduced the Stone and Bronze Age textiles preserved in lakeside settlements in southern Germany (project THEFBO), pointing to the frequent use of organic containers which were preferred to ceramic. Susanna Harris (University of Glasgow) reported on the textiles from the pile dwellings of Must Farm in the UK, providing a unique insight into Late Bronze Age textile production for daily life. Marie-Louise Nosch (Centre for Textile Research, University of Copenhagen, Denmark) reported on a collaborative project with Christina Margariti (Greek Ministry of Culture) and an international team to evaluate the archaeological significance on a large complex of textiles from the Late Bronze/Early Iron Age burial site of Stamna, Aetolia, western Greece. Iron Age textiles were also Margarita Gleba's topic (University of Munich, Germany) – in particular, finds from the western Balkans and central Adriatic which mark the

Fig. 10: Hybrid discussions between participants present in the ceremonial hall and those connected online (Image: Sabine Schrenk)

crossroads between two different textile traditions (project PROCON).

Three papers concerned textiles from the northern Roman provinces. Sylvia Mitschke (Reiss-Engelhorn-Museen, Mannheim, Germany) gave a lecture about her research on the large assemblages of Roman textile finds from Mainz. Her analytical investigations into the quality of the wool fibres provide new insight into the Roman textile economy. Frances Pritchard (Manchester, UK) reported on a rare case of textile finds from Roman London, indicating that Romanisation in Londinium happened quickly after the invasion. The impact of textile research in architectural and small finds studies was demonstrated by Judit Pásztókai-Szeöke (Budapest, Hungary), who introduced the archaeological remains of a workshop for cloth refurbishment in Roman Savaria including finds of textile tools and commercial lead tags.

Elsa Yvanez (Centre for Textile Research, University of Copenhagen, Denmark) took delegates to the Nubian site of Karanog, where Meroitic textile finds (100 CE to 300 CE) reveal dress practices and funeral rites.

The next section included presentations on Late Antique Egypt. Cäcilia Fluck (Museum für Byzantinische Kunst, Berlin, Germany) spoke about children's and women's clothing in the museum's collection and evaluated them in the light of parallel finds from recent excavations in Egypt. Béatrice Huber (University of Tübingen, Germany) introduced her excavations in Sharuna, Middle Egypt, where she evaluated textiles in their archaeological find context. Sabrina Tatz (University of Bonn, Germany) reported on her work on the textile finds at the monastic site of Deir el Bachit, providing evidence for monastic textile production, monastic dress and burial practices.

Orit Shamir and Alisa Baginski (Israel Antiquities Authority, Jerusalem, Israel) reported on Islamic and Early Medieval textile finds in Israel and the value and benefit of this material for archaeology in the country.

The last papers concerned archaeological textile finds in Germany: Christina Peek (Niedersächsisches Institut für historische Küstenforschung, Wilhelmshaven, Germany) introduced textiles and organic finds from a migration period cemetery in Fallward, which reveal traditions and contacts of the northern Barbaricum to the Roman world, Scandinavia and the British Isles. Ina Schneebauer-Meißner (University of Munich, Germany) reported on her investigations into early medieval textiles from graves in the cemetery of Petting in Bavaria. A detailed analysis of the technical data of each fragment and an evaluation of its position and stratigraphy in the grave revealed the function and social meaning of many of the textiles. The last paper by Tracy Niepold (University of Bamberg, Germany) introduced extraordinary textiles, both in terms of their preservation and their quality, from an early medieval burial in Trossingen, southwestern Germany.

A splendid evening lecture was presented by Karina Grömer (Naturhistorisches Museum, Wien, Austria) entitled "Archaeological Textile Research – Understanding the Past for our Society of the Future". The thrust of the paper was twofold: it demonstrated the various methods and aspects of archaeological textile research; and it showed the benefit of archaeological textile knowledge for contemporary issues of resource conservation and sustainability.

Originally planned for 2020, the conference had to be postponed to 2021 because of the pandemic. The meeting was a hybrid one (a mixed face-to-face and online event). About 50 people from all over the world participated online. For some of them, the different time zones shifted the meeting into the night hours. Following the presentations, lively discussions took place between the participants present at the conference in person and those connected online. The atmosphere and the beautiful ambience of the ceremonial hall and the interaction of the attendees were definitely communicated to the people online. Positive feedback showed that the hybrid format of the conference was successful and positively different from a pure online conference.

The event was made possible by the funding of the Deutsche Forschungsgemeinschaft and the Universitätsgesellschaft Bonn.

By Petra Linscheid and Sabine Schrenk

North European Symposium for Archaeological Textiles

23 to 26 August 2021, University of Oulu, Finland and online

The fourteenth Northern European Symposium for Archaeological Textiles (NESAT) meeting was hosted by the University of Oulu, Finland, 23 to 26 August 2021. The organising committee was headed by Sanna Lipkin (University of Oulu) and Saara Tuovinen was the conference secretary (University of Oulu). Other members of the committee were Krista Vajanto (Aalto University), Jenni Suomela (University of Helsinki) and Erika Ruhl (University at Buffalo). The conference was initially scheduled for May 2020 but was postponed due to the pandemic. Overall, about 150 participants attended virtually across three continents and at least 24 countries. To accommodate the myriad of different time zones, the symposium was hosted later in the day than is usual (which those attending from across the globe greatly appreciated!).

The conference kicked off on Monday with a unique, crafts-based research event, which focused on the practical aspects and application of textile work and handicraft skills. This event was originally scheduled as a meet-and-greet evening at which delegates could visit various exhibits and demonstrations. With the shift to a virtual format, this session moved online as well. Presenters gave their demonstrations live over Zoom, and the session showcased presenters' handicraft skills and technical research innovations. Overall, the presenters found creative, innovative, and sometimes inventive ways to give up-close-and-personal view of the "hows" of textile work, despite the interesting context of videoconferencing.

The first academic sessions of NESAT XIV began on Tuesday with Sanna Lipkin's welcome and lecture on archaeological textiles from northern Finland. The academic sessions covered a broad sweep of topics and ranged from technical and analysis-based presentations to contextual and collections-based material. In contrast with traditional conference formats, attendees were provided with a link to prerecorded presentations prior to the conference. The symposium sessions were largely discussion-based and provided space for researchers and attendees to engage in dialogue. The session chairs guided discussion, while attendees were asked to bring their questions to the table by either using the "raise your hand" Zoom feature or by typing their questions into the chat. In addition to short videos, some posters were shared using social media outlets, and included in the discussion sessions. Even though this format required participants to engage prior to the conference it also lightened the online conference participation. Online conferences can be strenuous, with long days sitting by the computer listening to presentations with no or little engagement. This format decreased the level of day-of-presentation stress and allowed participants and presenters to concentrate on the discussions. This format went beyond the question-and-answer sessions built into traditional conference schedules to create deeper and often more personal conversations, with several conversations often occurring simultaneously. Because on-screen video conversations could continue in the chat beyond the time scheduled, this often resulted in deeper, more organic discussions across both formats.

Tuesday's sessions were largely organised by era and included sessions on early textile production, Bronze Age fibres and fabric production, and Vendel and Viking Age textiles. The day ended with the live keynote lecture by Ulla Moilanen: "All we need is ... a detailed look into grave contexts". The keynote explored the impacts of gender-based assumptions in burial clothing and the complex issues which arise from these assumptions.

The programme continued on Wednesday with a series of context and materials-focused sessions. These addressed the colourful past and weaving, textiles from shipwrecks and cloth reproductions, the reproduction of decorative textiles, and ended with a session on caps, laces and looped textiles.

The symposium wrapped up on Thursday, with sessions addressing collections and collection management and context-specific materials. The first session discussed projects handling large collections followed by sessions on the clothing of priests and monks, clothing and textile finds from working contexts, burial textiles, in addition to a session on fibres and taphonomy. The day ended with a farewell from conference organiser Sanna Lipkin. Overall, the symposium was successful, despite facing a number of challenges due to ongoing travel restrictions and health concerns. Because the conference was hosted online, there seemed to be a larger number

of both early career researchers and non-academics in attendance; one such attendee stated that they found the online environment less intimidating, more accessible, and more cost-effective. Throughout the conference, dialogue occurred not only on the main "stage" of the conference call, but also within the conference chat. Due to these complementary features, multiple conversations occurred around similar materials. Additionally, the use of prerecorded videos with symposium sessions reserved for discussion made the conference both more accessible and inclusive. This included decreasing the financial burden which often limits attendance, in addition to removing linguistic barriers to participation. This format allowed participants to process information on their own time and return to it later if needed, further enhancing attendees' engagement with the material and one another in the live discussion sessions.

After the symposium, some of the video presentations will remain available at the conference webpage (www.nesatxiv.org) where there are also links to the social media posters on Facebook and Instagram. The conference proceedings will be published online in Monographs of the Archaeological Society of Finland.

By Erika Ruhl & Sanna Lipkin

Fig 11: Some of the NESAT XIV participants at the end of the conference

Recent publications

***Crafting Minoanisation: Textiles, Crafts Production and Social Dynamics in the Bronze Age Southern Aegean* by Joanne Elizabeth Cutler (2021). Ancient Textiles Series (Volume 33). Oxbow Books**

The mid second millennium BC material record of the southern Aegean shows evidence of strong Cretan influence. This phenomenon has traditionally been seen in terms of 'Minoanisation', but the nature and degree of Cretan influence, and the process/processes by which it was spread and adopted, have been widely debated. This new study addresses the question of 'Minoanisation' through a study of the adoption of Cretan technologies in the wider southern Aegean: principally, weaving technology.

By the early Late Bronze Age, Cretan-style discoid loom weights had appeared at a number of settlements across the southern Aegean. In most cases, this represents not only the adoption of a particular type of loom weight, but also the introduction of a new weaving technology: the use of the warp-weighted loom. The evidence for, and the implications of, the adoption of this new technology is examined. Drawing upon recent advances in textile experimental archaeology, the types of textiles that are likely to have been produced at a range of sites both on Crete itself and in the wider southern Aegean are discussed, and the likely nature and scale of textile production at the various settlements is assessed.

A consideration of the evidence for the timing and extent of the adoption of Cretan weaving technology in the light of additional evidence for the adoption of other Cretan technologies is used to gain insight into the potential social and economic strategies engaged in by various groups across the southern Aegean, as well as the motivations that may have driven the adoption and adaptation of Cretan cultural traits and accompanying behaviours. By examining how technological skills and techniques are learned and considering possible mechanisms for the transmission of such technical knowledge and know-how, new perspectives can be proposed concerning the processes through which Cretan techniques were taken up and imitated abroad.

ISBN: 978-1785709661

Price: £36

https://www.oxbowbooks.com/oxbow/9781785709661.html

***Crafting Textiles: Tablet Weaving, Sprang, Lace and Other Techniques from the Bronze Age to the Early 17th Century* edited by Frances Pritchard (2021). Ancient Textiles Series (Volume 39). Oxbow Books**

New research into the techniques of tablet weaving, sprang, braiding, knotting and lace is presented in this lavishly illustrated volume written by leading specialists from Austria, Canada, Denmark, France, Germany, Sweden, Switzerland, the UK and USA in eleven contributions. Drawing inspiration from the pioneering work of Peter Collingwood, this publication explores aspects of these craft skills in the prehistoric, Roman and medieval world through scientific, object-based analysis and 'research through making'.

Chapters include the growth of patterned tablet weaving for trimming garments in prehistoric Central Europe; recently identified styles of headdress worn in the Roman Rhineland and pre-Islamic Egypt; Viking-age Dublin as a production centre for tablet-woven bands; a new interpretation of the weaving technique used to make luxurious gold bands in the twelfth to late thirteenth centuries; and the development out of plaiting of bobbin lace borders in gold and silver threads from the fifteenth to early seventeenth centuries. Practical experiments test methods of hand spinning and the production of figure-hugging hose in ancient Greece and Renaissance Italy. A typology of braid and knotting structures in late medieval Europe is also set out for the first time. Diagrams, illustrations and photographs enrich each chapter with a wealth of visual source material.

The work is the outcome of recent discoveries of archaeological textile finds from excavations as well as fresh examination of material recovered in the past or preserved in treasuries. Early textiles form an increasingly popular subject of interest and this publication, which is a landmark in the study of various specialised textile techniques, aims to provide the reader with a better understanding of these

virtuoso craft skills in antiquity.
ISBN: 978-1789257595
Price: £38
https://www.oxbowbooks.com/oxbow/test/textiles-weaving-clothing-stitchery/crafting-textiles.html

***Egyptian Textiles and their Production: 'Word' and 'Object' (Hellenistic, Roman and Byzantine Periods)* by Maria Mossakowska-Gaubert (2020). Lincoln: ZeaBooks**

This volume presents the results of a workshop that took place on 24 November 2017 at the Centre for Textile Research (CTR), University of Copenhagen. The event was organised within the framework of the MONTEX project—a Marie Skłodowska-Curie individual fellowship conducted by Maria Mossakowska-Gaubert in collaboration with the Contextes et Mobiliers programme of the French Institute for Oriental Archaeology in Cairo (IFAO), and with support from the Institut français du Danemark and the Alexander von Humboldt Foundation. Twelve essays are arranged in 4 sections: I. Weaving looms: texts, images, remains; II. Technology of weaving: study cases; III. Dyeing: terminology and technology; IV. Textile production in written sources: organisation and economy. Contributors include Maria Mossakowska-Gaubert, Johanna Sigl, Fleur Letellier-Willemin, Lise Bender Jørgensen, Anne Kwaspen, Barbara Köstner, Peder Flemestad, Ines Bogensperger & Helga Rösel-Mautendorfer, Isabelle Marthot-Santaniello, Aikaterini Koroli, Kerstin Dross-Krüpe, Jennifer Cromwell, and Dominique Cardon. With 66 full-colour illustrations.
ISBN: 978-1609621537
Free download: https://digitalcommons.unl.edu/egyptextiles/

***Haut-, Leder- und Fellfunde der Älteren Eisenzeit aus Hallstatt: eine archäologische und gerbereitechnische Aufnahme von Funden aus dem Kernverwässerungswerk* by Grabriela Ruß-Popa (2021). ArchOn Hallstatt (Volume 3). Vienna: Verlag des Naturhistorischen Museums Wien**

This book presents Hallstatt period leather, fur and hide objects from the salt mine Hallstatt in Austria (site Kernverwässerungswerk), recovered during the archaeological excavations in 1990–1996. The salt mining from the Early Iron Age at the site is documented from the 9th to the 4th century BC. During this time, an accumulation of prehistoric mining waste measuring several meters thick was formed. In this "Heidengebirge" the organic artefacts have been preserved due to the preservative properties of the salt. There are a number of exceptional artefacts, such as fur cap fragments, including a complete (composite) children's fur cap, a shoe fragment, a sack made of goat skin, and an artefact that maybe can be identified as an ornament (a tassel?). Additionally, insoles for shoes can be recognised – shaped leather sheets that have been used to repair the worn soles.
The spectrum of objects identified can hardly be compared to those of Iron Age settlements or cemeteries in Central Europe due to their absence because of the lack of preservation. For the purposes of comparison, the late Hallstatt / Latène period salt mine from Dürrnberg near Hallein in Austria is the most suitable. Due to the numerous traces on the finds, there are new insights into skin, leather and fur processing, but also the use of tools, such as knives and punches and several awls, which would have been used to pierce the holes for sewing the leather. On the hide and leather objects there are a number of seams, including a series of barely visible, finely executed seams. As sewing materials, tree bast, leather straps (fur/skin), wool yarn, linen and sinew were used.
Alongside the identification of sewing materials, hints at tanning-like processes have been studied. This is recognizable from the fibre insulation found on the material of some artefacts from Hallstatt. Tanning processes with fat (oil) and/or salt are to be considered, but also smoke tanning. This is of importance, as previously raw hide has been assumed to be used for making artefacts, and not treated animal skin (leather), as the analysis demonstrates.
The numerous complex work processes to transform raw hide into workable material and then into certain artefacts point to the fact that the skin, leather or fur represented a valuable raw material. Also, due to the marks of repair, it can be assumed that the material was handled with care. This adds to the theory that there was a high degree of division of labour and efficiency within the mining community that worked in the mining and cultural landscape of Hallstatt
ISSN: 2707-3300
Free download: https://www.nhm-wien.ac.at/verlag/wissenschaftliche_serien/archon/bergbau

***Ikat from Timor and its outer Islands: Insular and Interwoven* by Peter Ten Hoopen (2021). Sidestone Press**

This is the first study to focus on ikat of the Timor region from a technical perspective, including microscopy and design analysis of asymmetry, an

understudied subject. Paradoxically this technical perspective highlights the human factor. Focused on the last century of the colonial period, we see the weaver's decisions in close-up, as if we are sitting next to her. This yields rich insights, not just in materiality, but also in the weavers' creativity.
Asymmetry is widely distributed in the region, yet has largely been ignored. This is curious, because asymmetry is highly interesting: it goes against ikat's technical diktat (which prescribes the production of two identical panels in parallel), hence requires extra work. Seven distinct ways to achieve asymmetry are differentiated, including visual tricks and illusions, flagrant displays of virtuosity and intellectual superiority. On Sumba, women of the nobility made thrilling and amusing efforts to hide their virtuosity, dyeing into their men's cloths tiny visual devices, secret keys, which revealed that their work was not just good, but luar biasa, out of the ordinary. Ironically, because these late 19th- and early 20th-century dyers were such great masters at hiding their virtuosity, it remained overlooked by generations of researchers.
Taking up Marie Jeanne Adams's 1969 call, so far unheeded, to deepen the study of Indonesian ikat textiles by means of microscopy, the author shot thousands of micro-photographs, allowing a study of yarn development over time, as well as the differentiation of 21 distinct weave types, a number far exceeding expectation, and their distribution across 41 ikat weaving regions in the Indonesian archipelago.
In the final chapter the author analyses what may have spurred the weavers of the region to create their most intricate, most time consuming, feats of artistry, and develops a view of these women as far more inventive and intelligent than they have been credited with before - and more assertive, using ikat's prestige to spin their men into a web of taboos and prescriptions.
ISBN: 978-9464280128
Price: 55€
https://www.sidestone.com/books/ikat-from-timor-and-its-outer-islands

***Kaisergewänder im Wandel: Kunsttechnologische und materialwissenschaftliche Aspekte* by Sibylle Ruß and Ursula Drewello (2021). Verlagsgruppe Schnell und Steiner**

German-language book

This extensive research on the imperial cloaks of the Bamberger dynasty covers aspects of textile technology and natural sciences. In this book, the authors present their analyses on the original substances, the many repairs and modifications of the 14th to 18th century as well as the severe changes to the textiles during the 1950s. One of the main focuses lies on the used materials, such as the gold threads of the 11th century, the production, which was able to be specified using natural scientific methods, and the advanced processing. The comparative analysis of six garments connected to Emperor Heinrich II. Shows the enormous technological quality of textiles from the High Medieval period.
ISBN: 978-3795435851
Price: 45€
https://www.schnell-und-steiner.de/artikel_10328.ahtml

***Latin Lexicon of Textiles: Clothes, adornments, materials and techniques of Ancient Rome* by Elena Miramontes Seijas (2021). British Archaeological Reports Publishing**

As a Latin lexicon, this volume pursues two main objectives: to create a broad corpus of Latin terms related to textiles, accessories and personal care and to collect all data in a comprehensible and practical format. Texts and visual sources were consulted, dating from the 3rd century BC up to the 4th AD, describing materials and trends from all regions within the Roman Empire and beyond. The lexicon is arranged in alphabetical order and each offers the etymology and Greek translation of the word, some quotations extracted from primary sources and more bibliography, to allow a deeper study. At the end, all terms are classified in different topics and two glossaries try to ease the search of a specific term either from English or Ancient Greek. This research broadens our understanding of daily life in antiquity through the study of textile manufacture and use during the Roman period.
ISBN: 9781407358444
Price: £58.00
https://www.barpublishing.com/latin-lexicon-of-textiles.html

***Making cities. Economies of production and urbanization in Mediterranean Europe, 1000-500 BC* by Magarita Gleba, Beatriz Marín-Aguilera and Bela Dimova (2021). University of Cambridge, McDonald Institute Conversations**

Large and complex settlements appeared across the north Mediterranean during the period 1000–500 BC, from the Aegean basin to Iberia, as well as north of the Alps. The region also became considerably more interconnected. Urban life and networks

fostered new consumption practices, requiring different economic and social structures to sustain them. This book considers the emergence of cities in Mediterranean Europe, with a focus on the economy. What was distinctive about urban lifeways across the Mediterranean? How did different economic activities interact, and how did they transform power hierarchies? How was urbanism sustained by economic structures, social relations and mobility? The authors bring to the debate recently excavated sites and regions that may be unfamiliar to wider (especially Anglophone) scholarship, alongside fresh reappraisals of well-known cities. The variety of urban life, economy and local dynamics prompts us to reconsider ancient urbanism through a comparative perspective.
ISBN: 978-1913344061
Free download: https://www.repository.cam.ac.uk/handle/1810/328684

Medieval Clothing and Textiles 16 **by Monica L. Wright, Robin Netherton and Gale R. Owen-Crocker (2020). Boydell and Brewer**

Following the Journal's tradition of drawing on a range of disciplines, the essays here also extend chronologically from the tenth through the sixteenth century and cover a wide geography: from Scandinavia to Spain, with stops in England and the Low Countries. They include an examination of the lexical items for banners in Beowulf, evidence of the use of curved template for the composition in the Bayeux Tapestry, a discussion of medieval cultivation of hemp for use in textiles in Sweden, a reading of the character of Lady Mede (Piers Plowman) in the context of costume history, the historical context of the Spanish verdugados (in English, the farthingale) and its use as political propaganda, an analysis of the sartorial imagery on a tabletop painting (attributed to Bosch) depicting the Seven Deadly Sins, and the reconstruction of one of the sixteenth-century London Livery companies' crowns.
ISBN: 978-1783275151
Price: £40
https://boydellandbrewer.com/9781783275151/medieval-clothing-and-textiles-16/

Redefining Ancient Textile Handcraft Structures, Tools and Production Processes **by Macarena Bustamante Álvarez, Elena H. Sánchez López and Javier Jiménez Ávila (2020). Purpurae Vestes (Volume 7). Proceedings of the VIIth International Symposium on Textiles and Dyes in the Ancient Mediterranean World (Granada, Spain 2–4 October 2019). University of Granada**

This volume "sews together" fifty presentations that follow a geographical scheme, including a final section dedicated to "transversal" themes, that guided the organisation and development of the event that took place from the 2nd to the 4th of October 2019. The first large section is dedicated to Spain and expands from the Late Bronze Age to Late Roman times, presenting a wide range of themes that go from typological studies of the elements related to textile production, textile evidence of different nature, the application of experimental studies, multifaceted visions of artisanal installations or even thoughts form the point of view of social analysis regarding this craft. The second block, dedicated to Central Europe, is mainly centred on the fruitful analysis of the already mentioned Prehistoric artifacts or textile evidences. The third and fourth sections are dedicated to the Italian Peninsula, separated into two chronological sections due to the high number of participants. The first one, dedicated to pre-Roman Italy, includes nine papers that study the tools used in this craft, not only from domestic contexts, but also funerary ones. Furthermore, other works are dedicated to the direct study of textile remains, being of great interest the role of women as an economic motor in the region of Veneto. The second part indicates once again the relevance of these studies in the central and northern parts of Italy, to which we must add another paper of the always paradigmatic Pompeii. The contribution on hemp process in Aquileia and the study of the written sources as part of the analysis of textile production must be highlighted. The fifth block is centred around both continental and insular Greece from both prehistoric times and Archaic and Classical Greece including analysis from the perspective of gender, of the role of women in textile production. The sixth block is dedicated to Egypt, and is mainly centred on the analysis of textile evidence given the favourable conditions for the conservation of this material in the region, which makes it a paradigmatic place for the study and analysis of clothes belonging both to the living and to the dead. The seventh block is exclusively dedicated to the Prehistory of the Near East, both during the Chalcolithic and the Iron Age. To end, a section is dedicated to transversal studies that are not strictly confined to territorial demarcations such as the study regarding the role of water in traditional textile production processes; or that that presents a modern take on the use of inks; or the experimental approximation of how royal purple was obtained in

Northern Africa.
ISBN: 978-84338674
Price: 61.43€
https://www.amazon.com/Redefining-handcraft-structures-production-processes/dp/8433867768?currency=EUR&language=de_DE

***Ten Kings' Clothes: Royal Danish Costume at Rosenborg Castle* by Katia Johansen (2021). Aarhus University Press**

Ten Kings' Clothes is the history of the Danish kings' wardrobes from Christian IV to Frederik VII illustrated by Rosenborg Castle's costume collection, world famous for its age, extent and the garments' elegance, magnificent fabrics and embroidery.

The royal costume is rarely exhibited, and this richly illustrated book thus offers an exclusive glimpse into the royal wardrobes. Historical garments tell not only their own story of the kings' coronations and weddings but also aspects of everyday life at court, including the contributions of tailors, embroiderers, valets, portrait artists, castle stewards and laundresses.

Ten Kings' Clothes is not only a history of Denmark, but also the history of one, special family. Her Majesty Queen Margrethe has written the foreword.

ISBN: 978-8771845150
Price: £60
https://www.oxbowbooks.com/oxbow/9788771845150.html

***Textile Activity and Cultural Identity in Sicily Between the Late Bronze Age and Archaic Period* by Gabriella Longhitano (2021). Ancient Textiles Series (Volume 37). Oxbow Books**

Clothing was an essential part of material culture in ancient societies both as a form of body protection and as house equipment. Besides a practical function, textiles played a crucial role in communicating various aspects of social and personal identity.

Based largely on the analysis of textile tools, this book is intended to be the first systematic attempt at reconstructing textile culture in ancient Sicily. Textile implements represent the most abundant category of evidence for textile activity in Sicily and in this book they are used as a means to explore the social dynamics within cultural interactions in the final Bronze–Iron Age and Archaic Sicily.

The book begins with an overview of the cultural complexity of communities in Sicily and the Aeolian islands, focusing on two crucial periods of Sicilian history, which are characterised by intense movements of peoples from the Italian peninsula and the establishment of Greek and Phoenician settlements. Through the investigation of textile tools, the book discusses several key aspects, including technological features of textile technology and production, knowledge transfer, networks of weavers, as well as the social significance of textile activity.

By employing an interdisciplinary perspective, this book is important not only for textile specialists but also for scholars and students dealing with culturally hybrid frameworks of ancient Sicily and provides a springboard for future studies on textile culture and cultural interactions in the ancient world.

ISBN: 978-1789255997
Price: £30.40
https://www.oxbowbooks.com/oxbow/textile-activity-and-cultural-identity-in-sicily-between-the-late-bronze-age-and-archaic-period.html

***Textiles in Ancient Mediterranean Iconography* (2021) by Susanna Harris, Cecilie Brøns and Marta Żuchowska. Ancient Textiles Series (Volume 38). Oxbow Books**

This volume, containing contributions from 16 authors, provides an ambitious synopsis of the complex, colourful world of textiles in ancient Mediterranean iconography. A wealth of information on ancient textiles is available from depictions such as sculpture, vase painting, figurines, reliefs and mosaics. Commonly represented in clothing, textiles are also present in furnishings and through the processes of textile production. The challenge for anyone analysing ancient iconography is determining how we interpret what we see. As preserved textiles rarely survive in comparable forms, we must consider the extent to which representations of textiles reflect reality, and critically evaluate the sources. Images are not simple replicas or photographs of reality. Instead, iconography draws on select elements from the surrounding world that were recognisable to the ancient audience, and reveal the perceptions, ideologies, and ideas of the society in which they were produced. Through examining the durable evidence, this anthology reveals the ephemeral world of textiles and their integral role in the daily life, cult and economy of the ancient Mediterranean.

ISBN: 978-1789257212
Price: £48
https://www.oxbowbooks.com/oxbow/test/textiles-weaving-clothing-stitchery/textiles-in-ancient-mediterranean-iconography.html

***The Valkyries' Loom. The Archaeology of Cloth Production and Female Power in the North Atlantic* by Michèle Hayeur Smith (2021). University Press of Florida.**

In *The Valkyries' Loom*, Michèle Hayeur Smith examines Viking textiles as evidence of the little-known work of women in the Norse colonies that expanded from Scandinavia across the North Atlantic in the ninth century AD. While previous researchers have overlooked textiles as insignificant artifacts, Hayeur Smith is the first to use them to understand gender and economy in Norse societies of the North Atlantic. This study is based on the author's systematic comparative analysis of the vast textile collections in Iceland, Greenland, Denmark, Scotland, and the Faroe Islands, materials that are largely unknown even to archaeologists and span 1,000 years. Through these garments and fragments, Hayeur Smith provides new insights into how the women of these island nations influenced international trade by producing cloth (*vaðmál*); how they shaped the development of national identities by creating clothing; and how they helped their communities survive climate change by reengineering clothes during the Little Ice Age. She supplements her analysis by revealing societal attitudes about weaving through the poem "*Darraðarljoð*" from Njál's Saga, in which the Valkyries—Óðin's female warrior spirits—produce the cloth of history and decide the fates of men and nations. Bringing Norse women and their labour to the forefront of research, Hayeur Smith establishes the foundation for a gendered archaeology of the North Atlantic that has never been attempted before. This monumental and innovative work contributes to global discussions about the hidden roles of women in past societies in preserving tradition and guiding change.

ISBN: 978-0813066622

Price: $90

https://upf.com/book.asp?id=9780813066622

***Weavings of Nomads in Iran: Warp-faced Bands and Related Textiles* by Fred Mushkat (2020). London: Hali Publications Ltd**

There is a rich tradition of hand-woven bands made by the nomadic pastoralists of Iran. They have a large and detailed design vocabulary, and were executed using weaving skills that were not exceeded by any other weaving tradition. No study of nomadic life and weavings in Iran is complete without them. Among Qashqa'i tribal weavers in particular, the warp-faced bands used to attach loads to pack animals were a key symbol of their nomadic life. These bands carry a large repository of motifs that may be a source of archaic design elements. Bands illustrate a connection between and among groups of nomadic pastoralists, as great distances may have separated their ancestors for hundreds of years. Although the overwhelming majority of weavers were illiterate, they possessed a different form of literacy in which they were capable of transferring an image into a woven structure. This is the first book devoted exclusively to these weavings.

ISBN: 9781898113805

Price: £85

https://shop.hali.com/product/View/productCode/MUSHKAT/

Habilitation

Agata Ulanowska, who works in textile and Aegean archaeology at the Faculty of Archaeology, University of Warsaw, has qualified as *Doctrix habilitata* and was awarded the academic degree of *Doktor habilitowana* by the Research Council of the Discipline of Archaeology at the University of Warsaw, Poland, on 26 May 2021. Her research is titled *New insights into organisation of textile production in Bronze Age Greece. From skills and ergonomics of production, through production modes, to administrative practices with seals and sealings* and aims at a deeper and multifarious understanding of textile production in the Aegean Bronze Age. She employed an interdisciplinary approach, which combines traditional contextual analysis of archaeological evidence, experimental archaeology, iconographic studies and textile archaeology methods, such as digital microscopy of textile imprints from the undersides of clay sealings. She has examined the following aspects of production: 1) ergonomics and functionality of work places; 2) craftsmanship, transfer of knowledge and skills, and gendered labour division; 3) textile manufacture in cross-craft interactions; 4) developments of textile technology and production modes; and 5) relationships between textile production and seals, and sealing practices.

PhDs

In August 2020, **Sylvia Mitschke** was awarded a PhD by the University Tübingen, for her dissertation *Material und Verarbeitung textiler Rohstoffe in der römischen Epoche am Beispiel der Funde aus Mainz* (Material and processing of textile raw materials in the Roman period, exemplified by the artefacts from Mainz). The dissertation is available to download at http://dx.doi.org/10.15496/publikation-53211

In May 2021, **Hanna Bäckström** was awarded a PhD by Uppsala University, Sweden, for her dissertation *Förmedling av mönsterförlagor för stickning och virkning. Medierna, marknaden och målgruppen i Sverige vid 1800-talets mitt* (The mediation of patterns for knitting and crochet. The Publications, the market and the target group in Sweden in the mid-19th century). The dissertation is published by Gidlunds.

Award

The European Cultural Heritage Award/Europa Nostra Award and the Grand Prix in the category Research was given to FIBRANET (FIBres in ANcient European Textiles), Denmark/Greece. FIBRANET was a Marie Skłodowska-Curie Action, hosted at the Centre for Textile Research, University of Copenhagen (CTR/UCPH) under the supervision of Marie-Louise Nosch, by Christina Margariti, Head of the Applied Research Department, Directorate of Conservation of Ancient and Modern Monuments, Hellenic Ministry of Culture (DCAMM). FIBRANET studied the fibres used in Europe in antiquity to make textiles. Fibre identification is the primary and most important aspect of textile studies as it reveals information on textile technology, as well as the establishment of trade routes and palaeoenvironmental information. A literature review of ancient texts and contemporary publications indicated the plant and animal fibres to be collected from around Europe. More than 20 different species of fibre were collected, processed and studied by optical and scanning electron microscopy. These included tree bark and sheep from northern Europe, deer from Scandinavia, sedges from the Iberian peninsula and wild silk and goat hair from southern Europe. Representative fibres such as linen, hemp, nettle, cotton, sheep wool and cultivated silk were subjected to artificial degradation experiments. The experiments were custom designed to simulate the conditions under which textiles are commonly preserved across Europe, such as incomplete burning,

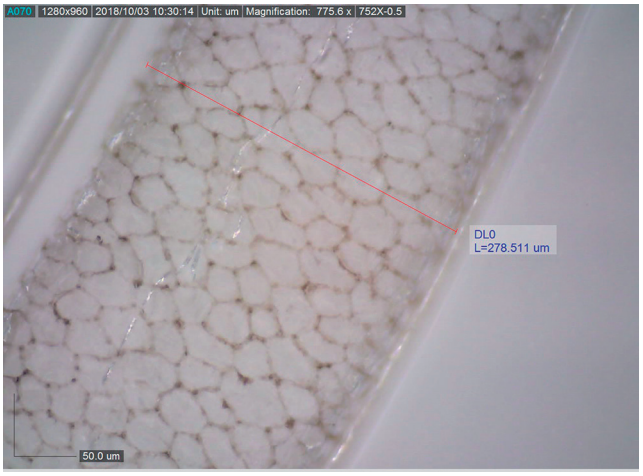


Fig. 2: Red deer fibre (*Cervus elaphus*, Denmark) under an optical microscope (Image: Christina Margariti)

Fig. 1: The Europa Nostra award, unveiled at CTR on 24 November 2021, with the CTR/UCPH's team and the prize recipients (the photograph shows from left to right: Christina Margariti, Eva Andersson Strand, Chiara Spinazzi-Lucchesi, and H. Forum Winther) (Image: CTR)

burial in high moisture content soil, and mineralisation by proximity to a metal (copper). Research results, longitudinal microscopy images and cross-sections of the fibres, as well as the relevant bibliographical references, were compiled in an online, freely accessible database (netlearning.gr/fibranet), where the end user can make their own correlations and identification of finds. The user can select the features which best describe their fibres, from one or more categories, and the database will provide the most probable identification fitting the description.

The collaboration of Denmark (CTR/UCPH) and Greece (DCAMM) has led to other common projects such as the Creative Europe programme, *The Fabric of My Life*, between Denmark, Germany and Greece, focusing on the clothing tradition of refugees and more recently to the European Cooperation in Science and Technology (COST) Action CA19131 entitled EuroWeb – *Europe through Textiles: Network for Integrated and Interdisciplinary Humanities*, which is aiming to rewrite the history of Europe through textiles.

FIBRANET research was funded by the European Union's research and innovation programme Horizon 2020, Marie Skłodowska-Curie Actions (agreement number 745865).

General Information

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. 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.

Please submit contributions by email to one of the editors:
Karina Grömer: karina.groemer@nhm-wien.ac.at
Mary Harlow: mharlow2020@outlook.com
Jane Malcolm-Davies: jane@jmdandco.com
Ulla Mannering: ulla.mannering@natmus.dk
Kayleigh Saunderson: kayleigh@saunderson.at
Elsa Yvanez: elsa.yvanez@gmail.com

Each annual issue of ATR is available on publication (usually 31 December each year or in early January the following year) online and as a digital download immediately and as a print-on-demand hard copy from the University of Copenhagen's Campus Print webshop.
Online: www.atnfriends.com
Print-on-demand:
http://www.webshophum-en.ku.dk/shop/search-1.html?keyword=archaeological+textile+Review

ATR is incorporated into the EBSCO indexing system.

Disclaimer

The views expressed by authors in articles printed in ATR are not necessarily those of the editors and are the responsibility solely of the individual contributors.