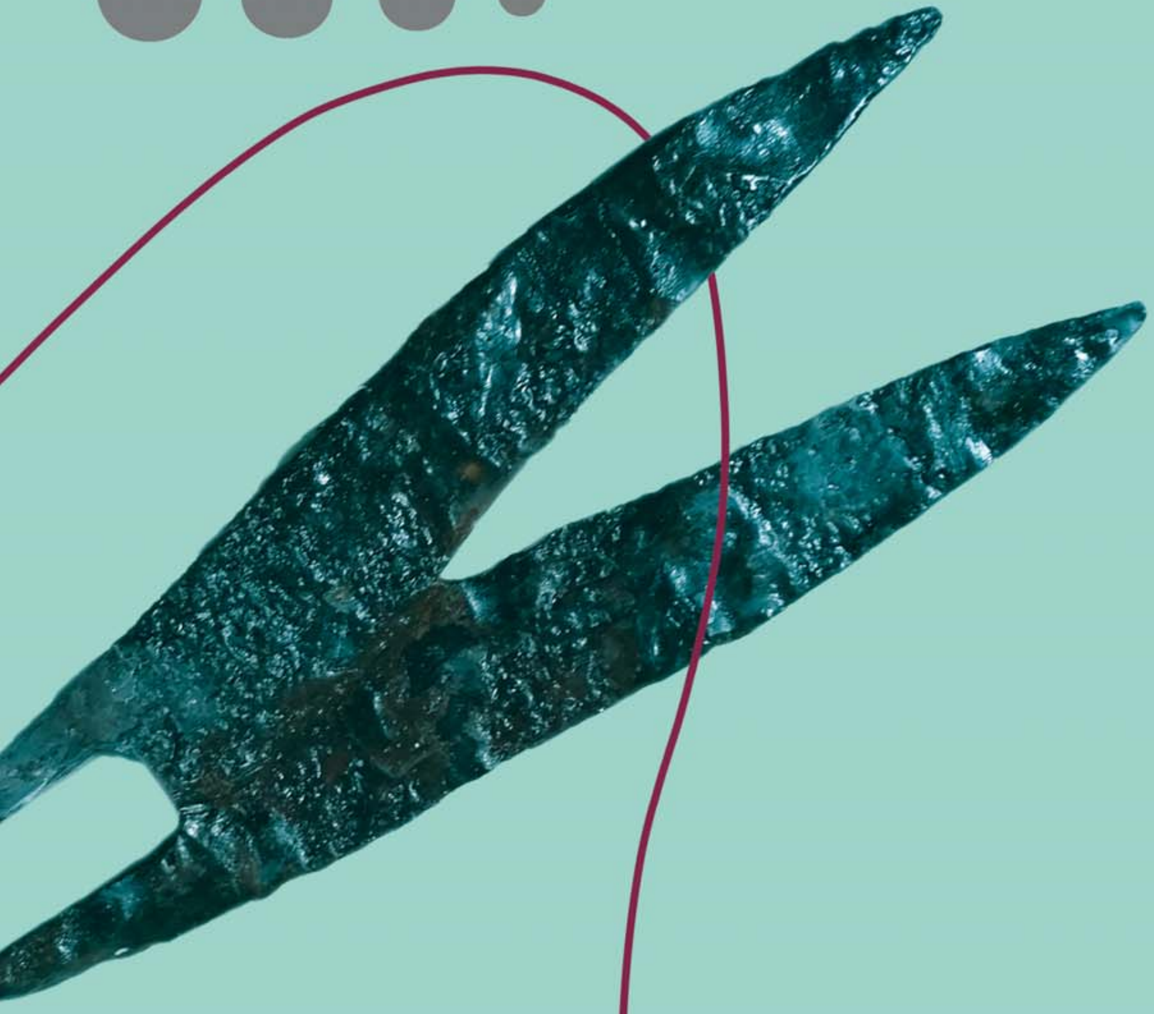
N° 62

ARCHAEOLOGICAL TEXTILES REVIEW



2020 issue

Archaeological Textiles Review

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Iron shears from Cascina Grande
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Editorial

The year 2020 is coming to an end and all over the world this year has brought challenges, sorrow and new habits to all of us. In academia, it has resulted in the cancellation of numerous events and conferences. But we have found new ways to meet – on Skype, Teams, Zoom and the like – which have brought unexpected benefits. However, many of us have also realised the high value of meeting colleagues in person and recognised the privilege of being mirrored in somebody else's eyes.

In 2021, when we hope the world will start to return to normal with the help of vaccines and a milder season, we look forward to continuing our scholarly tasks and disseminating the many excellent textile research projects which are flourishing in museums and universities all over Europe. Let us all wish for the year 2021 to bring many new and exciting research collaborations and publications to the field. We are very happy to disseminate these in the *Archaeological Textiles Review* through articles, project reports, conference reports and book announcements. You - our readers - are the content makers and receivers – we at ATR are just the facilitators.

Despite the pandemic, ATR received a steady flow of articles during 2020, and we already have many exciting papers in pipeline for the next issue (ATR63). This is a good situation for an editorial team but maybe not for an author who is keen to see their work in print. Nevertheless, we do our best to process as much as possible for the issue to come and to continue to be a swift publishing channel. Please have patience with us if things are delayed or postponed. We, in common with everybody else at the moment, struggle with lockdowns and difficult work conditions for international collaborative work. All our labours on ATR are voluntary so we are juggling many work and family commitments as well as editing submissions to the journal.

From this issue, we will publish ATR directly on our website (www.atnfriends.com). 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.

The layout of the journal has gradually changed in recent years thanks to Karina Grömer's hard work and creativity, and we encourage authors to take inspiration from this. We offer more opportunities for colour illustrations than most academic journals, which is of particular value in the scientific and aesthetic discussion of textiles.

We are currently revising the guidelines for authors and will upload the new version to the homepage soon. Please check there for guidance on style, format and layout for submissions to the journal. In the meantime, please turn to ATR60 for guidance on editorial consistency for now. We take pride in helping experienced researchers as well as newcomers to the field to disseminate their work, but we will, in future, concentrate our editing efforts on article and report content. It takes a lot of time to pass everything through the peer review system, but it is a necessary and rewarding process. It ensures that all articles published through our journal have the same high standards as other publications with which we like to compare ourselves.

We welcome all submissions and are delighted to read about textile research in all and every associated field – but please take care to adhere strictly to the editorial guidelines of the journal before submitting a manuscript. We currently have too much painstaking work for the editorial team in amending details which should have been corrected by the authors before submission.

We have invited Mary Harlow, who has recently retired from her position at University of Leicester, to join the editorial group. We thank Mary for her enthusiasm and look forward to collaborating with her in 2021 and into the future.

The Friends of ATN, which is the legal institution behind the newsletter/review, has not had an annual general meeting since 2017. The next meeting will take place during the 14th NESAT in Finland in August 2021, although it has not been decided yet if the conference will take place at the University of Oulu, and/or only online. During this meeting, we will present changes to the constitution so that they match the current publication scheme. More information on this will announced on the homepage at www.atnfriends.com.

This year's issue (as is usual) contains an interesting mix of articles from a range of periods and geographical areas, as well as projects and a few conference reviews, which we hope will be appreciated by our readers. Do enjoy reading ATR62 and please spread the word about it. ATR is now a true open-source journal, free to download. This is only possible with the work and help of many volunteers with enthusiastic hands and minds.

The deadline for research articles for each issue is 1 May but project and conference reports and other announcements are welcome by 1 October.

The Editors

Anne Kwaspen

An exceptional way to join two textiles:
A textile fragment from Hisn al-Bab, Egypt

Abstract
Since 2019, a research project has been ongoing on the many textile fragments that were excavated in Hisn al-Bab, near Aswan, Egypt (late sixth to early seventh century CE). Part of the study focuses on the determination of clothing fragments. Seams are an important feature for identifying garments. An investigation of these features revealed that one of Hisn al-Bab's textile fragments provides evidence for an unusual way of joining two woven textiles without using sewing techniques.

Keywords: textile, Egypt, Nubia, Hisn al-Bab, finishing border, seam

Introduction
The site of Hisn al-Bab, a military installation on a rocky slope and plateau on the eastern bank of the Nile, is situated in southern Egypt at the south end of the first Nile cataract, 10 km south of Aswan. Its importance to the military is obvious because of its strategic location on the frontier between Egypt and Nubia. The archaeological site consists of two fortresses (Gascoigne and Rose 2012; Styhler-Aydın and Döring-Williams 2017). The earlier fort is probably of late Roman date, and the use of it came to a violent 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. Over this time, Hisn al-Bab changed from an Egyptian frontier post to one recognised as being part of the Nubian state.

Excavations carried out by the Cairo branch of the Austrian Archaeological Institute since 2012 under the leadership of Dr Pamela Rose have focused on the Late Antique occupation of the earlier Roman fort (late sixth to early seventh century CE), at which time there was a significant Nubian presence at Hisn al-Bab. An abundance of textile fragments from six different areas within the fortress have been recovered. From the 2019 excavation season, Amandine Mérat began studyiing

Fig. 1: Textile 1192-004-0045AK/AM346, Hisn al-Bab, Storage magazine of the Ministry of Tourism and Antiquities, Aswan (Image: Anne Kwaspen)

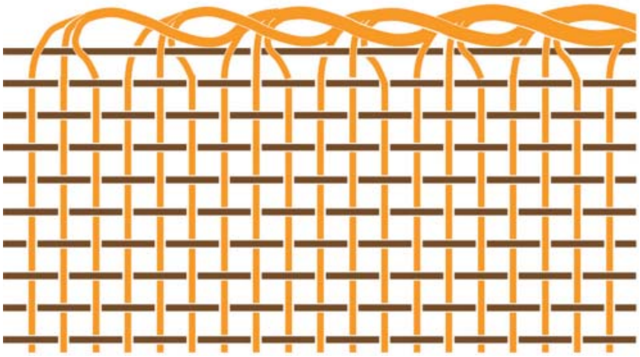

Fig. 2: Diagram of common finishing border of woven wool cloth (Image: Anne Kwaspen)

all the textile finds with the aim of studying the use and reuse of textiles at Hisn al-Bab, its industry, and possible trade and exchanges with Egypt and Nubia. The author also joined the team for one season in 2019 in preparation for a Marie Skłodowska Curie research project to study the impact of cultural cross-fertilisation between the diverse populations of Egypt in the Early Medieval period (seventh to tenth centuries CE) through a comparative study of the clothing worn in that period.

A search through the collection of textile fragments from Hisn al-Bab was conducted in order to identify clothing fragments. Specific elements that can indicate use as clothing are neck openings, sewn pleats, trimmings or woven corners that suggest the armpit point of a tunic. Unfortunately, none of these elements were found.

Another indicator of clothing can be the presence of seams. Some fragments were found with run and fell seams, one of the most common seaming methods in Egyptian clothing. In addition, two fragments were found with a less usual method of making a seam: two selvedges placed side by side without overlapping, and oversewn together. However, one fragment, textile 1192-004-0045AK/AM346 deserves a special mention. It shows an unusual way of joining two woven textiles.

Textile 1192-004-0045AK/AM346

The wool fragment was found in Area 1 of the excavation site. This area is a room that was clearly used as a storage facility, which can be deduced from the many finds in this room (Rose et al. forthcoming). It is therefore safe to assume that the fragment probably does not come from clothing or was no longer used as clothing in its last function.

The overall measurement of the textile is 22 cm in the warp direction and 27 cm in weft direction (fig. 1). It consists of two woven textiles which are joined together. The first woven textile measures 12.3 cm in the warp direction and 27 cm in the weft. The second woven fragment is smaller and measures 10.5 cm by 20.5 cm. Both are in S-spun naturally coloured brown wool. No fibre analyses were executed to identify the animal from which it came but it is very likely that it is camel hair. The spin angle of the S-spun warp threads is higher than the more loosely spun weft threads. This difference in the spin of warp and weft is a common feature in the woven textiles found at Hisn al-Bab. Both fabrics have similar thread count of 9 per cm for the warp and 10 to 13 per cm for the weft. Both have a weft faced tabby structure leaning towards a balanced weave.

Only one finished edge is preserved on each fragment. It is the edge with which the two pieces are joined together in an unusual way. However, in the context of comparing known finishing techniques for wool textiles, it should not be unexpected. A common way of finishing the warp ends in a wool weave in Late Antique Egypt was to work the threads into a twined cord running along the fabric (fig. 2). Usually, every three warp threads were bundled to be incorporated into the twined cord. This finishing technique was also used in the fragment under investigation here but it was used to connect two pieces rather than to finish one.

In both fabrics, the ends of the warp threads were bundled per three and then alternately intertwined with warp bundles of the other textile. The thread ends were only worked into a twined cord after the crossing, where the warp threads of the textile on

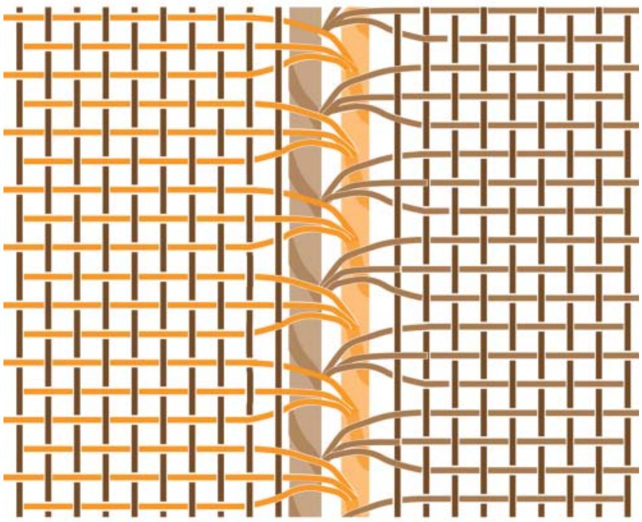

Fig. 3: Diagram showing how to join two woven wool cloths by intertwining the warp ends before creating two twined finishing cords (Image: Anne Kwaspen)

Fig. 4: Detail of textile 1192-004-0045AK/AM346: two twined cords (Image: Anne Kwaspen)

Fig. 5: Detail of the reverse side of textile 1192-004-0045AK/AM346 (Image: Anne Kwaspen)

one side are worked into the the twined cord of the opposite side and vice versa (fig. 3). In this way, the two fabrics are joined together without the need for sewing. This demonstrates an exceptional method of joining two textiles along the starting or finishing edges. Two twined cords lie next to each other on one side of the joined textiles (fig. 4). On the other side, the intertwining of the threads is visible (fig. 5).
It is a pity that the function of the original, complete textile cannot be determined. It would be interesting to know for which type of textile this method of joining was used. Since this is a unique find to date, it is not yet possible to determine whether this was typical for this region in Egypt or a finishing technique of Nubian origin.

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Luise Ørsted Brandt, Anne Haslund Hansen, Hussein Shokry & Chiara Villa

Bandages for Bastet:
a study of three Egyptian cat mummies

Abstract
Animal cults in ancient Egypt were popular especially in the Late and Greco-Roman periods, where tens of thousands of votive mummies were dedicated annually in catacombs in large necropoles. This article focuses on one of the resources required for the production of animal mummies, the textiles for bandages, in order to better understand the economic impact and organisation of animal cults. A study of three animal mummies from the National Museum of Denmark using computed tomography (CT) scanning and experimental archaeology calculated the quantities of textiles used for animal mummification. Two complete cat mummies contained entire cat skeletons while a separate head of a cat was modelled entirely from textile. The study demonstrates that at least 1 to 1.6 m^2 of textiles was used to wrap a cat mummy and that therefore large quantities of textile were required for animal cults. Textiles, in addition to other resources for mummification, were in high demand at large necropoles: their evidence offers new insights into one aspect of the complex process of mummification and emphasises the large economic and organisational scale of the animal cults.

Keywords: animal mummies, animal cults, linen bandages, textile production, computed tomography (CT) scanning

Introduction
This article reports the investigation of one resource for the animal cults: the textiles. It details the study of three animal mummies at the National Museum of Denmark to learn more about their contents, construction and bandages. Computed tomography (CT) scanning and experimental archaeology were used to calculate the quantities of textiles used for animal mummification and the time spent in producing them. Based on this study, the potential of CT-scanning as a non-destructive method for the study of textiles is evaluated. Finally, the evidence is used to discuss the use, reuse and economic and ritual role of textiles in animal cults.

Animal mummies in ancient Egypt
Catacombs in ancient Egyptian necropoles have yielded and still contain hundreds of thousands and even millions of animal mummies (Ikram 2005; Nicholson et al. 2015). The numbers are so enormous that sources indicate that animal mummies were even used as ship's ballast and subsequently sold as mummy-products as fuel, fertiliser and even medicine, pigments and paper (Elliott 2017). However, some were also collected as curiosities and have survived in museums and private collections around the world (Baber 2019).
Animal mummies can be divided into six categories: pet mummies, victual mummies, sacred mummies, votive mummies, false mummies and other mummies. Of these, the votive mummies were by far the most common and also form the most diverse group in terms of species with dedicated resting places. They include, among others, dogs, cats, ibises, raptors, crocodiles, and baboons (Ikram 2005, 2019). It is these votive mummies which are the subject of this study.
Animals were a part of the religious belief system of the ancient Egyptians. They were thought to be or contain a *ba*, part of the soul of their associated deity that would be active in both this life and the next one. Votive mummies were popular as they were believed to communicate messages to the gods (Bleiberg et al.

2013, 87-88). After death, animals were mummified and sold to pilgrims who dedicated them to their associated deity in the hope that their prayers would be heard (Ikram 2019). Dogs were, for example, associated with and dedicated to the dog or jackal-headed god Anubis, god of mummification and the afterlife, and cats to the protective goddess Bastet, represented as a cat or by a woman with a cat's or lion's head. Once a year, the dedicated mummies were escorted by priests to their resting place: catacombs carved out for the purpose or reused tombs (Ray 1976, 140).

Herodotus' accounts of the Egyptians' relationship to animals have given scholars the impression, that all animals were revered individuals (Malek 1997, 75) which, after a natural death, were mummified and brought to rest. However, evidence of strangulation and trauma has questioned this (e.g. Zivie & Lichtenberg 2005). The original interpretation is brought further into doubt by the incredible numbers of dedicated animals at large necropoles in Egypt such as Tuna el-Gebel, North Saqqara and Abydos (Kessler and el Halim Nur el-Din 2005; Nicholson 2005; Navilleet al. 2014). The Dog Catacombs at North Saqqara may have contained up to eight million dog mummies buried over a few centuries (Nicholson et al. 2015) and the galleries of Tuna el-Gebel likely housed more than one million ibis mummies (von den Driesch et al. 2005). The number of animal mummies that were prepared annually is likely to have been in the range of tens of thousands. Such numbers have led scholars to suggest that a large scale production of animals for mummification took place. This idea is supported by written sources such as the archives of Hor of Sebennytos, who was a scribe born around 200 BCE. He, among others, served in Memphis, where ostraca (texts on potsherds) provided evidence of the administration of the ibis cult. These texts, discovered in the animal necropolis of North Saqqara, are known as *The Archive of Hor*. The archive mentions temple personnel in charge of different aspects of the breeding of ibises (Ray 1976). A papyrus letter (Cairo Zenon Papyrus 59451, Letter to Zenon from two Hierodouloi of Bubastis) mentions two men who are cat feeders in connection with the cat cult in Bubastis.

Votive animal mummies are normally dated to the first millenium BCE and declined in number after the Roman occupation of 30 BCE. They were particularly popular in the Late Period (747 to 332 BCE) and the Ptolemaic Period (332 to 30 BCE) (Ikram 2005), probably as a response to a period of foreign rule and a wish to return to traditional customs. Many animal mummies in European museums are without archaeological context and have not been dated by radiocarbon analyses. Those which have been analysed in this way support a date to the Late and Greco-Roman periods (Burleigh 1980; Bleiberg et al. 2013; Wasef et al. 2015, De Moor et al. 2008), and indicate a possible change in the popularity of specific deities over this time period (Richardin et al. 2017).

Animal mummies provide important insights into the religious beliefs of the ancient Egyptians, techniques of mummification, and the economies of animal cults. There is no doubt that large-scale production would have required large quantities of not only animals, but also of fodder, vessels, oils, resins and textiles for bandages. In order to understand the full economic impact, organisation and extent of animal cults, it is important to gain insight into the resources needed to sustain them. In addition to the raw materials and how they were procured, it is necessary to estimate the labour used in their production or procurement. One of these resources was the textiles used during embalming and for bandages. Even though extensive quantities of ancient Egyptian textiles have been preserved by favourable conditions, they have not received appropriate scholarly attention, and only a few studies have focused on their role as bandages. However, a few recent studies indicate that bandages played both an important economic and ritual role in mummification (Riggs 2014; Drewsen 2019).

Bandages for mummification

The most commonly used textile fibre in ancient Egypt and the only one to have been reported from extant mummy bandages is flax (Bensen et al. 1979, 123). Most studies of bandages have been on those from human mummies. However, there are a few studies of bandages from animal mummies (e.g. Dunand et al. 2019, Tarek et al. 2019). Human mummies have shown wear and laundry marks (Hald 1946, Hall 1986), and it is therefore generally assumed that they were mostly made of reused textiles (Ikram & Dodson 1998, 153). Only exceptionally, as in the case of Tutankamun, were bandages produced specifically for wrapping (Winlock 1941, 10). Individual animal mummies have also been shown to contain bandages of different textiles, supporting the idea of reuse (Bleiberg et al. 2013, 127-128). While there is a general consensus on the reuse of textiles for animal mummies, it is unclear what quantities were needed and from where they came.

The collection of the National Museum of Denmark includes about 35 mummies or mummified specimens of several different species, including cats, reptiles, birds and fishes. Of these, two are complete cat mummies and one is a modelled head of a cat. These

Fig. 1: The three specimens from the National Museum of Denmark, Copenhagen: a) The modelled head of a cat (AAa 96) from the top; b) AAa 96 from the bottom; c) Cat mummy AAa 114; d) Cat mummy AAa 6 (Images: a & b - Søren Greve, c - Anne Haslund Hansen and d - Torben Eskerod)

were considered a relevant comparative evidence for the role and quantity of textile wrapping for archaeological material found in animal catacombs in general, and for disintegrated textiles, which do not enable thread counts or counts of layers, in particular. This is, for example, the case for the wrappings of dog and cat mummies from the recently analysed Dog Catacombs at the sacred animal necropolis of Saqqara (Brandt 2019; Nicholson et al. 2015).

Cat mummies are found at several burial places dedicated to cats in ancient Egypt, such as Bubastis, a city carrying the name of Bastet, and at the Bubasteion of Saqqara (Lenglet 1989, 20-22; Delvaux & Warmenbol 1991, 137-139; see map in Ikram 2005, xvii) and cats were particularly popular in the Ptolemaic Period (Malek 1997). Studies indicate that a large proportion of the cats died at a young age either as kittens or juveniles. While the cause of death is not clear for all cats, some demonstrate cranial fractures or dislocation of vertebrae consistent with strangulation, suggesting that they were killed for mummification (Armitage & Clutton-Brock 1981, 195; Zivie & Lichtenberg 2005, 117, Pl. 5.5).

Analyses of the cat mummies at Bubasteion in Saqqara revealed two types: 1) “Skittle-mummies” with the forepaws elongated along the torso and the hindlegs curled up along the abdomen and the tail between the legs and resting on the abdomen; and 2) a more naturally shaped cat with individually wrapped limbs (Zivie & Lichtenberg 2005). Museum specimens around the world vary in size (e.g. a specimen at Cairo Museum measures 24 cm in length (Gaillard & Daressy 1905, 95) whereas a specimen (inventory number 37.1991Ea-c) at Brooklyn Museum, New York, US, measures more than 80 cm in length), the wrapping style (from basic overlapping strips to elaborate geometric patterns), the use of coloured bandages, and modelled or painted facial features.

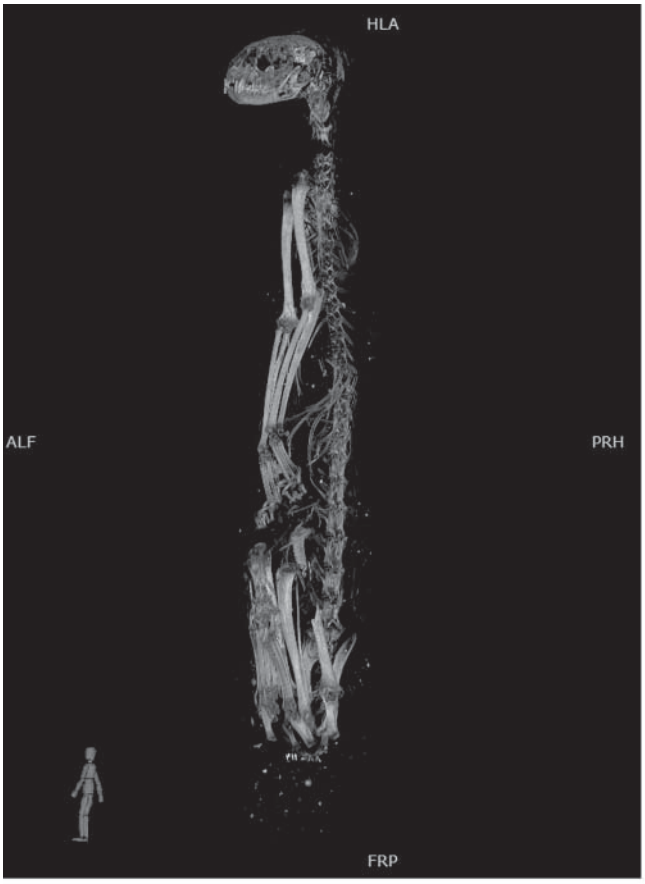
As previously mentioned, many of these museum specimens lack information about their find context and precise dating, which make it difficult to speculate about regional or chronological styles of wrapping. However, the elaborate geometric styles on animal mummies are often dated to the Roman period because human mummies from this era display a similar wrapping style (Bleiberg et al. 2013, 136). Nevertheless, a radiocarbon date of a cat mummy with geometrical wrappings, suggests that this wrapping style was used before the Roman period (De Moor et al. 2008, 110).

The National Museum of Denmark’s two cat mummies and the head of a cat mummy were submitted for further analysis (fig. 1 a-d). One of the cat mummies (inventory number AAa 6) was collected by Carsten Niebuhr during the Royal Danish Expedition to Arabia 1761-1767 (Hansen 2016, 88-89). It may have come from Saqqara, as the expedition is known to have purchased items from local farmers in this area (Hansen 2016, 52-53). The mummy is approximately 63 cm long and its outer layer is of broad bandages in a clearly different colour to that of the layer below. It was x-rayed in 2002. A second cat mummy (inventory number AAa 114) was donated to the museum in 1858/1859 by the shipbroker A. J. Polack, who was stationed in Alexandria (Buhl & Christensen 1969). The mummy is approximately 62 cm long and was x-rayed in about 1968, when it was documented that it contained a complete cat skeleton. The cat is wrapped in narrow bandages and covered by a black substance. The sculptured head of a cat (inventory number AAa 96) was also donated by A. J. Pollack in 1856/1857. The head was probably once attached to a cat mummy. It is covered with plaster which is gilded and painted. Judging from the bottom of the head, it is not possible to identify either bone or tissue.

Methods

The textile surfaces were examined using a Dino Lite Edge 3.0 digital microscope to record the spin direction of the thread, thread counts and weave. The mummies were CT scanned using a Siemens Somatom Definition AS CT Scanner at the Department of Forensic Medicine, University of Copenhagen. CT scanning is a radiographic technique which uses X-rays to visualise the internal structures of an object. The different tissues absorb the X-rays passing through the bodies differently and this effect is known as attenuation. The materials with a high density, such as compact bones, inhibit the passage of the x-ray and are visualised in white or light grey. The materials with lower densities, such as soft tissues or bandages, allow the majority of x-rays to pass through, and are visualised in black or grey. Air spaces are rendered in black.

The following scanning and reconstruction settings were applied: 120 kV, 300 mAs, slice thickness 0.6 mm, pitch 0.45, slice increment 0.4 mm and a sharp reconstruction algorithm (Br 59). The field of view was kept as small as possible, resulting in a pixel size of circa 0.4 mm. The CT images were visualised using Myrian version 2.2.1 (www.intrasense.fr), while the post-processing of the images were carried out using Mimics version 22 (https://www.materialise.com/en/medical/mimics). Mimics software allows the segmentation, i.e. isolation, and 3D visualisation of the different structures, such as the bones and bandages of the mummies based on their



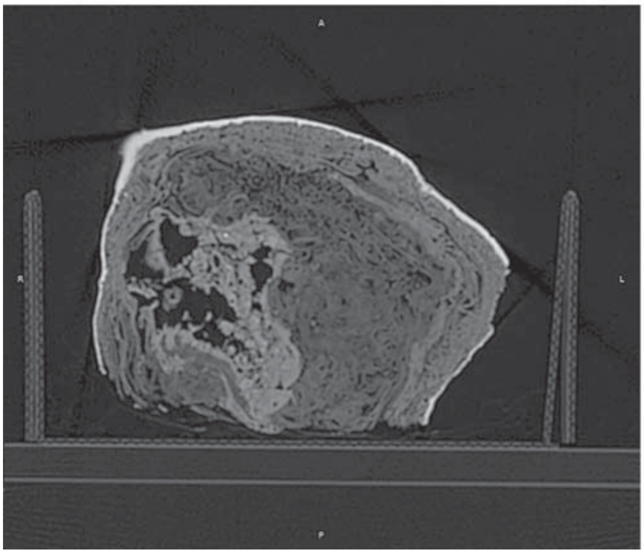


Fig. 2: CT scans of the cat mummies showing that two contained complete cat skeletons and that the cat head was modelled in textile: a) AAa 114; b) AAa 6; c) AAa 96 (Images: Chiara Villa)

attenuation (Villa et al. 2019). A series of 3D models of the bones and the external surfaces of the cats was generated using the volume and surface rendering visualisation techniques. In addition, 2D and 3D linear measurements, angles and external surface areas were obtained directly from Mimics, as CT scanning provides 3D scaled information. The scans were used for zooarchaeological observations, to visualise the internal constructions, and to assess the number of layers and their surface areas. The age-at-death of the cats were estimated based on the fusion state of the long bones as evaluated from the CT images using Smith (1969) as a reference.

Results and discussion

Zooarchaeological observations

The two complete mummies (AAa 114 and AAa 6), were shown to contain entire skeletons of cats, whereas the modelled head AAa 96 was constructed entirely of textiles and covered with plaster to form a cartonnage (fig. 2a to fig. 2c).

The mummy AAa 114 contains the articulated skeleton of a juvenile cat of approximately 62 to 84 weeks (fig. 3). The cat's skull is fractured on the left side, and the cervical vertebrae are discontinuous (between the third and the fourth vertebrae, there is a gap of 1.2 cm). The mummy AAa 6 contained the very

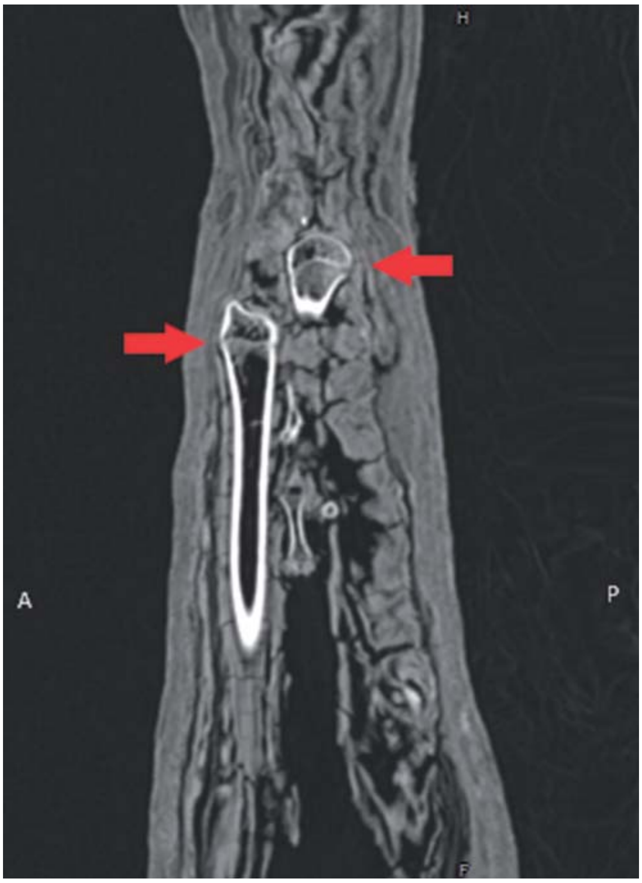


Fig. 3: CT image of the shoulder area, showing epiphyses of the humeri of AAa 114 which are not yet fused. The arrows indicate the well-visible line of fusion (Image: Chiara Villa)

fragmented skeleton of an adult cat. This individual also showed cervical discontinuation (there is a gap of 2.1 cm between the first and the second cervical). This mummy also showed dislocation of the fourth and fifth lumbar vertebrae. Both mummies have long museum histories with potential undocumented handling and examinations. It is therefore likely that the injuries are post-mortem, although trauma to the head and cervical vertebrae fits well with the evidence from other collections of cat mummies, which point to violent rather than natural deaths. Both cats seem to have been eviscerated as no remains of the internal organs were seen.

Construction of the cat mummies

Both of the complete cat mummies are skittle mummies. They are roughly equal in length (63 cm and 62 cm). However, the juvenile (AAa 114) is constructed with a textile extension of approximately 5 cm underneath the bottom of the cat. The original surface of AAa 114 is mostly lost, but can be observed in a few places as brighter and thinner than the layers below and in some places folded bandages are visible (fig. 4). The bright surface was already noted as missing on its arrival at the museum in 1858/1859. The current surface now mainly consists of overlapping homogenous bandages about 2.5 cm wide saturated with a black resinous substance. This may have formed a stiff or sticky base for the construction of the geometrical pattern. The brighter original outer bandages form various patterns. Traces of crossing bandages appear on the mummy's neck, while the top of the head has bandages forming a square-ish pattern. The body seems to have been decorated with horizontal bandages. These lighter fragments are likely to be the outermost layer. The ears of the mummy were modelled, but only the lower part is preserved (fig. 4c).

The other mummy (AAa 6) had looser and broader bandages of about 5 cm, of which the single outer layer is brighter and the inner layers slightly darker. By looking at the two cats in cross-sectional CT images, it was clear that the number of bandage layers used varies over the body. For example, AAa 6 had a flatter shape on one side underneath the shoulder girdle than on the other. This part is packed with more layers of linen to even out the shape and make it look symmetrical. The looser structure of the bandages of AAa 6 is seen in other cat mummies (e.g. British Museum, London, UK, inventory number 79.5351, Smithsonian National Museum of Natural History, Washington, US, inventory number 156306) and seems to represent a specific and recognisable style, distinct from AAa 114, which may have originally had a geometrical pattern covering its body. It is very likely that future dating and possible pinpointing of provenance for animal mummies may reveal that different styles are related to chronology or different workshops.

Item AAa 96 is an example of the complete construction of a body part from textile. The inner elements consist of irregular textile scraps covered by a series of smooth layers, creating a base for the gilded cartonnage. The ears are shaped individually by the use of folded cloth around a core. An example (inventory number E 11475) at Penn Museum (Philadelphia, US) shows a similar inner construction. The head may have belonged to a complete mummy, with the body containing a cat or cat bones, or a mummy with no zooarchaeological content. So-called "false" mummies are well-known from ancient Egypt. These refer to mummies that were produced in antiquity, but are empty or contain only parts of an animal. Many elaborately wrapped mummies have been shown to fall into this category. Preliminary results indicate

Fig. 4: Details of the construction of AAa 11: a) The uppermost brighter bandages; b) The geometrical pattern on the mummy's neck; c) The remains of the modelled ears (Images: Anne Haslund Hansen)

that an ibis mummy (inventory number 7461) at the National Museum of Denmark contained a few bones, probably a wing, and a row of hollow tubes, most likely large feathers (Persson 2017). Whether it is correct to call them false is a matter of debate because there are various ways to interpret them. The *Archive of Hor* mentions irregularities in the ibis cult, leading to the imprisonment of six servants and the supervision of the ibises' preparation to ensure the packing of "one god [in] one vessel" (Ray 1976, 77-78, 143). This text has been interpreted as evidence of the servants deliberately cheating with the contents of jars in the production of ibis mummies. Another suggestion is that, for the Egyptians, parts of the animal would symbolise the whole and that a mummy with a partial body would not be fake to them (e.g. Ikram 2019, 181-182) or that wrapped parts could derive from particularly valuable individuals (Bleiberg et al. 2013, 134). Alternatively, empty mummies could be explained by the large-scale production of animal mummies leading to a shortage of available animals.

Calculation of surface area

For AAa 114, the external surface of the mummy measures 0.19 m^2. The number of layers of bandages were measured at nine different points on the mummy on axial CT images. These varied from three to nine layers (fig. 5). A conservative estimate of an average of five layers to cover the body was used. The estimate of the quantity of textile used for an animal mummy therefore equals 1 m^2. It should be noted that this estimate does not include the brighter outer layers

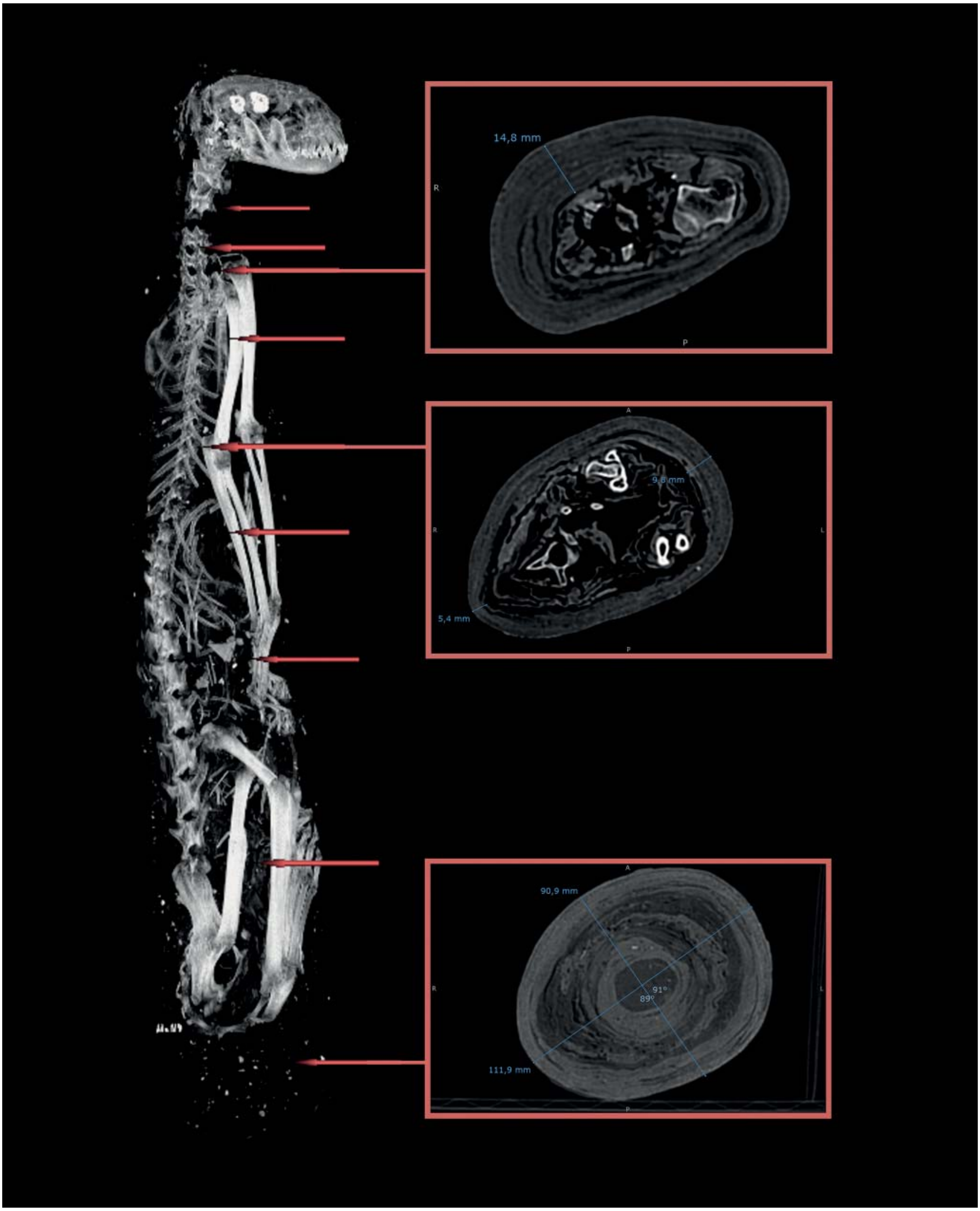


Fig. 5: Cat mummy AAa 114 with locations of cross-sections where the layers of textile were counted indicated (Image: Chiara Villa)

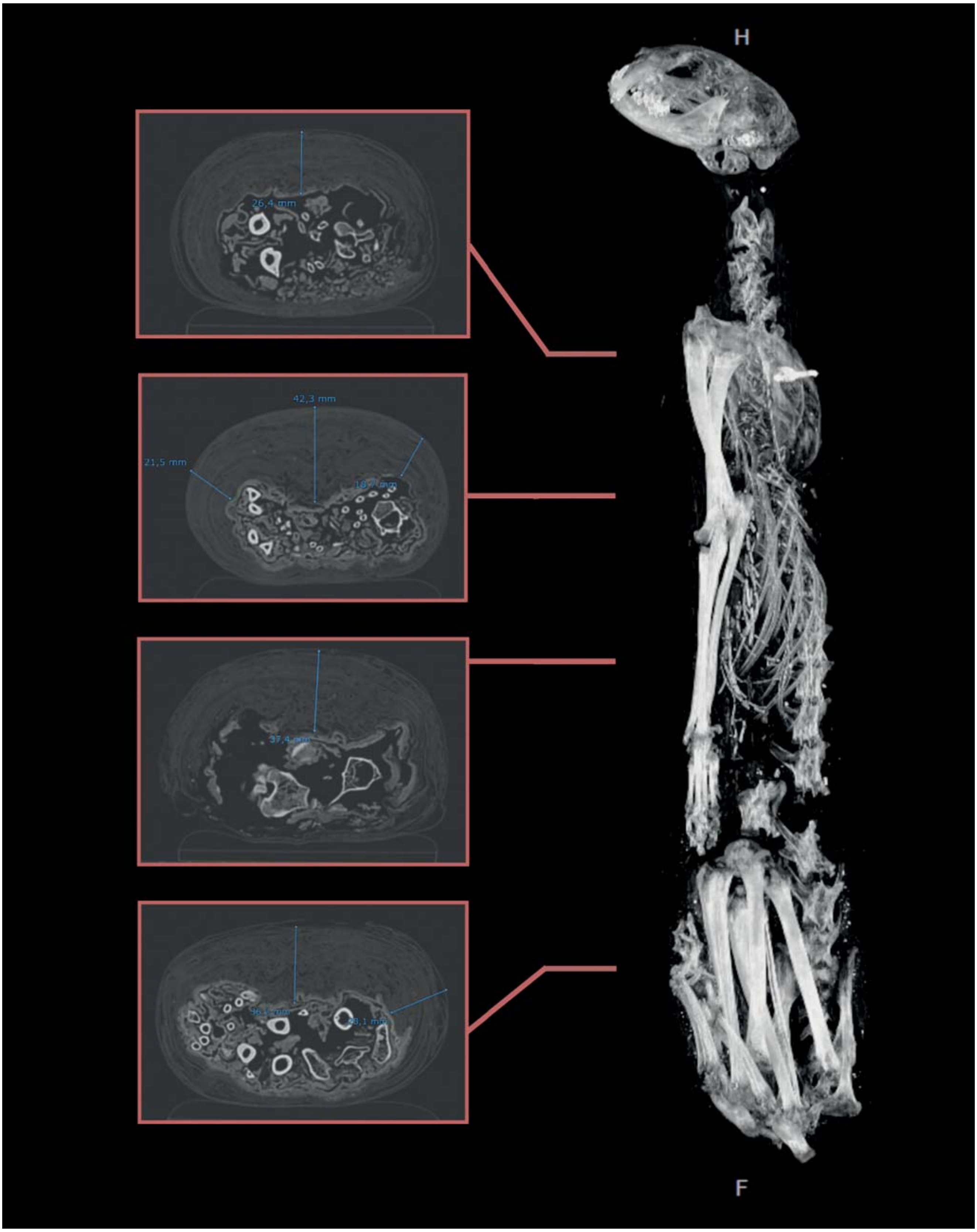


Fig. 6: Cat mummy AAa 6 with locations of cross-sections where the layers of textile were counted indicated (Image: Chiara Villa)

which have been removed. The total used must therefore have been considerably larger.

For AAa 6, the external surface of the mummy measures around 0.23 m^2. The number of layers at four different points along the mummy were measured. They varied from five to 11 layers (fig. 6). Using a conservative estimate of seven layers, the quantity of textile used for the mummy equals 1.61 m^2. This excludes the textile packing used to even out the shape of the body.

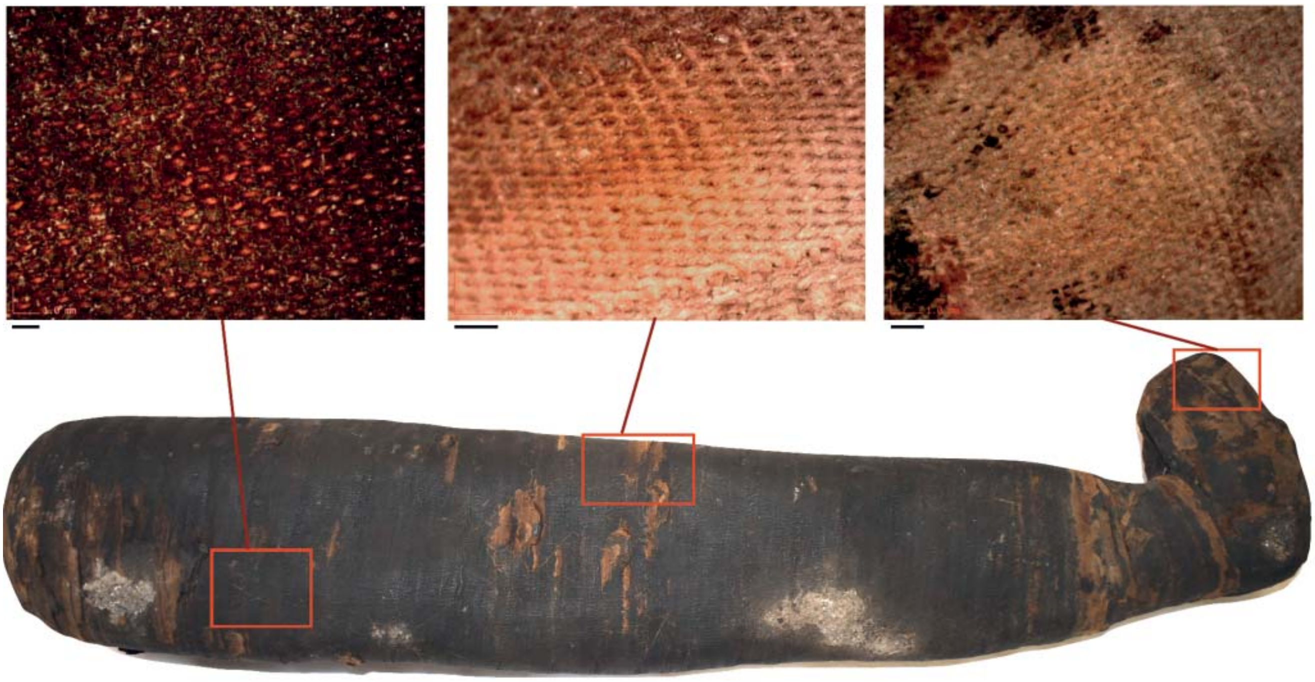


Fig. 7: Overview of AAa 114 and Dino-Lite photographs of bandages. The black bars are 1 mm long (Images: Luise Ørsted Brandt and Anne Haslund Hansen)

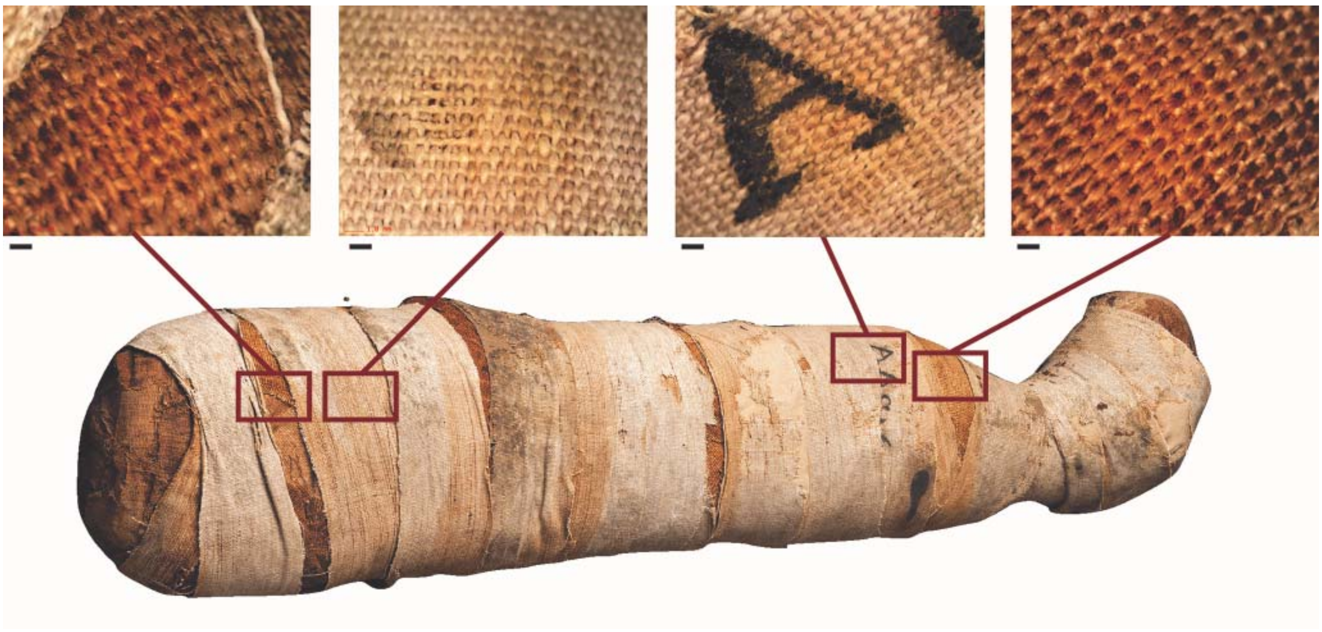


Fig. 8: Overview of AAa 6 and Dino-Lite photographs of bandages. The black bars are 1 mm long (Images: Torben Eskerod and Luise Ørsted Brandt)

AAa 114	Description	Place	Weave	Spinning direction	Thread count threads per cm*
Sample 1	Black current surface	Body of mummy	Tabby	S	13 / 32
Sample 2	Light overlying layer	Body of mummy	Tabby	S	18 / 36
Sample 3	Light overlying layer	Head of mummy	Tabby	S	20 / 40
AAa 6	**Description**	**Place**	**Weave**	**Spinning direction**	**Thread count**
Sample 1	Inner bandage	Shoulder girdle	Tabby	S	9 / 22
Sample 2	Inner bandage	Bottom of body of mummy	Tabby	S	9 / 22
Sample 3	Outer bandage	Body of mummy, lower	Tabby	S	14 / 28
Sample 4	Outer bandage	Body of mummy, upper	Tabby	S	13 / 31

Table 1: Results of the visual inspection using Dino-Lite. * It was not possible to recognise the warp or weft, although the most dense thread system is likely to represent the warp.

External inspection of the bandages
Photographs of the external textile surface of AAa 114 and AAa6 were taken in places where the surface was large enough to provide evidence for threads per centimetre, and as flat as possible to avoid distorting the image. Places where the bandages did not appear to be stretched were preferred (fig. 7 and fig. 8).
The black layer of bandages on AAa 114 appeared homogeneous so one spot was used for the calculation of the thread count because the glossy reflective surface was hard to photograph. All fabric weaves are tabby and the thread s-spun (table 1). Tabby weaves and s-spinning were very common in ancient Egypt as well as for the majority of extant ancient Egyptian textiles (Vogelsang-Eastwood 2000). All weaves are faced, meaning they have more threads in one direction (warp or weft) than the other. The thread counts vary from 9 x 22 threads/cm to 20 x 40 threads/cm. Both mummies have at least two different types of weaves represented which is as documented for other animal mummies (Bleiberg et al. Bruni 2013, 127-128). Both mummies have the coarser weave innermost and the finer one on top, where it could be seen.

Calculation of working time
Based on the thread counts, the time spent producing the linen cloth for the bandages was calculated. The calculations are based on the inner bandages for both mummies because, for AAa 114, this is the quality of the extant bandages, and for AAa 6, this is the quality of the majority of the bandages (except for the one or two outermost layers). The production time is an important aspect when considering textiles as one of the necessary resources for the animal cults. Unfortunately, no experiments determining the time spent producing textiles with Egyptian tools are known to be published. Therefore, if one wishes to gain an impression of the time invested, one has to use the few published experiments available, which may of course not be directly comparable to ancient Egyptian technology. A major obstacle is that the use of different technologies may provide differing production times. In addition, in experimental archaeology, modern craftspeople will have a different expertise and skills from ancient craftspeople: for example, efficiency has been shown to vary even between modern spinners (Mårtensson et al. 2006). It is therefore important to emphasise that such experiments always provide approximations of the time spent in textile production. Nevertheless, they have been extremely valuable in indicating the many processes involved in textile production and that collectively they represent very time-consuming work. Future experiments using ancient Egyptian technology may provide a closer approximation. The experiments in spinning and weaving linen by Ejstrud et al. 2011 at Ribe Viking Center (Denmark) using Viking Age technology are used here because they are currently the only known published examples using flax, and they have been used previously to estimate textile production time in ancient Egypt (Drewsen 2019). The most common spinning equipment used in ancient Egypt was, as in this experiment, a drop spindle (Salem and Al-Khalek; Vogelsang-Eastwood 2000, 272). Sources for the looms used in weaving in the different eras are few, but, most likely several different types were

in use simultaneously. In the New Kingdom, 16th to 11th century BCE, both the horizontal loom and the vertical two-beam loom seem to have been in use in Egypt, and in the Ptolemaic and Roman periods, the warp-weighted loom was in use at sites dominated by a non-Egyptian population (Mossakowska-Gaubert 2020). It cannot be determined which loom was used for the cat mummies' textiles, as the bandages have no selvedges, and they may come from multiple different looms. Therefore, two calculations for the weaving time of tabby are used here: one using a warp-weighted loom (Ejstrud et al. 2011) and one using calculations for a reconstruction of the Chalcolithic Period linen shroud of The Cave of the Warrior, in the southern Levant, with a ground loom (Levy & Gilead 2013). The Ejstrud et al. tests showed that a modern experienced spinner can spin an average of about 56 m of thread per hour and that an experienced weaver can produce an average of 5 cm of fabric (to a width of 95 cm) per hour on a warp-weighted loom (Ejstrud et al. 2011, 62, 67). Levy and Gilead's calculations suggest that a team of five (two skilled weavers and three children) can produce a 7 m linen textile (to a width of 2m) in 480 hours, that is 5 cm in 1.37 hours for each of the five persons, on a ground loom (Levy & Gilead 2013, 42).

The thread count of 13/32 threads per cm is equal to a total of 4,500 m of spun yarn for the bandages of AAa 114. Using the estimate of 56 m thread spun per hour, this equals 80 hours of spinning. With an approximate 1 m width, weaving 1 m^2 would have taken about 20 hours following Ejstrud et al. and about 34 hours following Levy and Gilead. The experiment at Ribe Viking Center was performed with 22 warp threads and 12 weft threads per cm and Levy and Gilead's calculations are based on a thread count of 12/17-18. A higher number of warp threads might have extended the required time. In total, therefore, at least 100 hours was spent spinning and weaving the bandages for cat mummy AAa 114. This is based on a conservative minimum quantity of textile and does not take the missing outer layer into account. This also excludes time spent harvesting and processing the flax and setting up the loom (Ejstrud et al. 2011; Levy & Gilead 2013), which were also time-consuming processes involving many different steps (Vogelsang-Eastwood 2000, 269-271; Andersson Strand 2012).

For item AAa 6, the bandages with a thread count of 9/22 are estimated to contain 3,100 m of spun yarn per square metre. That equals 4,991 m and 89 hours of spinning for the conservatively estimated number of layers, excluding the textile packing. The thread count of the inner layer is approximately equal to the set up used by Ejstrud et al. and results in 32 hours spent weaving the linen, and about 55 hours following Levy and Gilead. In total, using the proposed experiments with their inherent approximations, spinning and weaving of the bandages would require 121 or 144 working hours, respectively.

Even with the above described difficulties of using such experiments, it is clear that the working time invested in producing such bandages must have been enormous using either a warp-weighted loom or a ground loom. Droß-Krüpe discusses the use of time spent to weave linen based on Egyptian papyri from the Roman period. Her estimation that one weaver can produce 1 m^2 of linen in 107 hours supports the substantial use of time spent on weaving (Droß-Krüpe 2011, 82).

Consumption of textiles by animal cults

The quantities of textile used may vary between and within animal species according to their size and depending on whether the bandaging was meticulous or cursory. Nevertheless, the minimum estimates provided for the cat mummies at the National Museum of Denmark indicate a high demand for linen for wrappings. This could have been in the range of tens of thousands of square metres every year for a single catacomb such as the Dog Catacombs of Saqqara or the Ibiotapheion of Tuna el-Gebel. In large necropoles with multiple cults, the demand for textiles for bandaging must have been immense. The numbers provided here do not take the linen used during mummification before the final wrapping into account. The high demand for textiles at necropoles is also demonstrated by the Sarapieion archive's evidence of Ptolemais, son of Glaukias, who served as a detainee in the Memphite Sarapieon at Saqqara in the second century BCE (Thompson 2012, 209-212). Here, he profited by trading in cloth because linen was in high demand for shrouds, padding and bandages for mummies. Judging from this description, at least some of the textiles that entered embalming workshops were purchased, although it can be speculated that others were donated as offerings.

The calculations provided here confirm the well-established notion that textile production was a time-consuming process in ancient society and the time invested in textile production in ancient Egypt must have been enormous. The prices of textiles are described in several sources. They varied very much depending on quality and garment type (e.g. Thompson 2012, 210-211). A trade in second-hand textiles also seems to have made up part of the market (Janssen 1975). However, the linen qualities described are difficult to match to linen found in the archaeological record. It is therefore not straightforward to estimate the economic value of the bandages. Since textiles were circulated and reused to a large extent, even recycled textiles must have had a reasonable value. This is supported by a papyrus including a price list of the items found in a Greco-Roman embalmer's cache which lists linen cloth as the most valuable resource (Ikram & Dodson 1998, 105). The *Archive of Hor* also states a price for bandaging of mummies (Ray 1976, 145). However, the value of the currency listed is unknown.

The mummies studied here each consisted of at least two different qualities of textile, which confirms previous studies showing that several qualities were available for the embalmers. It also indicates that they might be made of reused textiles, as with other mummy bandages. That high numbers of textiles were used for human mummies has been acknowledged for a long time: e.g. the 375 m^2 of cloth used for the mummy of Wah (Vogelsang-Eastwood 2000, 295). However, the present study shows that high numbers of textiles were also needed for animal cults, that the quantities required in necropoles was much more substantial than hitherto recognised, and that reused textiles must have made up a significant part of the resources needed in the embalming workshops. The quantities calculated here illustrate that textiles were of great importance in the animal cults. It may be that their role extended beyond the practical use of enclosing the remains to a ritual role in transforming them and aiding their passage into the afterlife (Riggs 2014).

Concealing and displaying

All of the three specimens investigated demonstrate how textiles were used to mould and change the appearance of the body of the mummy. In AAa 6, textiles were used to make the body more symmetrical, probably to make it more appealing to the pilgrims who would buy it. The textile bottom of AAa 114 could have had the function of stabilising the mummy if it was to be displayed standing or it could simply have been applied to make it appear larger. The properties of textiles make them ideal for modelling, which is clear in the construction of the modelled head AAa 96. For some skittle cat mummy types (of which there are multiple variations), textiles were used to enhance ears, which were important for their appearance and recognition as cats. In this way, textiles were used both to conceal the true content of the mummies (not symmetrical or missing faunal content) but also to appeal to the pilgrim through specific and recognisable characteristics with a desirable and aesthetically pleasing shape. The exterior appearance of the animal mummies therefore seems to have been of great importance. This is supported by the placement of the finer bandages outermost. Since elaborately wrapped specimens sometimes do not contain faunal content, it is worth speculating on whether the exterior was actually more important in determining the price of the mummy than the interior.

In general, the shaping of the cats, with even exteriors and straight bodies and heads, adhere to some of the basic principles of Egyptian art, namely symmetry and frontality (Robins 1997, 19-24). In this way, the wrappings helped to create a shape which was considered to be the ideal image of the animal (Riggs 2014, 89). The compact wrapped shape would provide protection for the body in an actual and symbolic way. A wrapped body was associated with the appearance of the venerated and the divine (Riggs 2014, 144-146). It seems that the use of textiles was an aid to the mummy's perceived ability to act as a vessel for prayer.

Conclusion

This study has demonstrated that CT scanning was a non-destructive and rewarding method by which to provide a broad set of data on three specimens from the collection at the National Museum of Denmark. Furthermore, the method proved successful for the specific purpose of calculating the quantity of textile used to wrap two cat mummies and has potential for the calculation of cloth used on mummies in general. The scans showed that the two cat mummies contained complete cat skeletons, while the head was modelled entirely in textile. It was possible to estimate the age of the cats, although the precise cause of death could not be determined. The images offered good opportunities for studying the construction of the mummies, including the probable preparatory black layer of AAa 114, which may have been an optimal surface for its geometrical wrappings. The two complete items seem to represent two distinct types of cat mummy: a tightly bound mummy with modelled facial features and a more loosely wrapped mummy. It is likely that, in the future, radiocarbon dating and studies of provenance may reveal whether such types can be associated with different geographical areas or workshops or date to specific time periods.

This study also demonstrated that large quantities of textile were required for animal cults and must have made up a much needed and valuable resource at large necropoles. The textiles were, however, just one of the resources required at the embalming workshops. Nevertheless, their evidence sheds light on the complex process of mummification and emphasises the economic and organisational requirements of the animal cults. In the future, further studies of resources for animal mummification will add to this picture.

This study is valuable for the documentation and future preservation of the mummies. Many museums contain objects collected prior to controlled excavations. This study has shown that interest in such objects can be revived by means of new methods and multidisciplinary object-based research. It is hoped that the present study will, alongside archival research, contribute to the mapping of how, and from which sites, artefacts were collected and subsequently dispersed in the "pre-archaeological" period.

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Christina Margariti, Ina Vanden Berghe, Gabriela Sava & Tina Chanialaki

The analysis and conservation of a 5th century CE child's tunic from Egypt

Abstract
This paper presents the conservation and analysis of an excavated child's linen tunic originating from Egypt, which was donated to a museum in the late 19th century. The tunic had repeatedly treated and alteratered during its museum life, starting as early as the 1930s when it was wet cleaned, and later in the 1970s, when it received an adhesive support. It was probably during this treatment that it lost its three-dimensional shape. In 2015, the tunic was conserved as part of an EU co-funded refurbishment of the museum to which it belongs. During this conservation, the tunic was returned to its original three-dimensional shape, the purple dye used to decorate it was identified as a mixture of madder and indigoid, and it was also dated between the fifth and seventh centuries CE using radiocarbon 14 dating techniques.

Keywords excavated textiles, tunic, Egypt, wet-cleaning, HPLC-DAD, radiocarbon dating, adhesives

Introduction

A child's linen funerary tunic was part of a collection of objects excavated in Egypt (including materials other than textiles) and given to the National Archaeological Museum (NAM) in Athens by two donors, namely Demetriou in 1880 and Rostovitch in 1904 (Apostolaki 1999, 3-4). Similar textile finds, also referred to as "Coptic" textiles, found their way into museums as early as the beginning of the 20th century (O'Connell 2008; Rutschowskaya 1990; Hall 1982). Coptic textiles are native to Egypt, where they originated as a pagan and later became a Christian art form. In the fourth century CE, Christianity became the official religion of Egypt. This was followed by the Arab conquest in the seventh century CE, when Egypt converted to Islam, at which time Islamic designs replaced Coptic ones, particularly in textiles (du Bourguet 1971; Badawy 1978; Caroll 1989).
In 1921, the tunic, together with the rest of the textiles at NAM, were separated from the donated collection, and in turn donated to the Museum of Decorative Arts in Athens, as textiles were then perceived as decorative objects rather than archaeological finds. The textiles remained in this museum, now renamed the Museum of Modern Greek Culture (MMGC). The tunic, together with 13 other textiles, was selected for the new permanent exhibition of the MMGC, and was therefore conserved by the textile conservation laboratory of the Directorate of Conservation of Ancient and Modern Monuments (DCAMM) in 2015.

The tunic (MMGC accession number 764)
It is a cross-shaped tunic woven in one piece of maximum dimensions 1.2 m length and 1.08 m width with a neck opening of approximately 215 mm (fig. 1). It is an undyed linen tunic with narrow sleeves (as revealed after conservation) decorated with tapestry bands (*clavi*) woven into the main fabric, and squares, known as *tabulae* (Gabra 2014, 262), woven into the main fabric and secured along two sides by stitching (Apostolaki 1999, 95). The tapestry bands are

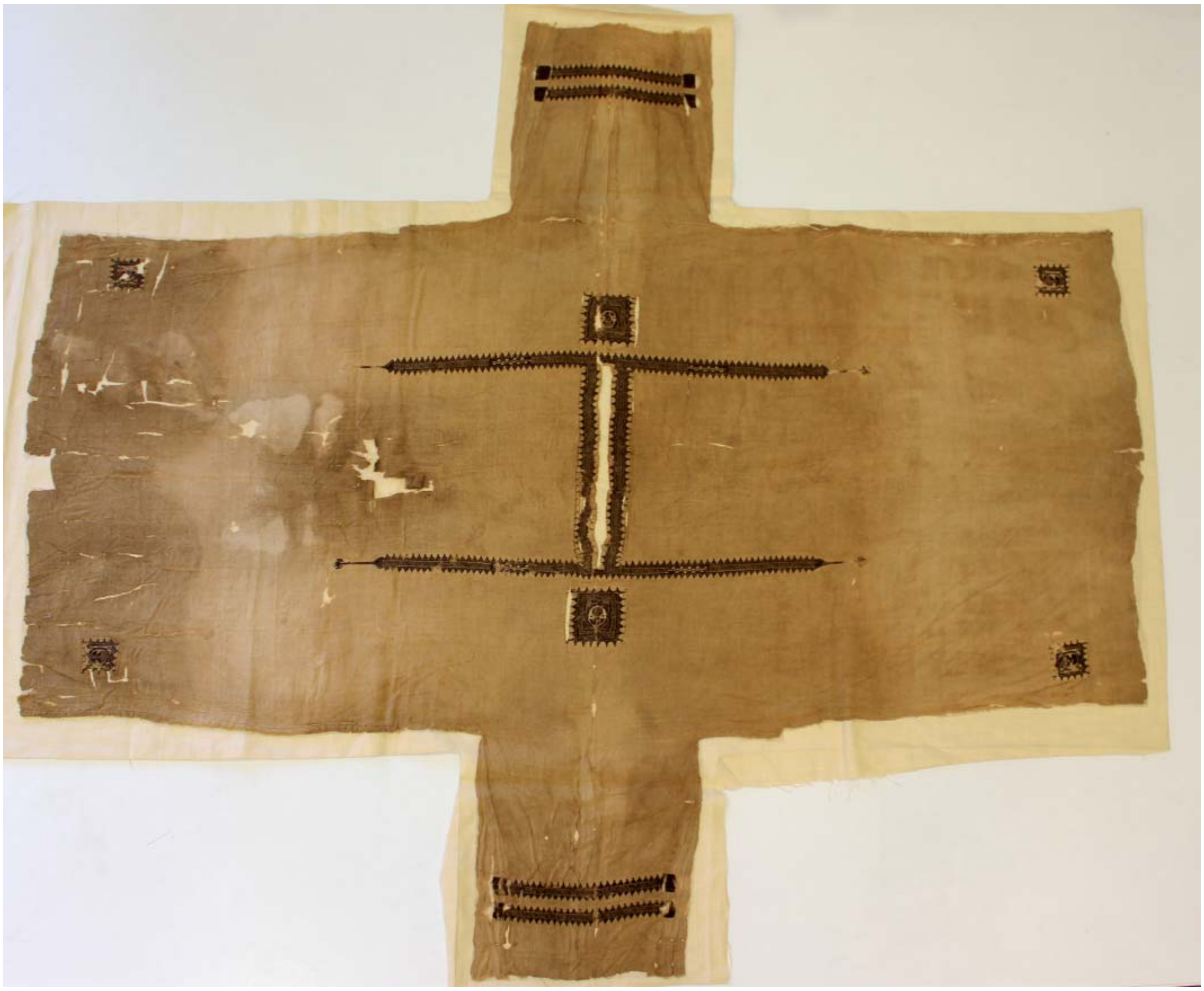

Fig. 1: The tunic before conservation (Image: Christina Margariti and Tina Chanialaki)

approximately 25 mm wide with stylised geometrical patterns and jagged edges. They decorate the neck opening and the ends of the sleeves, known as *manicae* (Stern and Hadjilazaro Thimme 2007, 34). Similar width bands with jagged edges, a stylised floral pattern, ending in leaves with long stems, decorate the front and back of the neck opening. The tunic is also decorated with six square tapestry patches with figurative patterns (*tabulae*). There is one on each shoulder approximately 55 mm x 65 mm, and one on each bottom corner of the hem approximately 40 mm x 40 mm (fig. 2). Traces of a waist tuck have been preserved in the form of three straight and parallel creases running across the width in the middle of the tunic. The creases are approximately 40 mm apart and there is no evidence of stitching holes along them. Waist tucks are found in the majority of narrow-sleeved tunics and would have been a method of adjusting the length, either by stitching or to accommodate a drawstring (Kwaspen & Verhecken-Lammens 2020; Pennick Morgan 2018, 102, 104). Measurements and evenness of the width seem to provide evidence as to whether the height adjustment was done by stitching or a drawstring (Pennick Morgan 2018, 102). A combination of tunnel and whip stitch was used along the sleeves and sides of the tunic to give it its three-dimensional shape.

Condition on receipt

Upon receipt, the condition of the tunic was poor. It was creased, deformed and stained, with tears and missing parts, and it had lost its original three-dimensional

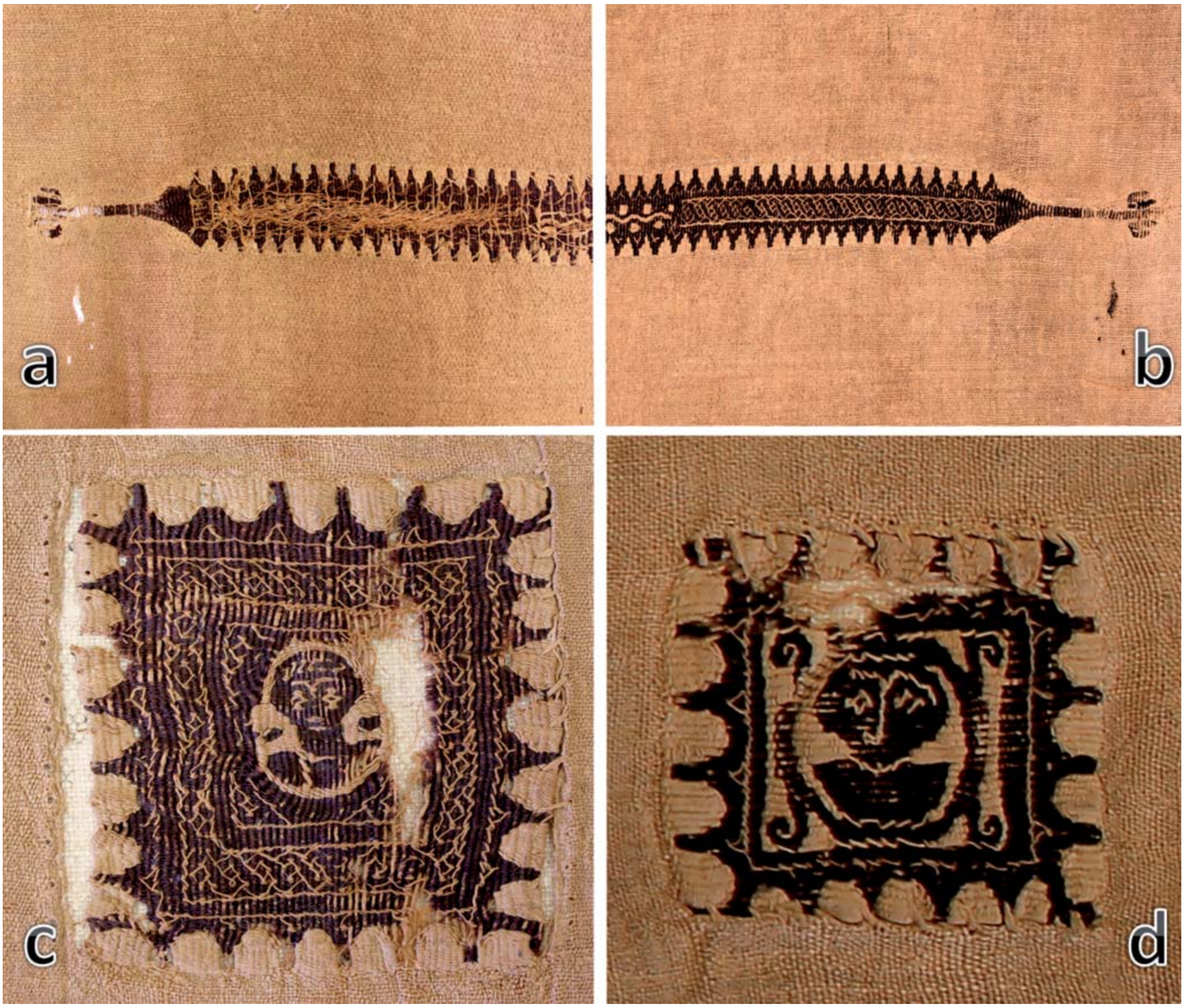

Fig. 2: a) Front of one of the decorative bands; b) Reverse of one of the decorative bands; c) One of the larger square tapestry decorations; d) One of the smaller tapestry decorations (Images: Christina Margariti and Tina Chanialaki)

shape during a previous treatment, as explained below. The tunic was lined with a modern off-white textile. The new textile was secured in place with a coarse synthetic net, double coated with synthetic adhesive, and with additional stitching around the edges of the object. The adhesive bond between the net and the new textile had failed and, as a result, the net was not adequately supporting the lining. However, the adhesive bond was still strong and adequately supporting the object-net layer, but the coarse net was causing mechanical stress to the object, and the original textile was impregnated with the aged adhesive and had become brittle and mechanically weak (fig. 3). One side of the tunic, from the middle down towards the hem, was heavily stained, had lost sections, and the remaining fabric was extremely brittle. In all probability, the stains were caused by the decomposing body of the deceased, which established an acidic environment which accelerated the deterioration of cellulosic fibres (Timár-Balázsy & Eastop 1998, 28).

Analysis of the tunic

Past analyses and study

Anna Apostolaki, curator and later director of the museum that housed the textiles collection, studied the weave and construction and dated the textiles,

Fig. 3: Detail of one of the sleeves, showing stress and deformation caused by the previous treatment and support (Image: Christina Margariti and Tina Chanialaki)

based on their technical characteristics and decoration typology (Apostolaki 1999). Before the second world war, she collaborated with Konstantinos Zeggelis, professor and later dean of the National Technical University, on the analyses of the dyes in several textiles. Unfortunately, this study, along with many others, were lost, when her house "was completely looted during the *Katochi* (Axis occupation 1941-1945) and the *Dekemvriana* (civil uprising 1944-1945)" (Apostolaki 1952; Stassinopoulos 1997; Charalambides 2014). Thankfully, a small fraction of her collaborative work with Zeggelis has been preserved as part of the Apostolaki Archive at the Benaki Museum in Athens. In a letter from to Apostolaki dated 16 January 1935 (Apostolaki 1935), Zeggelis describes the analyses of red, yellow and blue colours from three objects, and concludes that the dyes alizarin and indigotin and combinations of the two had been applied (Chanialaki et al. 2016). In the same letter, he rules out the possibility of any of the purple colours having been dyed with shellfish purple, a fact that concerned Apostolaki and later researchers (Rutschowskaya 1990, 28; Trojanowicz et al. 2004).

Current analyses

Weave and construction analysis, fibre and dye identification, and radiocarbon dating were undertaken. Study of the weave and the construction was aided by the use of thread-counters, an Olympus CX40 stereomicroscope, and a Dino-Lite AM413T digital stereomicroscope. Fibre identification was performed with an Olympus AX70 optical microscope, with fibre samples mounted on glass slides with Entellan® medium; and a JEOL JSM-6500F scanning electron microscope, with samples coated with gold/palladium and viewed at high pressure at 15keV. High Performance Liquid Chromatography-Diode Array Detection (HPLC-DAD), was used for the purposes of dye analysis at the Royal Institute for Cultural Heritage in Belgium. Dyes were extracted from the fibres using harsh acidic conditions (Vanden Berghe et al. 2009). Dye identification was based on comparison of the dye compounds with an extensive reference library of spectra from natural and synthetic dyes developed in-house there. Radiocarbon 14 dating determinations were measured on the Accelerator Mass Spectrometer (AMS) at the Horia Hulubei

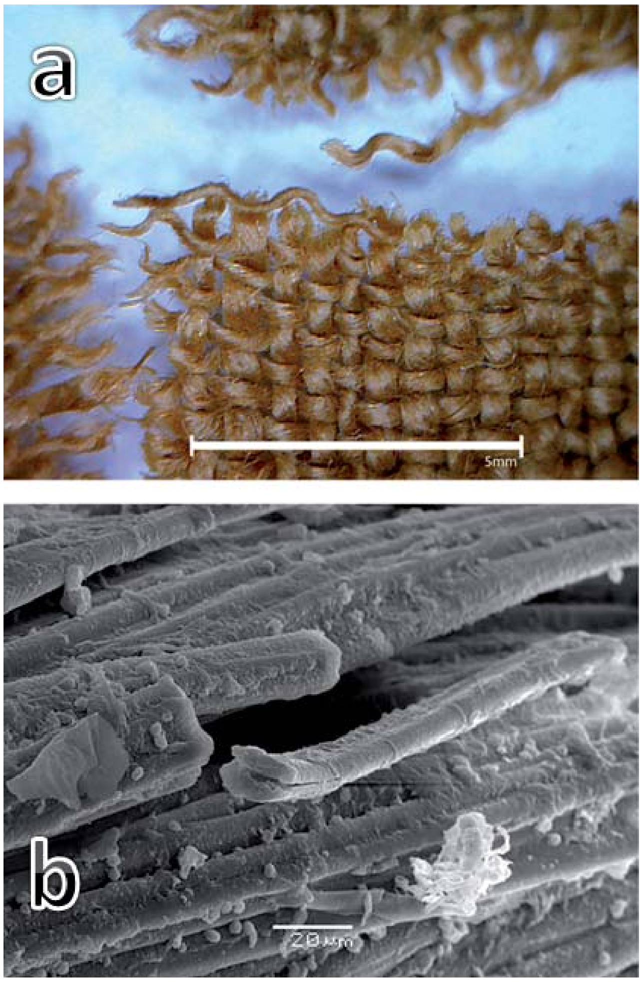

Fig. 4: a) Detail of the main textile; b) Scanning electron micrograph of the linen fibres of the main textile (Images: Christina Margariti and Tina Chanialaki)

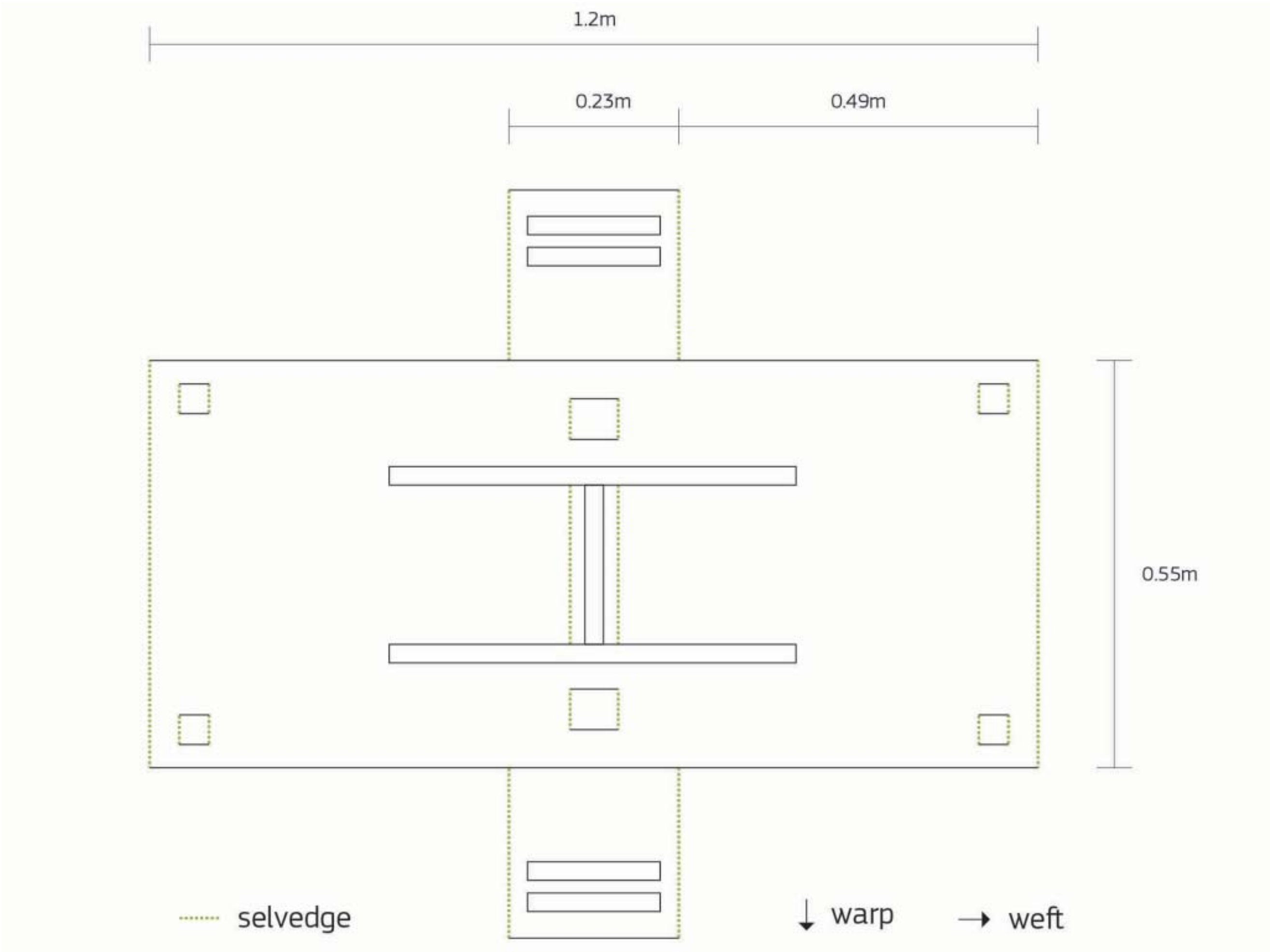

Fig. 5: The tunic with an indication of the selvedges (Image: Tina Chanialaki and Andreas Koutouvalas)

National Institute for Research and Development in Physics and Nuclear Engineering, Romania (lab code RoAMS). Graphitisation was performed with the system CHNOS Elemental Analyser/AGE 3 (Wacker et al. 2010; Sava et al. 2019). Dating calibrations were performed using OxCal and the IntCal13 calibration curve date (Bronk Ramsey 2009; Reimer et al. 2013).

The main fabric of the tunic is a plain balanced weave 18 x 18 threads per cm of undyed, s-twisted linen yarns with varying diameters (fig. 4). The warps of the textile run horizontal to the finished tunic and selvedges have been retained along the neck opening, the sides of the sleeves, the front and back hem, and the top and bottom sides of the decorative tapestry squares (fig. 5). The decorative bands and squares were made with a slit-tapestry technique, of approximately 8 x 16 threads per cm square, with undyed double linen warps, and purple wool z-twisted and off-white (undyed) linen s-twisted wefts (fig. 6). The presence of z-twisted yarns is quite a rare occurrence for an object of this time period originating from Egypt (Bender Jørgensen 2017, 238-239, 243; Verhecken-Lammens n.d.). Pattern details were executed by undyed, s-twisted linen thread with a flying-thread brocading technique (Verhecken-Lammens 2013) described as embroidery by Apostolaki (1999, 95) (fig. 2a). The sides of the tapestries that are not woven into the main fabric were secured to it by whip stitching with Z3s undyed, linen cord (fig. 7).

The extract of the purple wool contains the following dye composition: purpurin (71), alizarin (14), indigotin (6.5), munjistin (5) and isatin (3.5). The numbers represent the relative ratio of each compound, in percentages, based on the peak area of the compound after integration at 255 nm wavelength. More significant is the relative ratio between purpurin and alizarin is 83/17 (peak area ratio of both molecules at 255 nm, expressed in percentages) (Vanden Berghe et

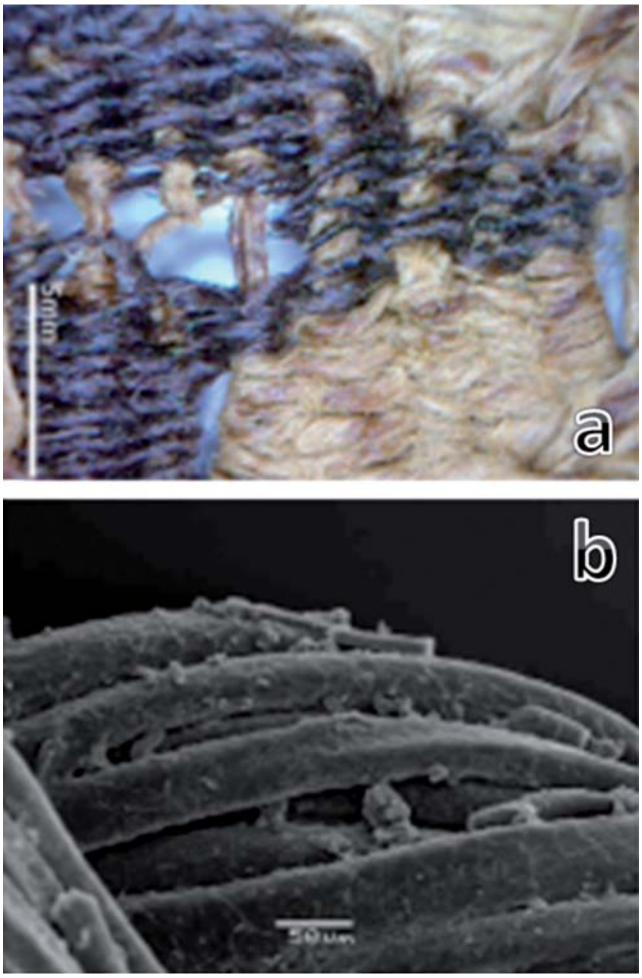

Fig. 6: a) Detail of the tapestry decoration; b) Scanning electron micrograph of the wool fibres of the tapestry decoration (Images: Christina Margariti and Tina Chanialaki)

al. 2017).

It was concluded that the purple colour of the wool threads was not produced by shellfish but obtained after mordant and vat dyeing with red anthraquinone dyes from the roots of a Rubiaceae family plant and the blue vat dye indigotin from from an indigoid plant source, respectively. The given purpurin/alizarin ratio indicates the use of dyer's madder (*Rubia tinctorum* L.), while the indigoid dye refers to either woad (*Isatis tinctoria* L.) or indigo (*Indigofera* or *Polygonum* sp.). No distinction can be made between the two sources of the blue dye, either through its chemical composition or by its historical context.

This method of dyeing purple is entirely in keeping with the well-known Egyptian tradition for it (De Moor et al. 2010; Wouters et al. 2008). This is repeated proof of the dyeing techniques used in Egypt from the second century onwards, which are based on combining two (or more) colour sources from a very limited palette, consisting of a red, a yellow and a blue dye source, in order to create a wide range of shades (Vanden Berghe 2011).

According to radiocarbon 14 dating analysis, the find was placed between 424 and 611 calAD, i.e the middle of the fifth to the early seventh centuries CE (RoAMS-625.73: 1527±41BP). This falls within the range of Apostolaki's (1999, 95) dating, based on the typology of the textiles which placed the tunic between the fourth and sixth centuries CE. Bearing in mind that the dating of Egyptian tunics before the sixth century CE was based on woven-in tapestry decorations by Apostolaki (1999, 46) and the radiocarbon 14 dating results, it would be acceptable to date this tunic to the fifth century CE. Radiocarbon dating of the tunic was not very straightforward and had to be repeated. The first test placed it between 1504 and 1396 calBC (RoAMS-569.73: 3169±30BP), which was probably impossible. The reason for this deviation could potentially be attributed to the combination of the poor condition of the find with the presence of synthetic adhesives (polyvinylacetate - PVA) that had impregnated the fibres during the 1970s treatment. It was therefore decided to repeat the analysis, this time subjecting the sample to an advanced pretreatment with more than one solvent (namely hexane/acetone/ethanol) to remove the synthetic adhesive residues. This pretreatment is generally not applied to cellulosic samples straightaway, since it might dramatically reduce the volume of the sample's organic matter, which is crucial for the execution of the analysis (Hajdas et al. 2014).

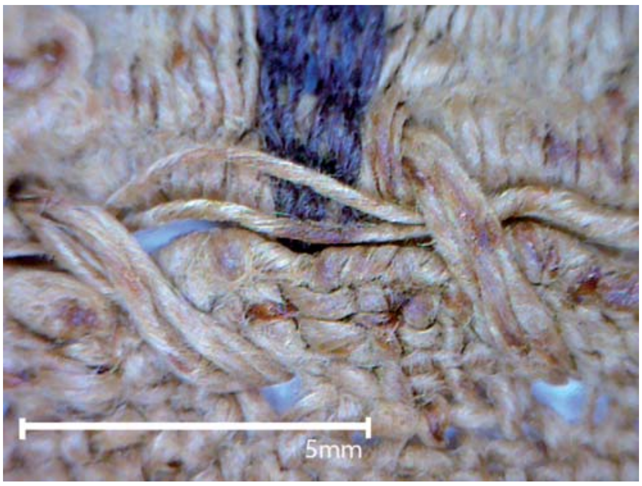

Fig. 7: Detail of the stitching which secures the tapestry decorations on the main fabric (Image: Christina Margariti and Tina Chanialaki)

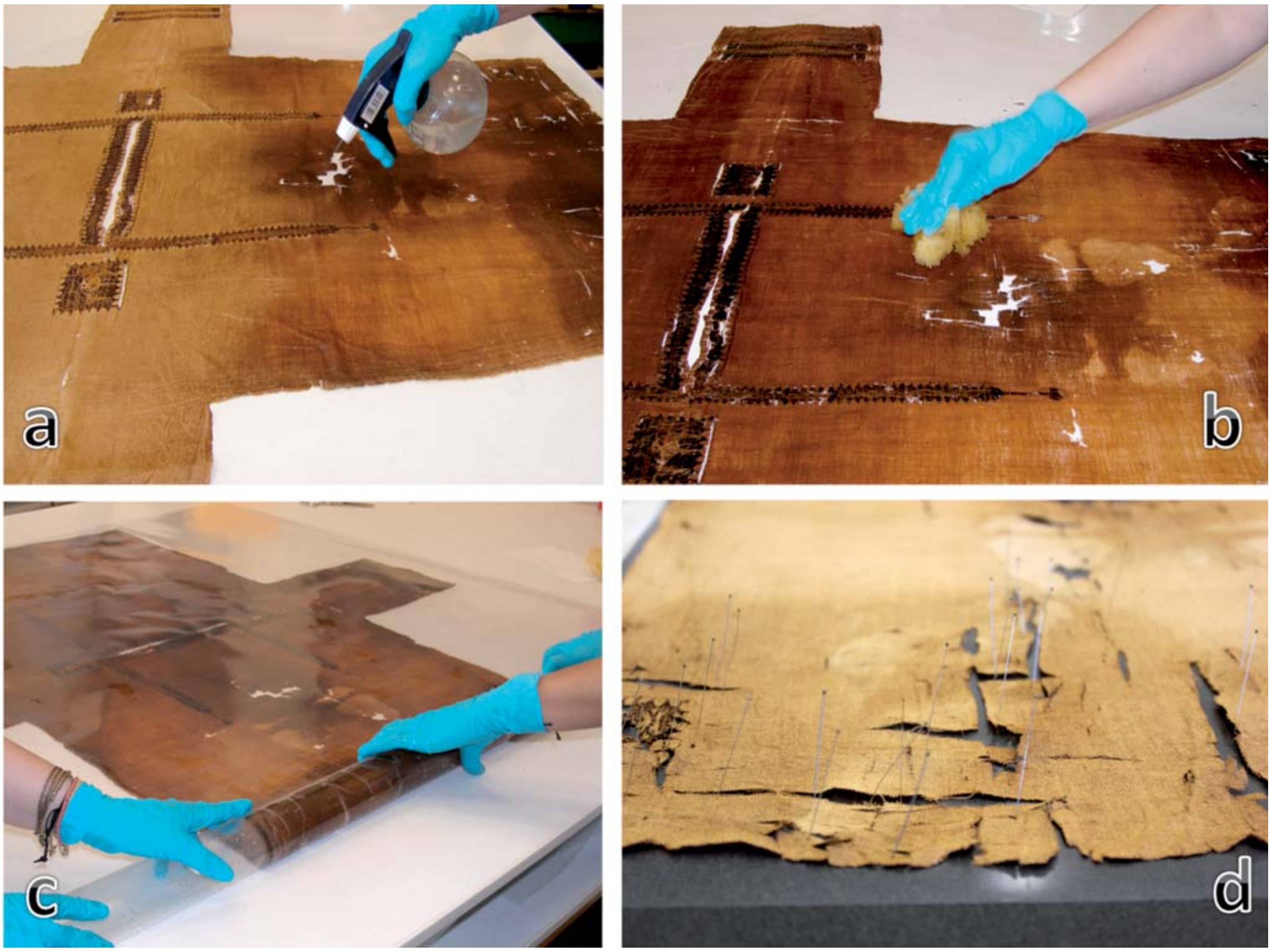

Fig. 8: a) Spraying water on the tunic; b) Blotting excess water with natural sponges; c) Rolling the tunic to turn it upside down; d) Using entomological pins to secure the loose fragments during drying (Images: Christina Margariti and Tina Chanialaki)

Conservation of the tunic

Past interventions and treatment applied

Apostolaki (1999, 3-4) observed perceptively that the finds were cut by the looters and stitched in pieces on different objects. Moreover, in a draft letter, she reports that the museum was "full of moth", and that the Coptic textiles had suffered from this the most (Apostolaki 1926-1932). She also wrote that she wet cleaned them with natural soap and subsequently supported them on new linen fabrics with stitching (Apostolaki 1999, 3-4, 40).

There is no evidence or documentation that the collection was conserved during the following decades but this would have been impossible because the museum was closed and its collection transferred to the safer storages of the National Archaeological Museum during the second world war, where it remained for many years (MMGC 2020). Much later, during the 1970s after the collection had already returned to the MMGC, a trained textile conservator treated the tunic with synthetic adhesive and coarse net and linen supports. This technique was popular in the United States and the United Kingdom from the 1960s (Brooks and Eastop 2011; Hackett and Hillyer 2019; Hillyer 2010, 181). It was described in detail by a senior conservator who witnessed the procedure at the time. First, a coarse synthetic net was sprayed with a polyvinyl acetate adhesive (Mowilith D65) on a glass surface. After drying, the net with the adhesive was ironed onto the reverse of each object (Kavassila 2013). Based on that evidence and the first published image of the tunic (Apostolaki 1999, 45), it was deduced that the tunic lost its three-dimensional shape during the 1970s intervention. The fabric was originally stitched along the sides to give the tunic its three-dimensional shape. When the object was flattened out to receive the adhesive support the stitching was not undone, but the fabric was cut, preserving in this way the original stitching along the front side of the tunic.

Recent conservation of the tunic

Conservation work started with the removal of the modern linen lining, which was achieved mechanically since the adhesive bond had failed. This was followed by mechanical surface cleaning with a low power vacuum. Then, the net lining was removed by deactivation of the synthetic adhesive with solvent. The object was placed on a silicon-coated polyester film (with the reverse side of the object upwards). The silicon release film was used to avoid adhesion of the object to the working surface after reactivation of the adhesive with the solvent. Blotting paper pads cut in 10 x 10 cm squares and impregnated with pro analysis ethanol (purity 99.5% denatured with ≤1% methyl ethyl ketone) were placed on the net for 10 seconds and pressed lightly with glass weights (Timár-Balázsy & Eastop 1998, 324). A 10 x 10 cm area was treated each time, and when the net was successfully removed, treatment progressed to an adjacent area. According to the Teas solubility chart (a triangle diagram of solvents first published by Teas 1968), among the non-toxic solvents, acetone is the one that dissolves polyvinyl acetate adhesives, while ethanol has a borderline dissolution effect (Horie 1997, 198). However, complete dissolution of the adhesive might have driven its molecules deeper into the fibres, the fragile condition of which would not permit sufficient rinsing. In addition, preliminary testing with acetone showed that it affected (melted) the synthetic net used in the past to carry the adhesive. It was therefore decided to apply ethanol that would swell rather than dissolve the adhesive (Timár-Balázsy & Eastop 1998, 324). The selected treatment was very efficient in removing the net easily with limited fibre loss (the majority of which was used as samples for the instrumental analyses described above).

When net and adhesive residue removals were complete, it was revealed that the object was in a fragmentary condition, brittle, and deformed. The application of ethanol probably increased the dessication of the fragile fibres because alcohols are known to form azeotropic mixtures with the bound water molecules within fibres, and extract it during evaporation (Timár-Balázsy & Eastop 1998, 177). It was therefore decided to continue treatment of the tunic with floating/bench solvent and wet cleaning, to ensure further removal of the swollen adhesive (solvent), removal of polar dirt accumulated from the long years of storage (water), humidify the brittle fibres, and move and align the fragments with minimum fibre loss and stress (water) (Bresee 1986; Breeze & Eidelheit 1995; Timár-Balázsy & Eastop 1998, 194, 275). As Apostolaki (1999, 4) documented, the tunic had been wet cleaned before, therefore no ethical issues applied. The process took place with the tunic placed on the laboratory bench rather than immersed in a bath, to avoid mechanical stress of the fragile textile. A mixture of 75:25 ethanol in deionised water was lightly sprayed first on the inside and then on the outside of the tunic and blotted with natural sponges and blotting paper. The mixture was changed to 50:50 ethanol in deionised water for the next two applications and finished with deionised water in the last two. In total, the process was repeated six times, each time turning the textile upside down. It was protected inside with two layers of silicon-coated polyester film (the upper layer always removed during washing) (fig. 8). No surfactants were added to the mixture as bench washing would not allow for sufficient rinsing. When wet cleaning was complete the object was realigned, secured in place with very

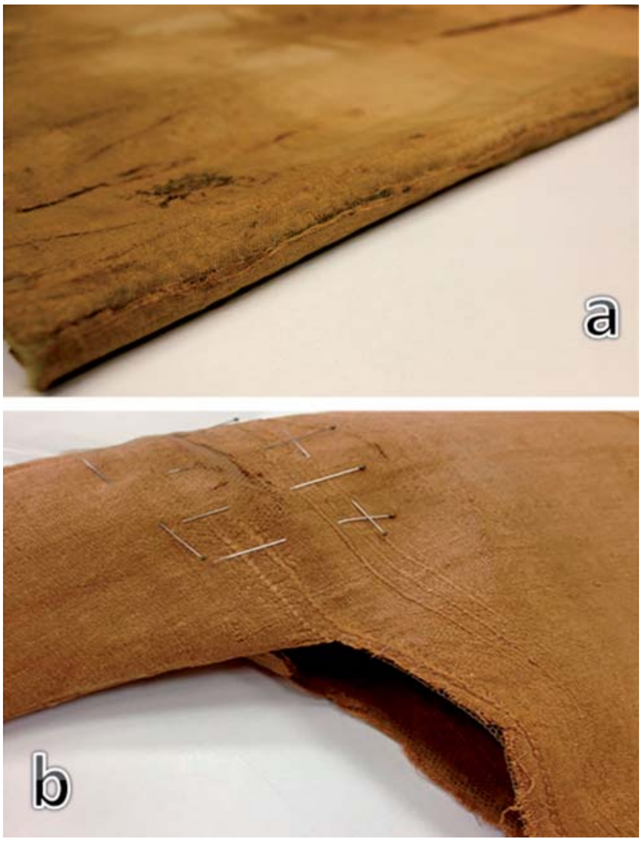

Fig. 9: a) The nylon net was used to stitch the tunic back to its original three-dimensional shape; b) Stitching the sides revealed the underarm openings of the tunic (Images: Christina Margariti and Tina Chanialak)

Fig. 10: a) Side A (possibly the front) of the tunic after conservation; b) Side B (possibly the back) of the tunic after conservation (Images: Andreas Santrouzanos)

fine entomological pins (size 00 and 000) on archival polyethylene foam (Plastazote®), and left to air-dry, locally aided with blown air (using hair dryers on a cold setting). Drying of the object was complete in approximately one hour.

After treatment, the fibres were more relaxed and elastic, i.e. they had regained some of their lost moisture. Colour measurements before and after solvent and wet cleaning were used to evaluate the efficiency of the treatment in successfully removing the old adhesive and dirt by measuring the colour changes with a HACH LANGE spectro-color chromameter using CIE L*a*b* coordinates. These demonstrated that the colour of the tunic became lighter, and that of the main fabric moved to yellow, while the purple decorations moved to the blue and red areas of the colour spectrum. Based on these results, it was considered that a great amount of the discoloured (darkened) adhesive and dirt had been removed.

After cleaning, the missing areas were in-filled with cotton percale sheeting fabric dyed to the appropriate colour in the lab with Solophenyl, Ciba Geigy® dyes. Cotton was chosen for two reasons: first, as it is a lighter fabric than linen it adds less mechanical stress to the fragile object; and second, deeper colour tones can be achieved when dyeing it in a conservation laboratory. In addition, the tunic was fully supported on the inside by stitching on nylon bobbinet with silk monofilament threads, both dyed in the lab with Lanaset, Ciba Geigy® dyes. Full support with nylon bobbinet rather than cotton was selected because it is much lighter and much more elastic than the latter, and to allow future access to the inside of the tunic's main fabric and the reverse of the tapestry elements for further study. An overlay support of nylon bobbinet was placed over the most fragmented, stained area to provide additional support. The full net support was used to return the tunic to its original three-dimensional shape by laid-thread couching that would provide better support than running stitch, using a silk monofilament thread (fig. 9a & fig. 10). This action featured the small size of the tunic, the narrow sleeves and the apertures on the underarms areas (fig. 9b and fig. 10).

An acrylic (Plexiglas®) hollow rod padded with two layers of cotton domette, covered with an undyed silk habutae, with an additional sleeve case made of one layer of cotton domette and covered with dyed-in-the lab silk, were prepared for the future display of the tunic. Finally, the tunic was padded and placed in an acid-free box for storage.

Conclusion

Conservation afforded unrestricted access to sample the object and to perform analyses that provided interesting evidence and information on the construction, material identification and dating of the tunic. Radiocarbon 14 dating had to be repeated twice since the first time the analysis gave totally unexpected results. This was possibly due to a combination of the very poor condition and heavy impregnation of the fibres by synthetic adhesives. On the other hand, despite the presence of the synthetic additives, the procedure used still allowed the dyes to be extracted from the fibres so that analysis was possible. This showed that the purple was obtained by the use of madder and woad or indigo, the well-known procedure for the purple dyeing wool in Egypt. However, little is known about the influence of the impregnation products on dye behavior and dye extraction in general. This emphasises that the influence of previous treatments and interventions have to be taken into account when planning such analyses and interpreting the data. Conservation greatly improved the condition of the brittle fibres and restored the original shape of the object. Viewing the tunic in its three-dimensional form illustrated the staining pattern from the decomposition products of the body, and highlighted the fact that the tunic was made for a child, making the provenance of the object more intelligible to the museum visitor.

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Cultural interconnections: textile craft and burial practices in Early Medieval Sudan

Abstract
This article focuses on a loincloth found in situ on the skeleton of an Early Medieval male buried on the Nubian island of Sai, in northern Sudan, dated to the seventh to ninth centuries BCE. This loincloth differs from most contemporary textile production because it was woven in a triangular form and probably using threads made from dromedary wool. It exhibits several phases of repair and reuse until its burial with the body. This garment therefore illustrates the textile expertise and clothing practices of the ancient Nubians, as well as the cultural role of textiles in funerary rituals.

Keywords: ancient textiles, burial practices, fibres, Early Medieval, Sudan, Nubia, weaving

Introduction

Despite abundant archaeological remains ranging from mounds of ceramic sherds to standing granite columns, little is known about the Medieval period on the Nubian island of Sai (modern Sudan). Often cited as the seat of a bishopric, with at least five bishops known from textual remains, Sai was a strategic location during Medieval times (Łajtar 2006, 92; Hafsaas-Tsakos & Tsakos 2010, 79; Francigny 2017, 538). From the Bronze Age and the Kerma period, it served as a control station on the Nile river. Until recently, the people of the Medieval era there have not been the focus of research. Discoveries were made in conjunction with other remains such as those from the New Kingdom layers in the main settlement or, as in the present case, the excavation of a Meroitic cemetery.

One of the major medieval sites at Sai is a church located to the north of the island and still marked today by four standing columns dominating a cluster of kôms covered with red bricks. Without excavating the site, it has been proposed that this church served as the cathedral of Sai (Vercoutter 1958, 160; Geus 1996, 1188). However, finely carved blocks and capitals as well as a red granite column found in the Ottoman fortress suggest that the cathedral was in fact located in the town and was later dismantled during the Ottoman phase of occupation.

An archaeological survey conducted in 2010 around the island revealed the existence of 26 previously unregistered medieval sites (Hafsaas-Tsakos & Tsakos 2010, 78). Among them, a few seemed to correspond to small churches or religious buildings, and one to a large pottery production area. In most of the cemeteries associated with Christian constructions or settlements, it is possible to see the continuity with older burial areas from the Meroitic and Post-Meroitic periods (circa 350 BCE to 550 CE). This is also the case at site 8-B-5.A, where the loincloth under discussion here was found.

Located to the west of the main ancient and medieval settlement of the island, the site has so far only been investigated for its Meroitic graves. Organised in five rows oriented north-south, with a total of 68 units, these Meroitic graves belong to an elite group whose cemetery was separated from the main necropolis so that it would be visible from the town (Francigny 2014, 799). Originally covered with tall mudbrick pyramids, the graves were used as family vaults over generations and filled with high quality funerary deposits often containing rare, imported goods. In 2010, a series of

Fig. 1: View of grave CH 01 (©Sai Island Archaeological Mission)

unusual intrusive burials were recorded at the surface of several graves. They all consisted of Christian stillborn and child burials placed in the shaft or at the entrance of the graves, either in pots or wrapped in shrouds (Francigny 2010, 56). In contrast to the adult Christian graves that surround the Meroitic cemetery, these child burials were not always oriented east-west with the head to the west. Especially when placed within the Meroitic access ramp, the grave diggers adopted a pragmatic approach rather than a religiously meaningful one, depending on the space available and the nature of the soil.

During the 2011 campaign, the adult medieval burials were also investigated to extend the information known about this unique configuration. It was the first time that such a phenomenon was recorded: an early medieval population gathering their graves around an ancient cemetery and placing their children under the protection of what they saw as their ancestors. The adult graves cover the surface of the site with a different appearance from the Meroitic graves, thanks to the narrow shape of the burial chamber and the total absence of superstructures. The graves are of different types: some have a short access ramp leading to a vaulted chamber built with mudbrick or a lateral niche, while the vast majority are made of a single vertical shaft at the bottom of which the corpse is deposited. In most instances, no construction was made inside the shaft itself, except for rare cases with a mudbrick cover. Otherwise, it is not unusual to find a few bricks around the top of the body, placed there to protect the head. The absence of an empty space created by a cover means that the corpse was buried deep in homogeneous soil that contributed to the exceptional conservation of the human remains and their associated organic material. Almost all the Christian burials in this area seem to be intact, as they contain no valuable material for robbers.

Grave CH 01, where the loincloth was found, was the first in a series of eight medieval adult graves excavated at cemetery 8-B-5.A. It is located in the south-west

Fig. 2: Loincloth in situ on the skeleton (Image: ©Sai Island Archaeological Mission)

corner of the site, in an area heavily disturbed by Ottoman graves. While adult Christian burials carefully avoided the Meroitic monuments and graves, it is clear that during Ottoman times little could be seen of the ancient cemetery, as many Ottoman graves cut through the remains of existing superstructures and substructures. The fact that Christian burials were laid out in a different way gave the impression that they were early enough in date to have still witnessed and understood the organisation of the Meroitic necropolis. This impression was later confirmed by a radiocarbon 14 analysis of the loincloth, placing CH 01 between 649 CE and 879 CE (95.4 % calibrated date)[1]. The garment was found in situ around the corpse of an adult male (fig. 1). The corpse was placed at the bottom of the grave in a supine position, head to the west, with the entire body tied with a bicolour rope.

General presentation

Left undisturbed since its interment with the deceased, the garment itself is fairly well preserved. Its arrangement on the body was readily visible to the excavators, who recorded every detail available before its removal (fig. 2). It survives today as three main fragments (the two upper corners and a large lower part), which are easily reassembled into an elongated triangular shape (fig. 3). While the sides are quite well preserved, the lower point of the triangle is missing. Both its shape and its position on the body show that the textile was woven and used as a loincloth. Unsurprisingly, the garment suffered from its close proximity to the body during decomposition and a large portion of it was destroyed, particularly in the middle area that would have received much of the putrefaction fluids. The remaining textile is brittle and shows several folds, deeply impressed in the fabric, which indicate the original positioning of the pieces and greatly assist the reconstitution and understanding of the complete garment.

It is a triangular wool cloth, woven into shape starting from the upper side and tapering towards the lower point. When complete, it would have measured about 104 cm wide across the upper side and about 127 cm down the longer sides. It is preserved at a maximum length of 113 cm. The method used to create this rare tapering shape remains difficult to ascertain with any degree of certainty, but it involved a pronounced variation in the weave density and a reduction of the warp thread count (see below). The plain weave of the textile (Textile A) shows many damaged areas, demonstrating the long use of the loincloth during the individual's lifetime before its interment as a funeral cloth. The prolonged wear is even illustrated by a mended section, where darning threads fill an area worn out through sitting. A later large patch was applied to the face of the loincloth fabric, effectively covering most of the original garment. Torn from a finer and darker wool textile (Textile B), the patch was secured with crude sewing. The irregular positioning of this later piece, as well as the coarse threads and sewing techniques, could indicate that the patching was done around the time of the funeral and as a final stage of textile reuse and recycling.

The loincloth was worn in the same manner as the pharaonic loincloths often illustrated in Egyptian reliefs and paintings (Vogelsang-Eastwood 1992, 10). However its bigger size implies a looser fit. The garment was positioned along the lower back of the corpse, with the two upper corners wrapped around the waist and knotted at the navel. It has short ties attached to each of the upper corners, presumably used to secure the knot. The long-pointed part was passed through the legs and brought up in front, then tucked under the knot with the free part left hanging at the front. It is not possible to ascertain its exact length or eventual décor because the Sai loincloth is missing its lower point. In any case, the garment would have effectively covered the buttocks and genitals, with extra fabric adding some bulk around

Fig. 3: Overall view of the loincloth (Image: Elsa Yvanez)

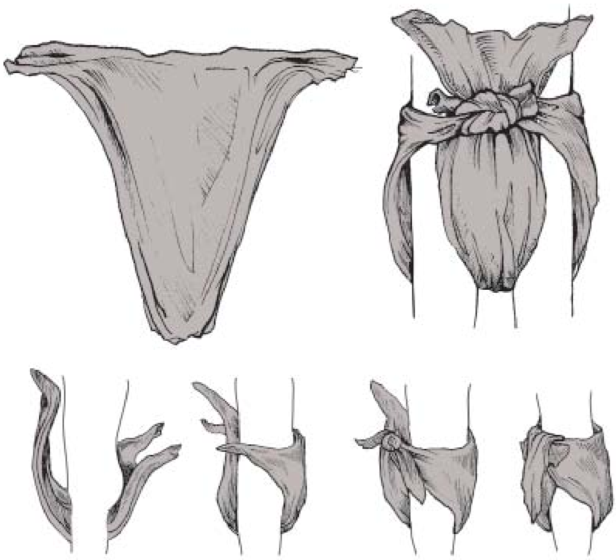


Fig. 4: Reconstitution of the loincloth as worn on the body for the funeral (Image: Kayla Younkin)

the upper thigh area (fig. 4). Either worn by itself or as an undergarment, a loincloth of similar shape is a basic piece of clothing of which there are many ancient examples along the Nile valley. However, this specific piece presents unusual technical characteristics which help to better define the textile production of early medieval Nubia.

Textile analysis of Textile A – loincloth

TEXTILE A. Loincloth	
Dimensions	Fragment 1: L. 57 cm, W. max. 32 cm Fragment 2: L. 26 cm, W. 44 cm Fragment 3: L. 91.5 cm, W. 36 cm (top) and 20 cm (bottom)
Material	Wool (most likely dromedary hair)
Spinning	S-spun, single ply
Weave structure	1/1 tabby weave
Thread count /cm	6 warps x 5 wefts (ground weave), 11 warps x 5 wefts (along the edges)

Table 1: Technical data Textile A

Overview: This nearly complete triangular loincloth retains three portions of intact selvedges. The tapered triangular fabric was woven in a coarse, predominantly balanced tabby weave employing thick wool yarns (table 1). On removal from the burial, the fabric was revealed to have many areas of wear and tear, including fragile and abraded fibres. There are also areas of distended weave due to deterioration.

As mentioned above, some substantial portions of the garment fabric were missing, primarily from the buttocks area where decomposition fluids must have drained after interment and caused decay of the organic material. Irregularities in the weave structure are due to many broken wefts which were repaired with small knots. A few weaving errors were also noted, such as occasional missed shafts. Several wedges, or returning wefts, were also observed in the ground weave (fig. 10).

The tapering triangular shape of the loincloth was created during the weaving process itself. It was accomplished by manipulating the warp and the weft threads at irregular intervals, inducing a reduction in the number of threads used in the ground weave (fig. 10). Augmenting the thread count along the edges also helped in weaving a denser area which made use of the unwanted warps.

The upper border consists of an edge with looped warps, reinforced on four picks (or wefts) by the use of weft pairs instead of single threads. This border is classified as a variant of Type A3, in the *Late Nubian Textiles'* typology (Bergman 1975, 50, fig. 51) (fig. 5a and fig. 5b). The short lower border was not preserved. Along the two long sides, the selvedges are, for the most part, intact – except for one missing area on the left side measuring approximately 30 cm in length. The selvedges are of a simple type C1, not reinforced by the insertion of extra threads or cords. They are, however, strengthened by the weave of a denser, almost warp-faced portion, 1.5 cm wide (fig. 5a). The thread count in this area is 11 warps per cm by 5 wefts per cm. As the weaving progressed, the weaver started adding along the left selvedge extra warp threads in the shed, first using one warp pair, then a second one. The corners of the fabric appear to taper quite drastically at first glance, but this pronounced tapering is due largely to the memory of the fabric as the corners had been pulled tightly to secure a large knot about the waist of the individual. The left corner of the loincloth bears a little knot, tied with several small looped fringes, maybe primarily used as a "button" to fasten the garment. These small fringes are two plied, Z twisted, and are essentially the extremities of the first wefts used in the border. This knot is tied to another small piece of a different fabric in a darker coloured wool. On the right corner, the fabric is tied into a small ball, maintained by two short cords originally meant to be attached to the "button". The cords are made of a very coarse dark animal hair fibre (possibly goat), two plied and Z twisted, with knots at each of the cord extremities. The measurements of the cords are 16.5 cm and 13.5 cm in length.

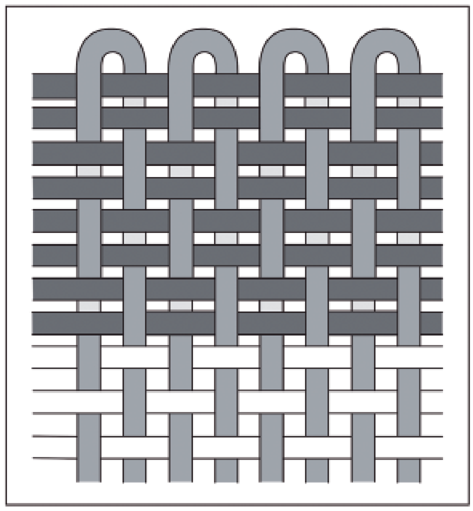


Fig. 5: Textile A: a) Detail of the right corner of the loincloth, showing the starting border, the selvedge and the closing cord. b) Schematic drawing of the starting border (Image: Elsa Yvanez)

Darned area: Below the large reinforcing patch sewn to the seat area of the loincloth, a presumably long expanse of the garment ground fabric had been previously mended. Only portions of the mended area remain, since the centre of the garment has disintegrated, and it is difficult to ascertain the total coverage of this repair. This relatively extensive area of darning exhibits a somewhat crude appearance, and at least three distinct kinds of wool yarns have been used in the mending – a light orange, a thick dark brown, and a finer russet brown (fig. 6). The stitching is very uneven and runs parallel to the deteriorating ground weave. Long runs of darning wefts are inserted into the main weave, including warp and weft returns as well as longer threads passing through the ground weave and knotted in.

Fig. 6: Textile A. Detail of the mended area (Image: Elsa Yvanez)

The main warps and wefts are grouped in an irregular fashion, by two to four, on their own or with extra darning threads.

Fibre analysis: Small samples – portions of thread no greater than a few millimetres in length – were taken from both the loincloth base fabric (Textile A) and from the applied patch (Textile B). Threads from both the warp and weft of these two areas were sampled. Morphological features of longitudinal fibre sections were examined by polarised light microscopy and scanning electron microscopy (SEM). Two reference slides were also examined under the microscope: one sample from modern dromedary hair and another sample from modern sheep wool (microscope slide library, Textile Conservation Lab, American Museum of Natural History, New York). The fibres were first examined with an optical microscope for a preliminary analysis. Because of the extreme desiccation and fragility of the fibres, cross sections and scale casts could not be obtained at this time. They would probably prove inconclusive due to the degraded state of the fibre. Each sample (aside from the previously mounted sample of sheep's wool), was prepared on a slide in Cytoseal 60, a permanent low-viscosity mounting medium with a refractive index of 1.495, and examined under magnifications of 10x, 40x and 100x.

Preliminary observations of the loincloth material revealed certain clear morphological characteristics (fig. 7): the fibre is composed of a wide and continuous medulla contained within the walls of a brown cortex

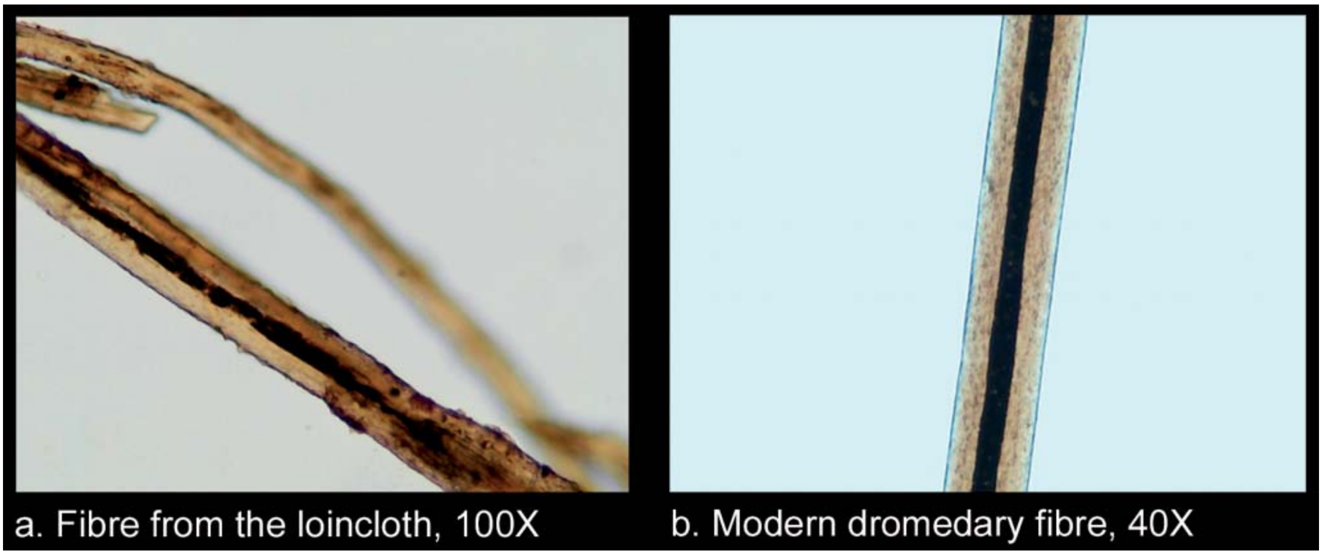


Fig. 7: Micrographs of fibre samples: a) Fibre from the loincloth base fabric (Textile A), at x100 magnification. B) Reference sample of dromedary hair from the Bronx Zoo (New York, US), at x400 magnification (Image: Mary Lou Murillo)

and thin cuticle layer. The deep brown pigmentation follows a linear pattern along the length of the fibre. This general appearance, especially the presence of such a noticeable medulla and the brown pigmentation, is not consistent with sheep wool. However, it is found in modern dromedary hair fibres, both in the standard reference sample and other modern Sudanese camels (Abd Elgader et al. 2017). Both warp and weft threads of the loincloth Textile A exhibit the same fibre characteristics, indicating a homogenous fibre content throughout the weave.

Only faint scale patterns could be perceived on the cuticle of the fibre. This could be due in part to the natural degradation of the archaeological specimen, and in part to its intrinsic qualities. Camel hair is often identified by the lack of relief in its cuticle scales (Fiedler 1979, 49). Where they are better preserved, the loincloth fibres showed a rather smooth appearance, in keeping with the appearance of the fibres from the modern dromedary hair. The slide prepared from the hair of a modern dromedary was a sample of the coarser guard hair (and not the fine underfur or down) of the camel and, in contrast to the loincloth fibre, was unprocessed and unspun. As a reference specimen, despite its modern date and pristine condition, it has nonetheless shown immediate similarities with the loincloth fibres, including the existence of a wide continuous medulla and a deep brown linear pigmentation.

Additional fibre samples were also taken for analysis at the Microscopy and Imaging Laboratory at the American Museum of Natural History (AMNH) in New York (United States) using an EVO60 SEM. The fibres were attached to small pin stub specimen mounts with double-coated carbon conductive tabs, and then sputter-coated using a gold palladium alloy to promote conductivity. The stubs were then analysed under SEM which permitted the collection of data for three specimens: fibre from the loincloth base fabric (Textile A), fibre from the applied patch (Textile B), and fibre from the modern dromedary guard hair (fig. 9).

Even under high magnification, the loincloth fibres appear very degraded (fig. 9b). The cuticular scale pattern is almost non-existent, with a blurred outline, in contrast to the imbricate pattern visible on modern dromedary hair (fig. 9a). However, it is consistent with the degraded archaeological samples taken from several textiles from Ballana and Qustul and previously identified as dromedary (Fiedler 1979, 51). By comparison, even degraded sheep wool from the same sites show more pronounced scales.

Measurements taken on the SEM photographs show archaeological fibres with a diameter of about 22 μm, versus modern dromedary fibres with a diameter of 50 μm to 80 μm. The fibre loss experienced by the archaeological specimen, as well as the differences between fine and coarse camel wool, may explain this discrepancy. Generally, fine camel wool fibres have a range of 5 μm to 22 μm, while coarser fibres measure an average of 40 μm. Modern sheep wool on the other hand presents a range of 10 μm to 70 μm (Fiedler 1979, 49).

On the basis of measurements and longitudinal morphology, it is therefore impossible to positively identify the origin of the loincloth fibres. The degraded state of the loincloth's fibres impedes identification. However, a network of evidence based on morphological traits and comparisons with other modern and archaeological samples point to dromedary as a likely source (for a general description of dromedary wool in archaeological textiles, see Rast-Eicher 2016, 223-224).

Textile analysis of Textile B – The patch

TEXTILE B. Mending patch applied to the seat area of the loincloth	
Dimensions	L. 21 cm, W. max. 12 cm
Material	Wool, sheep (?)
Spinning	S-spun, single ply
Weave structure	1/1 tabby weave, weft dominant, weft patterning
Thread count /cm	10 warps x 17 wefts

Table 2: Technical data Textile B

Overview: The large rectangular patch (fig. 8) was torn from a different, recycled textile and laid on top of the loincloth ground weave without much care. The abraded and torn sides of the patch were folded in, while the preserved original selvedge and edge were simply laid on before sewing. This patch was most likely applied to reinforce or hide the damaged seat area. The large darned area repaired with polychrome yarn is located precisely beneath it. It is attached by crude sewing with uneven running stitches of coarse animal hair, which could suggest a hasty modification of the loincloth, perhaps just prior to burial.
The patch itself is woven with a much finer wool than the loincloth, in a balanced 1/1 tabby weave with a higher thread density (table 2). It is primarily weft-dominant, with slightly thicker threads in the warp than the weft. It was woven with reinforced selvedges, type C2, using three cords of two, four, and four threads each. In its present state, it is impossible to determine if the preserved edge is the lower or upper edge of the original piece. It seems to be of type B7, with looped warp threads assembled in a flat braid (Bergman 1975, 50, fig. 51).
The fabric was decorated along its borders, approximately 4 cm from the edge, with a cross-stripe of beige or light yellow thinner wefts. Woven in a weft-faced technique, the light threads draw three thin lines: two beige picks, two brown picks, eight/nine beige picks, two brown picks, two beige picks. About 13 cm from the edge, three picks of patterned weft pairs also form a discrete horizontal line. The threads have a thicker diameter than the ones used in the ground weave and are going over/under groups of two to four warps in an irregular fashion, creating short areas of floating wefts (*crapautage*). The wool used for this decoration is of a slightly darker colour.

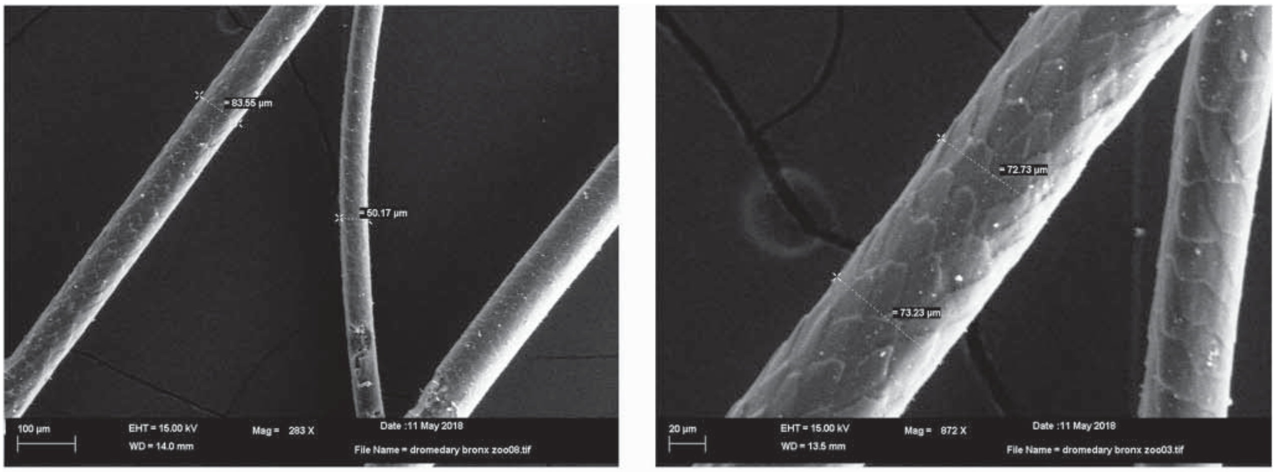
Fig. 8: Detail of Textile Bn the fabric used for the mending patch, showing the light colour stripe and the crude stitching (Image: Elsa Yvanez)

Fibre analysis: The fibre sample taken from the patch was especially degraded and contaminated by exogenous agents, which made analysis very difficult. An informal and preliminary observation showed that the overall look of these fibres was very different from that of the base loincloth fabric, and certainly different from the modern dromedary fibre (fig. 9c). The fibres have a jagged or rough appearance, perhaps the result of deterioration of more pronounced, imbricate, and coronal scales of sheep fibre cuticles. In that regard, it more readily matched the modern sheep's wool slide. The fibres have a diameter range of 14 µm to 16 µm, consistent with the average measurement of 20 µm registered for modern sheep fibre. For these reasons, it is possible that the patch is made from sheep's wool.

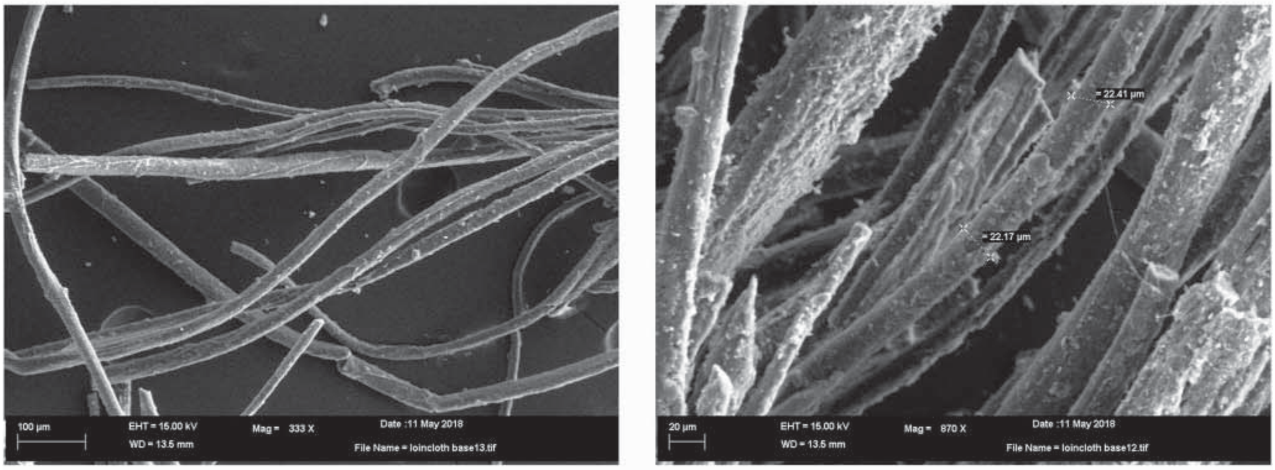
Discussion

Dromedary fibres

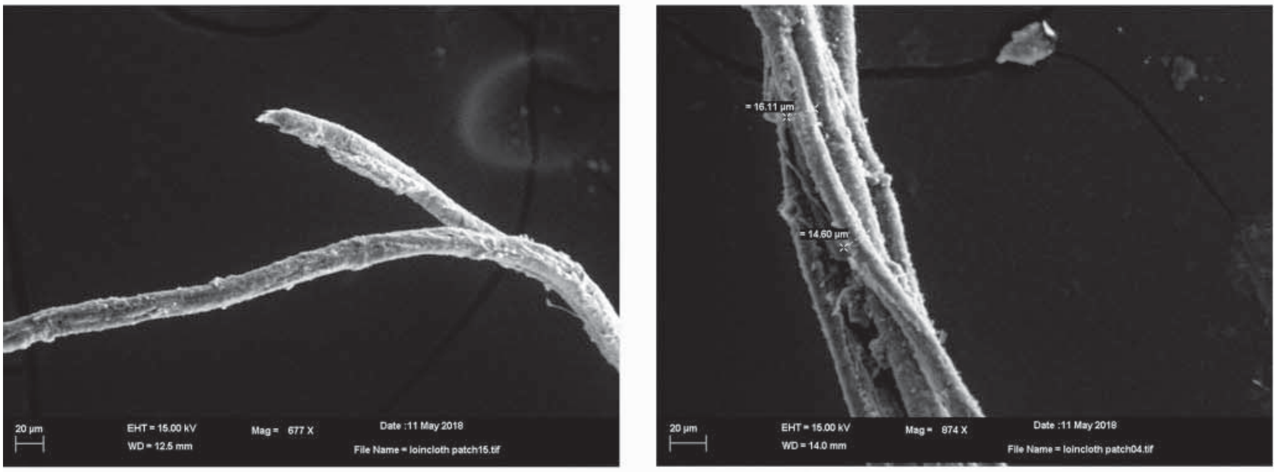
In Sudan and Nubia, the first remains demonstrating the presence of camels (*camelus dromedarius* L.) along the Nile are dated to the Napatan period and were found in an area adjacent to the Taharqa temple in Qasr Ibrim from the late ninth to early eighth centuries BCE (Rowley-Conwy 1988). First attested by animal droppings and bone remains, camels continued to be exploited through the Meroitic period, when their use was first noted as wool conveyors from 350 BCE to 350 CE (Chaix 2010). Among the hundreds of wool textiles discovered on Late Meroitic sites, about 30



a. Modern reference sample, dromedary hair from the Bronx Zoo, magnification 203X and 872X.



b. Sample from the loincloth ground fabric, magnification 333x and 870x.



c. Sample from the patch fabric, magnification 677X and 874X.

Fig. 9: Electron micrographs of fibre samples from modern dromedary fibres and archaeological Textiles A and B (Image: Mary Lou Murillo and Anibal Rodriguez)

occurrences have been securely identified as camel hair during systematic fibre identification projects (see below). Many others may appear as more material is subjected to analysis. Camel wool is particularly well attested in Lower Nubia: in Ballana, Qustul, Debeira, Abka, Ashkeit and Serra East (Bergman 1975, 12; Mayer-Thurman 1979, 10-12). The sites along the Scandinavian Joint Expedition concession have proved especially rich in ancient textiles, many of which were woven with dromedary wool. This type of fibre is not restricted to this area, as it was also recognised in the fourth cataract region, at Kassinger Bahri (Maik 2007, 101). Dromedary fibres were generally used to weave simple rectangular fabrics used as large tunics and mantles which were reused as shrouds. It also appears in furnishing pieces, such as a polychrome pile weave blanket and an elaborate tapestry showing rows of lotus flowers and palmettes (Bergman 1975, 68, 81, plate 71.1 & plate 73). The large Lower Nubian collections of extant textiles show that the use of wool increased through time from the Late Meroitic period, and the use of plant fibres declined, until wool represented the majority of raw material for textile production (Yvanez & Wozniak 2019). The use of camel wool seems to have followed this development and was particularly important during the Post-Meroitic period (circa 350 BCE to 550 CE), a time when the animal must have been essential to the expansion of trading networks. They also played an essential role in the construction of royal power – both material and symbolic – as shown by the numerous camels interred with the Post-Meroitic sovereigns at Ballana (Lenoble 1994). Camels probably remained just as significant during the following medieval period, enabling communications and exchange between the Nubians and their neighbours. The suggested identification of dromedary wool in the Sai loincloth illustrates another aspect of animal exploitation in early medieval Nubia, making it a key component of the local population's resources.

Weaving techniques

Besides the remarkable in situ preservation of its raw material, the main characteristic of the Sai loincloth is its weaving technique. Making a garment generally involves one of two processes: either tailoring large fabric into a shaped garment by cutting and sewing it, or directly weaving the garment into shape, meaning that the shape and dimensions of the garment are created at the very beginning of the weaving project and implemented through the weaving process. In ancient Sudan and Nubia, most garments were of this latter type, mainly consisting of rectangular fabrics wrapped around the body, as a dress or a mantle, or folded and assembled into a tunic. This technique was economical, efficient, and required very little or no sewing at all. The Sai loincloth was directly woven into a triangular shape, thereby following a more complex weaving process. This single fact, apparently mundane for anyone unfamiliar with textile making, sets this garment apart from the general production. It required a different method than the ones used for pharaonic loincloths, which were assembled from two cut triangles sewn down the middle and hemmed, and the Meroitic loincloths, which were cut into a scalloped shape and hemmed. It also relied on specific weaving techniques, and possibly on a specific type of loom.

The key challenge is to find a way to reduce the width of the cloth as it is being created in order to achieve a triangular-shaped fabric on a loom. The Sai loincloth goes from an estimated 104 cm wide along the upper edge to a mere 22 cm at the preserved bottom of the lower part. The width would have presumably continued to decrease until the fabric finished in a point. Several methods were known in the ancient world which might achieve this effect but none of them seems to perfectly apply to the Nubian specimen (Granger-Taylor 1982). On the contrary, it seems that a range of different techniques was used on the same cloth to dramatically reduce its width. The first notable method was to decrease the actual number of warps used across the fabric. There are an estimated 350 to 400 warp threads at least used along the starting border, but there are only 159 warp threads in the bottom part. This drastic diminution in number would automatically narrow the web. It is difficult to understand how this reduction was achieved. Several areas of the cloth show returning warp threads, which instead of running down the full length of the fabric were purposely turned back into the weave, forming discreet wedges as they did (fig. 10). Where these threads went and how they were stopped or even maintained in tension on the loom is not known, but the use of a set of subsidiary rods is possible. The returning warps do not form a regular pattern and are always associated with a number of returning wefts. They seem to intervene every 15 cm to 20 cm or so, and concentrate on areas along the side edges. However, one point is clear: the triangular shape was intentional from the very beginning of the weaving, while building the starting border and laying-out the warp threads on the loom. The second technique used to decrease the width of the cloth was to introduce a variation in the density of the weave, since a textile with spaced-out warp threads would be larger than one with dense

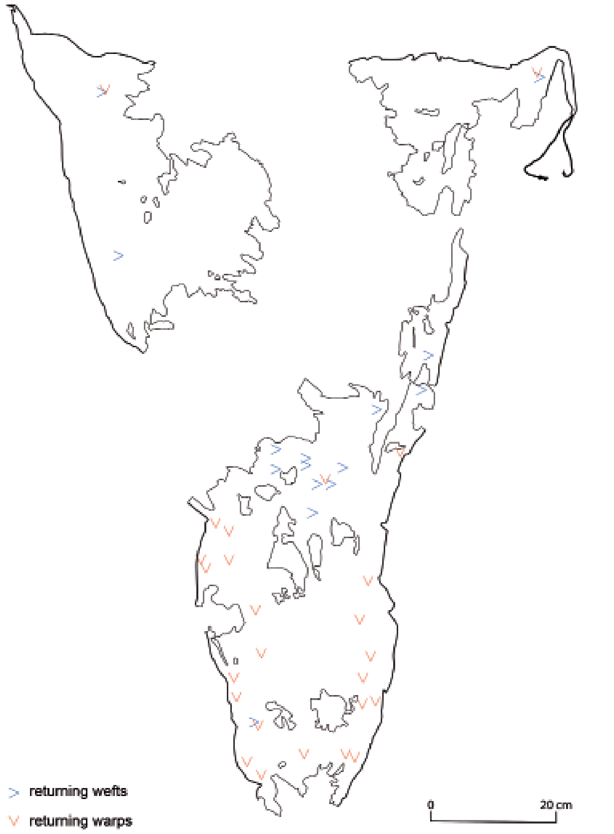


Fig. 10: Diagram showing the broken wefts, and the returning wefts and warps (Image: Elsa Yvanez)

warp threads. Unfortunately, the prolonged use of the Sai loincloth, as well as its degraded state, produced many post-weaving variations, such as areas of very distended weave in the middle of the garment. Where the structure is well preserved, it appears that the density of the warp threads is much higher along the side edges than in the central part of the weave. It goes from 6 warps per cm at the centre to 11 warps per cm closer to the edges. The tabby weave even becomes completely warp-faced for 1.5 cm along the selvedge, notably reinforcing the edges. It is highly probable that these two portions of warp-faced weave, on both sides of the triangle, were used to “push away” the unwanted warps, thereby creating a tapered shape while keeping a consistent weave density in the main body of the garment.

As the study progressed, it became difficult to envisage how these different processes could have been implemented on the warp-weighted loom, the weaving tool of choice during the previous Meroitic and Post-Meroitic periods (Wild 2011; Yvanez 2015). Despite the broad versatility of this tool, laying-out all the warps according to a triangular shape seems particularly arduous when using a set of the large pear-shaped clay loom weights known in Nubia, let alone while maintaining a constant and regular tension throughout weaving. The use of fixed warp bars appears better suited for the task, especially to attach the diagonal selvedge threads that keep clearly-defined edges to the piece. The horizontal loom, known in the Nile valley for millennia, or the two-beam vertical loom, seem more logical candidates. The use of one of these two looms is further illustrated by the starting border, in which warp threads appear to be regularly grouped every centimetre or so where the leashes would have been passed to attach the fabric to the beam (Vogelsang-Eastwood & Kemp 2001, 108, 324-333). No archaeological traces of the horizontal ground loom or the vertical two-beam loom have been identified so far in ancient Sudan because of their wooden construction and their temporary character. If this hypothesis is confirmed, the loincloth from Sai would offer a welcome addition to the body of knowledge about local textile craft, by attesting specific expertise about loom types and a particular item of clothing.

Comparisons with other loincloths from Nubia

The loincloth from Sai does not follow the same construction methods as its many pharaonic counterparts, which were using two cut triangular panels sewn together and hemmed. It cannot be related either to Meroitic specimens, since these garments were also cut and sewn to shape, albeit from one single piece of fabric. It has a better match to three similar textiles discovered in different Nubian sites: Ashkeit (Bergman 1975, 23-25, 76-77, fig. 12-13, Bergman 1988, 31-32, fig. 5-6), Qustul (Mayer-Thurman & Williams 1979, 142, number 178) and Kulubnarti (Adams and Adams 1998, 53, plate 9A-B).

The piece excavated in the cemetery of Ashkeit was found in situ around the hips of a mature individual of undetermined gender, lying in the grave in a supine position. It has the same triangular shape, the same types of starting border and selvedge, and is made in the same woven-to-shape technique with returning warps. Found in a cemetery in use for a long period between about 350 CE and 600 CE (Bergman 1975, 76-77), the cloth has been dated to the Late Meroitic to the Post-Meroitic period (around 300 CE to 400 CE). In view of the other examples, it might be safer to attribute it to a later Post-Meroitic/ Early Christian phase (around 500 CE to 650 CE). It is interesting to note that this loincloth was woven with dromedary wool, as were many other specimens found by the same team along the Scandinavian Joint

Expedition concession in Lower Nubia. It illustrates the important role played by dromedaries in the pastoral economy of the region from Late Antiquity onwards (Bergman 1975, 12). Another loincloth discovered in an early Christian grave at Qustul shows the same use and technical characteristics as well as being found in a similar funerary context. The ground weave displays few differences from the Sai and Ashkeit pieces, with the use of a weft-faced tabby weave and the creation of a reinforced corded selvedge along the two long sides. It is made of wool of an unidentified species. The Kulubnarti specimen is also a wool loincloth with a tapered shape, but its general aspect is much narrower than the previous examples, with an elongated trapezoidal shape. Its good preservation provides the opportunity to observe a fine fabric woven with reinforced corded selvedges and finished by ornamental twining and fringes. These would have been left hanging over the knot of the garment, decorating the mid-section or upper-thigh areas of the body. Another textile with a tapered shape finished with fringes was also found by the Scandinavian Joint Expedition in Abka, in a Post-Meroitic grave, indicating a possible recurrence of this type of ornamentation along the finishing border of tapered textiles (Bergman 1975, 25-26, 84). This piece, in weft-faced tabby weave, was also decorated with thin red, yellow, blue and brown horizontal stripes. Its context of use and discovery was unfortunately not as well preserved as in the other cases, since this fragment was found in a disturbed multiple burial. A fifth triangular loincloth was also reported from the early medieval levels of Qasr Ibrim, but its weaving technique is not reported (Adams & Adams 2010, 168). This piece is surprisingly made of cotton, a fibre that ceased to be used on a large scale in Nubia some time during the Post-Meroitic period. Evidence suggests that it remained in use in Qasr Ibrim only (Yvanez & Wozniak 2019).

This small body of evidence, especially the three well-preserved triangular loincloths from Sai, Ashkeit and Qustul, confirms the creation of a specific type of wool loincloth at the end of the Post-Meroitic period (circa 500 CE), thanks to new weaving techniques. Thus far, this particular weave-into-shape method remains unique along the Nile valley and has its roots in the expertise of local Nubian weavers. The juxtaposition of dromedary fibre and the probable use of the ground loom point to the integration of relatively new pastoral practices and craft technologies in the local Nubian culture of the time.

The cultural link between the use of a ground loom and nomadic populations is quite well attested in the Maghreb/Mashreq areas, along the Nile valley and in Arabia, where textile crafts also rely extensively on wool from dromedaries. The ground loom, a light and temporary structure, which is easy to install, operate and dismantle, is particularly well suited to nomadic life (for Sudanese examples of ground-loom weaving, see Crowfoot 1921). However, the use of dromedary wool with the ground loom need not to be exclusively related to nomadism. In the case of the Nile valley, it seems that these two phenomena were embedded in the daily life of the sedentary population.

Comparisons with other burials

As a product of different weaving methods, the Sai loincloth illustrates the transformations in textile craftsmanship in Nubia at the end of the Post-Meroitic period and the beginning of the Medieval era. Besides its technical attributes, the garment also provides an interesting glimpse into the Christian burial customs on Sai Island. The man buried in his loincloth was laid in a supine position in a rectangular shaft oriented east-west, with his arms along his chest, his hands on his pelvis, and his legs closed. Despite the good preservation of organic remains in the grave, no trace of other fabric was found. The body was maintained in a tight position thanks to a network of bi-colour ropes, knotted in a criss-cross pattern from head to toe (fig. 1).

This suggests that the loincloth was the sole covering of the deceased, who was not wrapped in a shroud. That fact alone distinguishes this inhumation from the burial rites observed in other medieval graves on Sai Island. Several undisturbed Christian graves have also been excavated in cemetery SN, where many of the bodies were found wrapped in shrouds (Geus et al. 1995). Some shrouds wrapped the body from the midsection to the legs, with the arms crossed over the pelvis and the head bare. Other larger sheets entirely enveloped the body from head to toe. In some cases, the textiles were maintained in place with a network of knotted black strings. A particularly well-preserved inhumation of a young child even shows the complex wrapping method of a specifically designed shroud, intended to secure the body in a crouched position with the head leaning toward the thorax (Peressinotto et al. 2001). The hyperflexion of the cervical rachis is a recurring trait of Christian burial practices in this cemetery. No such complexity of taphonomic process is visible in tomb CH 01 in cemetery 8-B-5.A. The deceased is not wrapped in a shroud but is wearing a garment, probably his own loincloth reused for his funeral. From the body position to the context of the loincloth, the same can be said for the burials at Ashkeit and Qustul (Bergman 1975, 76; Mayer-Thurman & Williams 1979, 142).

Conclusion

This specific type of loincloth seems to correlate with different burial customs in which the body of the deceased was visible during the funeral. This approach to funerary rites implies deeply grounded differences in body acculturation processes, suggesting the negotiation of cultural, social, or ethnic identity. The data remains insufficient to justify this difference. Could it correspond to a particular time period or population group? It is hoped that further study of medieval cemeteries and funerary textiles will refine our understanding of this clothing item as well as its associated burial customs.

[1] **Abstract from the radiocarbon dating report:**
The date is uncalibrated in radiocarbon years BP (Before Present – AD 1950) using the half life of 5568 years. Isotopic fractionation has been corrected for using the measured δ13 C values measured on the AMS. The quoted δ13 C values are measured independently on a stable isotope mass spectrometer (to ± 0.3 per mil relative the VPDB. Bronk Ramsey et al., 2004; Bronk Ramsey et al., 2002). The calibrated ranges have been generated using the Oxcal computer program (v. 4.2) of Bronk Ramsey, using the 'INTCAL09' dataset (Reimer et al. 2009).
Analysis performed by Haley Sula, University of Oxford Radiocarbon Acceleration Unit.

OxA Sai Island, Sudan SAI/ 001	Material textile	δ^{13} C 18.00	Date 1290 ± 60 95.4% probability 649 - 878 calAD (95.4%)

Acknowledgments

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Medieval Nubia:
a contribution to the study of textiles from Meinarti

Abstract
An examination of textile finds from Meinarti led to a new identification of pieces of textile, including fragments of furnishing textiles, most likely carpets, previously unnoticed in the assemblage. This new evidence expands the available knowledge about textiles for furniture in medieval Nubia. The article describes the technical features of the fabrics and discusses their potential social and economic value in the archaeological context and during the specific historical period of the site.

Keywords Nubia, furnishing textiles, wool, kilim, twining, nomads

Introduction
Nubian rulers were converted to the Christian faith after two Byzantine missions visited them in the first half of the sixth century (Vantini 1975, 7-28; Kirwan 1937, 289-295; 1980, 134-139; Monneret de Villard 1938, 66; Richter 2002; Welsby 2002, 31-34). At that time, the territory between the Second and Sixth Cataract of the Nile was divided into three kingdoms: Nobadia, Makuria and Alwa. The mission sent out by empress Theodora (527 to 548 CE) led by the monophysite priest Julian arrived first in Nobadia and few years later in Alwa, while a concurrent mission sent by emperor Justinian (527 to 565 CE), bringing the melkite faith, reached the kingdom of Makuria.
After a century, the Christian kingdoms of Nubia faced the Arab conquest: in 651 to 652 CE a great battle took place in the Makurite capital, Dongola. Later, medieval writers described the great ability of Nubian archers, who sent arrows directly into the eyes of the Muslim soldiers. At the end of the battle, a non-aggression treaty, called *baqt*, was concluded between the Egyptians and Nubians. This treaty stipulated the exchange of slaves for cereals, wine, horses and textiles and also regulated the circulation of people and trade goods between Nubia and Egypt (Plumley 1975, 241-245).
At some point between the end of the seventh century and the beginning of the eighth century, Nobadia and Makuria merged into one great kingdom. In that new configuration, the territory of Nobadia was supervised by a royal representative called an *eparch*, who was in charge of the annual delivery of slaves to Egypt and controlled the trade traffic. No merchant was allowed to go further than the Second Cataract (Vantini 1975, 603-604; Seignobos 2010).
Meinarti – "the island of [saint] Michael" in Old Nubian (Crowfoot 1927, 145) – is located immediately north of the Second Cataract, circa 350 km upriver from Philae (fig. 1). The site, a large *kom* 175 m long and 95 m wide, was variously occupied from the third century to 1500 CE. During the period under consideration, Meinarti played an important role in the Nubian trade control policy. In the medieval written sources, the island was described as a control point for traffic on the river and also as the occasional residence of the eparch of Nobadia (Vantini 1975, 540, 680). In fact, it was the southernmost place of the district under the eparch's jurisdiction.
The excavations at Meinarti were conducted by anthropologist and archaeologist William Y. Adams (University of Kentucky) from 1963 to 1964 for the Sudan Government Antiquities Service and under the

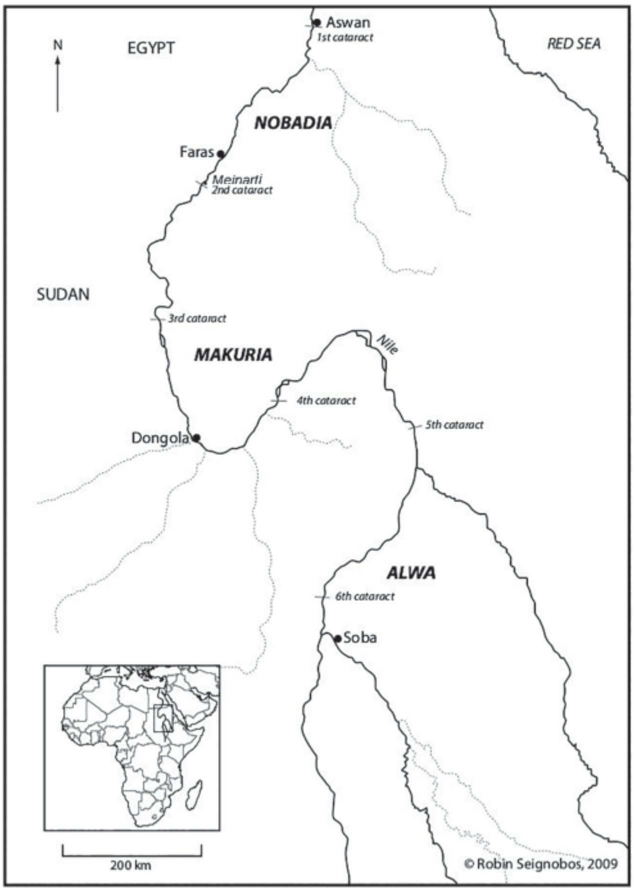

Fig. 1: Map of the medieval kingdoms of Nubia (Image: © and courtesy of Robin Seignobos)

auspices of UNESCO as part of the emergency Nubian Campaign. In such circumstances, Adams chose to explore only half of the mound from top to bottom and succeeded in registering all the occupation levels of the town. He identified 18 levels which he related to six phases. Between each phase he noticed traces of flood damage or destruction, which implied partial or total rebuilding (Adams 2001, 2002, 2003).

The textiles are mostly wool tabbies and weft-faced tabbies decorated with colour bands (blue and/or red) and range from coarse to fine. Tabbies are here considered coarse quality when both warp and weft are fewer than 10 threads/cm, medium quality when warp and weft are from 10 to 20 threads/cm and fine quality when warp and weft number more than to 20 threads/cm. In weft-faced tabbies, it is the number of weft threads/cm which is the determinant: for fewer than 10 wefts/cm the quality is coarse, between 10 and 20 wefts/cm the quality is medium and more than 20 wefts/cm the quality is fine. All the textiles were retrieved from Level 5b with the exception of two pieces. Textile inventory number 18123 was found in Level 6, subphase 5a and textile inventory 18135 was recovered from Level 5, subphase 5c.

This level was dated to the 13th century CE, more precisely to between 1285 and 1286 CE when an Egyptian raid was conducted in Nubia by the emir ʼAlamaddin Sanjar al-Masruri, governor of Cairo and the emir ʼIzzaddin al-Kurani. The Egyptian historian Maqrīzī compiled a description of this invasion of the country of the Nuba by the Egyptian armies of Sultan Qalāwūn: "When the army arrived at the frontier of Nubia, King Simamun ordered that the country should be evacuated. He was very brave. He sent a messenger to Jorais, his agent in the island of Mika'il and the district of Daw – the lord of that province was known among the Nubians under the name of Sahib al-Jabal – and ordered him to evacuate the country under his jurisdiction" (Vantini 1975, 683-685).

How did the eparch organise the evacuation of the country? Did the inhabitants of Meinarti have time to secure their goods before leaving the town? Or did they flee their houses hastily abandoning all their belongings? As far as the administrative building is concerned, at least two caches were found by Adams' team, which attest to an attempt to prevent some valuable items – mainly pottery – from being plundered by the Egyptian soldiers. Unfortunately, it seems that none of the people involved in hiding them had the opportunity to come back after the raid to retrieve the objects. As some pottery was secured in the eparch's complex, probably because it was difficult to transport, it is reasonable to assume that precious textiles may have been taken away by the eparch's people. Unlike ceramics, fabrics do not break easily, and are lighter and easier to load for transportation. It is also possible that such textiles were found and taken by the Egyptians. The textile fragments found in Meinarti were mostly torn rags, which were used for secondary purposes such as wrappings. This explains why there were not taken away by Meinarti inhabitants or by the Egyptian soldiers.

The textiles' exact provenance was not always recorded but almost all the fragments were unearthed within the area labelled "Building II-III" (Adams 2002, 88). This huge building, located in the southern part of the village, consisted of three large open courtyards which were progressively "subdivided into whole series of interior suites" (Adams 2002, 32). Additional suites were also built at the northern, western and southern parts of this unique building. Adams identified this place as the "eparchal complex". He considered suites C, E and F components of a "public sector", used by the eparch to host his visitors and conduct negotiations while goods were probably stored in suites A, B and D. The outer suites may have served for the residence of the eparch's retinue. The fragmentary textile finds were scattered around the area of Building II-III (potentially the "public sector" or "private suites"). Two pieces were found in caches, where they were probably used as wrappers.

Re-examination of the textile material from Meinarti

The textiles were studied by Nettie K. Adams and published in the third Meinarti volume, dedicated to the Late and Terminal Christian Phases of the site (Adams 2002). It is important to point out that the observations were made directly in the field, under very difficult conditions and without appropriate equipment (N.K. Adams, pers. comm.). Adams wrote several chapters in the volumes edited by her husband, W.Y. Adams, who did not have the opportunity to return to the material before publication. However, in a short but valuable chapter, she describes the textile material from the Phase 5 levels, giving, when possible, the provenance of various fragments and relevant technical data for 22 items including weave, fibre, spin direction of the warp and weft as well as descriptions of the patterns and colours (Adams 2002, table 9). The textiles are tabby or weft-faced tabby weave. Wool and linen fibres dominate but cotton and silk were also identified. The most popular pattern is band decoration.

During a recent study visit to the Sudan National Museum in Khartoum, in 2017, there was an opportunity to examine medieval textiles and tools relevant to textile production in the museum's storerooms. In contrast to Adams' facilities in 1964, the team included a textile conservator, quite good lighting, and a digital microscope which permitted a more careful and precise examination of the Meinarti textiles. A detailed observation of the finds identified, in some cases, several textile objects with the same inventory number. As a result, the Meinarti textile corpus numbers 29 woven textiles and one braid (table 1). Weft-faced tabbies and balanced tabbies are still the most common weaves (there are 25). However, examination of the fibres by microscopic magnification (x200) identified features which were less consistent with former conclusions. Almost all textiles appeared to be wool. Only one piece was positively identified as linen; three others as bast fibres; and one as silk. No cotton fibres have been identified so far.

In this assemblage, three textiles present interesting features, which were apparently unnoticed before. One is the textile originally registered as number 145 (which is now inventory number 18135). It was published as a richly decorated "woollen [*sic*] robe" woven in a weft-faced tabby. However, it is made in slit-tapestry, also called kilim. The two other textiles – a fragment of pile-weave and a thick fabric fragment made in a weft-twining technique – were found in a box labelled inventory number 18130 (which primarily corresponds to textiles registered in the field under number 370).

Textile inventory number 18135

There are more than 50 preserved pieces of this fabric found in Meinarti. These include its two edges (the right and left sides of the textile) but the fringes usually left on the extremities of the transverse edges are not preserved. Warps and wefts of the fabric are made of wool. The density of the fabric is 7 warp threads/cm and 32 weft threads/cm. The fabric has a close "tight" weave. The cream-coloured warp is Z2s-plied; the weft is Z-spun. The decoration is woven in slit-tapestry. The decoration displays a rich palette: blue, dark blue, yellow, cream-coloured, orange and green. Textiles are very sensitive to light, which can quickly cause the dye to fade. Exposure to light also breaks down the chemical structure of textile fibres, making them weak and brittle. The fabric from Meinarti underwent physical damage (it is cracked, dried, and fragmented) but the dyes did not undergo significant degradation and decolourisation - the colours are still intense. The decoration is composed of colourful bands in blue, green, orange, yellow and dark blue on a dark red ground. Almost every band displays a different ornamental motif, mostly in geometrical designs but also with stylised floral elements. Both the technical and decorative features of this textile suggest it as a kilim.

Some definitions of kilim indicate a fabric woven by nomadic Islamic communities from Anatolia, Iran and the Caucasus: "Flat-woven covering or hanging, produced in Islamic lands of central Asia, the Middle East, the Balkans and north Africa. Most were produced in nomadic or village setting on horizontal or vertical looms" (Campbell 2006, 386). However, kilims were produced long before the Islamic period and in various areas. The oldest fragment of a fabric woven in kilim technique was found in Qatna, Tell Mishrife, Syria, and dates from the second half of the second millennium BCE (James et al. 2009, 1112-1113 & fig. 3a to fig. 3c). This technique also characterises one of the fabrics discovered in Gordion, a Phrygian city near modern day Ankara in Anatolia, dated between the tenth and ninth century BCE (Gaspa 2018, 75). Here the term kilim refers to a textile produced by tightly interweaving the warp and weft to produce a flat

	SNM inventory number (+ excavation number)	Provenance	Weave type	Fibre, Colour	Thread count/cm (wp x wf)	Spinning direction	Dimension (cm)	Description	References
1	**18096** (6-K-3/238)	Level 5, fill of Building II-III	tabby	wool, brown	9 x 9	S (wp, wf)	12.0 x 18.0	Fragment of wool cloth	unpublished
2	**18113** (6-K-3/270)	Level 5, fill of Building II-III, room 78	weft-faced tabby	wool, cream (wp), purple, dark blue (wf)	6 x 25-30	S (wp, wf)	21.5 x 14.0 15.0 x 11.0 15.0 x 10.0 9.0 x 9.0 9.0 x 10.0 4.0 x 4.0 7.5 x 5.0 3.0 x 4.0 3.0 x 2.5	9 fragments. Band decoration. Purple band 9 cm wide, blue band'swidth impossible to estimate. Edge reinforced with a double warp (2 separate threads, each S-spun)	Adams 2002, 89-90
3	**18114** (6-K-3/372)	Level 5, fill of Building II-III	tabby	wool, blue	16 x 20	S (wp, wf)	14.0 x 9.0	Lack of decor	Adams 2002, 89, 91
4	**18115** (6-K-3/231)	Level 5, fill of Building II-III	weft-faced tabby	wool, cream (wp), purple, dark blue (wf)	9-10 x 25	S (wp, wf)	11.0 x 5.0 3.0 x 2.5 5.0 x 4.0 4.0 x 1.5 7.0 x 1.0 9.0 x 3.0 4.0 x 3.0 3.5 x 2.0 4.0 x 1.5 3.5 x 2.5 3.0 x 1.5 5.0 x 1.5 2.5 x 0.5	Similar to 18113, they probably formed one piece	unpublished
5	**18117** (6-K-3/177)	Level 5, fill of Building II-III	tabby	linen, cream (undyed)	8 x 9	S (wp, wf)	11.0 x 7.0 12.0 x 7.0	Undecorated tabby. Small brittle fragments	Adams 2002, 89, 91
6	**18119** (6-K-3/233)	Level 5, fill of Building II-III, room 23	weft-faced tabby	wool, cream (wp), blue, brown (wf)	4 x 20	S (wp, wf)	4.0 x 8.0 1.0 x 3.0 2.5 x 2.0 4.0 x 1.0	Wool textile with blue and brown bands	Adams 2002, 89-90
7	**18120** (6-K-3/118)	Level 5, fill of Building II-III, room 25, cache	weft-faced tabby	wool, purple, dark blue	6 x28	S (wp, wf)	28.0 x 16.0	Band decoration. Purple band 1.4 –1.8 cm high, blue band 1.5 cm	Adams 2002, 89
8	**18123** (6-K-3/320)	Level 6, subphase 5a, area of Building II-III	weft-faced tabby	wool, dark blue, light blue	4 x 20	S (wp, wf)	20.0 x 28.0 (general measurement of the surface of the textile. very fragmentary. kept under glass)	Band decoration	Adams 2002, 89-90
9	**18124** (6-K-3/109)	Level 5, Building II-III, room 25, cache	weft-faced tabby	wool, dark blue(wp), dark red (wf)	6-8 x 25-30	S (wp, wf)	7.8 x 1.0 7.7x2.4 10.5 x 0.5 10.3 x 1.8 10.0 x 4.0 2.0 x 1.0 3.8 x 1.3 6.4 x 1.0 2.0 x 1.4	11 fragments, band decoration, about 0.5 cm high	Adams 2002, 89-90
10	**18125** (6-K-3/234)	Level 5, fill of Building II-III, room 13	weft-faced tabby	wool, beige (wp, wf)	6 x 32	S (wp, wf)	8.0 x 12.0 1.5 x 3.5 1.0 x 5.5 1.0 x 5.0	Weft-faced tabby, without decor	Adams 2002, 89-90
11	**18126** (6-K-3/112)	Level 5, fill of Building II-III, room 25, cache, inside a pot	weft-faced tabby	wool, brown (wp), dark blue, brown (wf)	6x 28	S (wp, wf)	9.0 x 13.0 5.0 x 8.0 5.0 x 6.0 4.0 x 5.0 3.0 x 7.0	Wool textile decorated with brown and blue bands, brown warp	unpublished

Table 1a: Inventory of the textiles from Meinarti with updated data, Sudan National Museum, Khartoum, February 2017

	SNM inventory number (+ excavation number)	Provenance	Weave type	Fibre, Colour	Thread count/cm (wp x wf)	Spinning direction	Dimension (cm)	Description	References
12	**18127** (6-K-3/329)	Level 5, fill of Building II-III	weft-faced tabby	wool, a) brown (wp, wf), purple (wf), dark blue (wf), cream (tassel); b) brown (wp, wf), dark blue (wf)	a) 6 x 28 wątków (dark blue-red); b) 6 x 36 (brown-purple)	S (wp, wf for both textiles); S3z2s (tassel)	15.0 x 7.0 (purple. dark blue) 7.0 x 5.0 8.0 x 5.0 10.0 x 7.0 4.0 x 1.0 6.0 x 3.0 5.0 x 4.0 25.0 x 8.0 14.0 x 6.0 5.0 x 2.0 9.0 x 3.0 (tassels)	Fragments of band decorated textile. Possibly two different fabrics:a purple-dark blue one, decorated with tassels and a dark blue and brown one	Adams 2002, 89-90
13	**18129** (6-K-3/176)	Level 5, fill of Building II-III	tabby	wool, red, dark blue	13 x 8	S (wp, wf)	13.0 x 10.0 28.0 x 23.0	Textile decorated in plaited effect	Adams 2002, 89-90
14	**18130 a** (6-K-3/370)	Level 5, fill of Building II-III	weft-twining	wool, cream (wp), dark red, red, dark blue (wf)	2 (each warp composed by 10 unspun threads) x 4	10 x Z2s (wp), S4z (wf – loosely spun)	6.0 x 2.5	Twined décor	Adams 2002, 89-90 but material preserved in the box not consistent with description
15	**18130 b** (6-K-3/370)	Level 5, fill of Building II-III	Pile textile, impossible to determine the type of knot because of its bad condition	wool, cream (wp, wf), dark red, dark blue, orange, beige (pile)	3 x 10	S2z (wp) Z (wf)	3.0 x 3.0 3.0 x 4.0 2.5 x 2.0 3.0 x 2.5	carpet	Adams 2002, 89-90 but material preserved in the box not consistent with description
16	**18130 c** (6-K-3/370)	Level 5, fill of Building II-III	tabby	wool, brown	10 x 10	S (wp, wf)	3.0 x 1.5	Undecorated brown wool tabby	Adams 2002, 89-90 but material preserved in the box not consistent with description
17	**18130 d** (6-K-3/370)	Level 5, fill of Building II-III	weft-faced tabby	wool, cream (undyed)	4 x 16	Z2s (wp, wf)	4.0 x 3.0 3.0 x 3.5	Lack of decor	Adams 2002, 89-90 but material preserved in the box not consistent with description
18	**18132 a** (6-K-3/271)	Level 5, fill of Building II-III, room 58	weft-faced tabby	wool, cream (wp, wf), brown (wf)	2 x 8	Z2s (wp), Z2s (wf)	14.0 x 18.0 13.0 x 7.0 8.0 x 7.0	Thick fabric, probably furnishing textile – plaid, carpet, blanket ? Band decor.	Adams 2002, 89-90 (271d)
19	**18132 b** (6-K-3/271)	Level 5, fill of Building II-III	tabby	wool, dark brown (wp), light brown, blue (wf)	6 x 6	S (wp, wf)	4.0 x 4.0 4.0 x 3.0 7.0 x 6.0	Textile decorated with blue bands on a brown ground	Adams 2002, 89-90 (271d)
20	**18134** (6-K-3/232)	Level 5, fill of Building II-III, room 7, fold together with a leather garment	weft-faced tabby, weft-patterned	wool, cream (wp), cream, dark blue, light green, red (wf)	4 x 18	S (wp, wf)	2.5 x 4.5 2.5 x 3.0 3.0 x 3.0 2.0 x 2.0 7.0 x 4.5 9.0 x 5.0 4.5 x 2.5 6.0 x 7.0 4.5 x 3.5 4.0 x 4.5 3.0 3.5 3.0 x 1.0 2.5 x 2.0 2.5 x 2.5 4.5 x 2.0	Weft-faced tabby, band decor, plain bands and chequered pattern	Adams 2002, 89-90, colour figure 57, pl. 4d

Table 1b: Inventory of the textiles from Meinarti with updated data, Sudan National Museum, Khartoum, February 2017

	SNM inventory number (+ excavation number)	Provenance	Weave type	Fibre, Colour	Thread count/cm (wp x wf)	Spinning direction	Dimension (cm)	Description	References
21	**18135** (6-K-3/145)	Level 5 (sic), subphase 5c, scattered through the fill of Building VII	kilim	wool, pink (wp, wf), dark red, green, dark blue, light blue (wf)	7 x 20	Z2s (wp), Z (wf)	Many fragments; the bigger ones are 6.0 x 30.0 11.5 x 22.0 9.0 x 27.0 11.0 x 21.0 9.0 x 22.0 14.0 x 28.0 28.0 x 19.0 15.0 x 34.0 23.0 x 23.0 23.0 x 22.0 17.0 x 25.0	Wool textile, geometric patterns in bands. Selvedge preserved. Numerous big fragments in good condition. Dyes lightly decoloured.	Adams 2002, 89-90, colour figures 54-56
22	**18131 a** (6-K-3/179)	Level 5, fill of Building II-III	weft-faced tabby	wool, brown (wp), dark blue (wf)	5 x 12	S (wp, wf)	3.5 x 3.5 2.0 x 2.5 1.5 x 2.0 3.0 x 1.5	Lack of decor	Adams 2002, 89-90, content of box not consistent with description
23	**18131 b** (6-K-3/179)	Level 5, fill of Building II-III	weft-faced tabby	wool, beige (wp, wf)	7 x 18	S (wp, wf)	7.0 x 1.0	Lack of decor. Selvedge	Adams 2002, 89-90, content of box not consistent with description
24	**18131 c** (6-K-3/179)	Level 5, fill of Building II-III	weft-faced tabby	wool, cream (undyed) (wp), red (wf)	5 x 20	S (wp, wf)	2.0 x 2.5	Lack of decor. Selvedge. Wedges	Adams 2002, 89-90, content of box not consistent with description
25	**18131 d** (6-K-3/179)	Level 5, fill of Building II-III	tabby	wool, brown (wp, wf)	18 x 14	S (wp, wf)	Numerous fragments in bad condition. very brittle	Lack of decor	Adams 2002, 89-90
26	**18250** (6-K-3/386)	Level 5, inner shrouding of the body buried under the floor of Building VIII	warp-faced tabby	silk, red, cream, blue, green, yellow, dark blue	68 x 15	S (wp, wf)	Number of very small fragments impossible to estimate. very dry and brittle	Textile decorated with vertical bands, selvedge 1 cm wide	Adams 2002, 89, 91, colour figure 62
27	**18251** (6-K-3/387)	Level 5, outer wrapping of the body buried under the floor of Building VIII	weft-faced tabby + embroidery (backstitch)	wool, cream (wp), dark red, dark blue, brown, yellow, cream (wf)	3 x 14	S (wp), Z (wf) S2z (embroidery thread)	Many fragments. estimated total surface 2 sq. m. The bad condition of the fabric prevents from measuring each fragment.	Textile with geometric decor, deeply impregnated with products of body's decomposition. Selvedge preserved.	Adams 2002, 89-90, colour figure 60
28	**18116** (6-K-3/102)	Level 5, fill of Building II-III (in the bottom of a small glazed bowl)	braid textile	wool, beige	n.c.	S	9.0 x 9.0 3.0 x 5.0 3.5 x 1.5 1.5 x 1.5	Textile from showcase, width 1.0 cm	Adams 2002, 89, 91
29	**15601** (6-K-3/506)	Level 7, scattered through the fill	weft-faced tabby with supplementa ry continuous pattern wefts, floating on the reverse. The warp setting creates a ribbed surface.	wool, cream, brown (wp), dark red, cream, green, blue, dark brown (wf)	4 x 18	S2z (wp), Z (wf)	8.0 x 5.0 7.0 x 4.0 8.0 x 5.0 2.0 x 1.5 8.5 x 10.0 4.0 x 4.0 10.5 x 8.0	The textile is decorated with red and green rectangles, oriented vertically. The red rectangles are separated by blue and yellow ribbed frames, the green ones by brown and yellow	Adams 2001, 105 and pl. 40f
30	**18121** (6-K-3/371)	Level 7, cemetery fill	warp-faced tabby	wool, brown	10 x 5	S (wp, wf)	11.0 x 10.0 14.0 x 9.0	2 fragments	Adams 2001, 105

Table 1c: Inventory of the textiles from Meinarti with updated data, Sudan National Museum, Khartoum, February 2017

Fig. 2: General view of the kilim, inventory number 18135, after conservation (Image: Barbara Czaja)

surface. From a technical point of view, kilim is a tapestry weave, more precisely a weft-faced tabby: that is, the horizontal wefts are pulled tightly downwards so that they hide the vertical warps (Hull & Luczyc-Wyhowska 2000, 43-44). A kilim is smooth on both sides. The decorative repertoire is also a characteristic: it consists of bands, geometrical patterns, and stylised floral motifs. Kilims are decorative fabrics used as interior textiles such as rugs or wall hangings.

A preliminary reconstruction of the decoration was first proposed by Adams (2002, fig. 54 to fig. 56). During conservation, the textile conservator made an attempt to arrange the decoration in accordance with the original appearance of the fabric (fig. 2 and fig. 3). As a result, it appears that the fabric was a minimum of 150 cm in length and 95 cm in width. The size and the shape of the fabric from Meinarti shows that it served as a furnishing textile, probably decorating the house. The quality of the fabric shows that the kilim was woven in a professional workshop by an experienced weaver. The only other example of such a textile known so far in the Nubian corpus is one found in Gebel Adda dating to the Ottoman period (16th to 18th centuries CE). It is presently kept at the Royal Ontario Museum, Toronto, Canada (inventory number ROM 973.24.3491).

It is difficult to find comparative material dated to the same period for the decoration in the Meinarti kilim. The closest parallels to this specific ornamented decorative band were found in fabrics dating to the 19th and 20th centuries produced in the Maghreb: Mzab Valley (Algeria), El Jem and Matmata (Tunisia), Oulad Bou Sbaa (Marocco) (Spring & Hudson 1995, 87). Today, similar kilims are still woven in this area (Hull and Luczyc-Wyhowska 2000, 91-92). Both the patterns and colours are similar to the fabric from Meinarti (see, for example, Zena Kruzick Tribal Art - Textile Gallery, 2018). Such a traditional ornamentation could have survived to this day, passed on from generation to generation in isolated circles of nomads. It is not reasonable to establish a provenance for the Meinarti kilim based on comparison with these recent textiles. However, the fabric preserved today in the Sudan National Museum undeniably attests to the antiquity

Fig. 3: Detail of a fragment of the kilim before conservation (Image: Magdalena Wozniak, courtesy of the Sudan National Museum)

and longevity of the decorative repertoire of north African nomadic communities and as such represents an exceptional piece of their heritage.

Textile inventory number 18130b

Among the fabrics from Meinarti stored in the Sudan National Museum there is a textile preserved in four small parts with pile (fig. 4). The fragments measure 3 cm x 3 cm; 3 cm x 4 cm; 2.5 cm x 2 cm; and 3 cm x 2.5 cm. The warps, wefts and piles of the fabric are made of wool. The density of the textile is 3 warp threads/cm and 10 weft threads/cm. The warp-threads are S2z plied, the weft is Z-spun. The warp and weft have the natural cream colour of undyed wool yarn. The yarn of the pile is in five colours: cream-coloured (undyed), dark red, dark blue, orange and beige.

A knotted-pile carpet contains raised surfaces, or piles, from the cut off ends of knots woven between the warp and weft. Most carpets are made of sheep's wool, which is durable, is readily dyed, and easily handled. Camel hair and goat hair are rarely used. There are various ways of knotting the pile yarn around the warp yarn. The Turkish, or symmetrical, knot is used mainly in Asia Minor, the Caucasus, Iran (formerly Persia), and Europe. This knot was also formerly known as the Ghiordes knot. The Persian, or asymmetrical, knot is used principally in Iran, India, China, and Egypt. This knot was formerly known as the Senneh (Sehna) knot (Ford 1997, 10-40).

Fig. 4: Fragments of pile-weave, inventory number 18130b (Image: Magdalena Wozniak, courtesy of the Sudan National Museum)

Fig. 5: Fragment worked in twining technique, inventory number 18130a; a) face side, b) reverse of the same fragment (Image: Magdalena Wozniak, courtesy of the Sudan National Museum)

Unfortunately, the piles of the Meinarti pieces are very worn, and it is not possible to describe more precisely the specific technique used. In addition, it is possible that the pile was produced in a loop-pile technique and the seemingly cut off ends are in fact loops broken as a result of wear and tear.

Textile inventory number 18130a

The last piece identified is a small fragment worked in twining technique. This fragment was initially interpreted as woven in the soumak technique. However, it is identical on both sides (fig. 5), which confirms it is twining. It measures 6 cm in length and 2.5 cm in width. Both warp and weft are wool. The density of the fabric is 2 warp threads/cm (each warp is composed of 10 loose yarns) and 4 weft threads/cm. The undyed warp is Z2s-plied; the weft, in three colours (red, dark red, and dark blue) is S4z-plied.

The twining technique is known in textile assemblages from Nubian sites. It appears mainly in a group of undyed wool fabrics from Lower Nubia in the finishing borders and associated with tassels (Bergman 1975, plates 38 and 39; Gebel Adda textiles ROM 973.242841.1, ROM 93.24.3400). These textiles are dated to the Post-Meroitic period (350 to 543 CE). The twining decoration is usually in two colours, yellow and red/purple (with variations in the number of twined wefts) and with red/purple tassels. Twining appears also in cotton fabrics, where the twining wefts are undyed. The threads used for twining are Z2s-plied.

The Meinarti fragment, securely dated to the medieval period, displays different features in construction from the Lower Nubian Post-Meroitic examples: the warps are very thick, composed of ten Z2s-plied threads, while the wefts are composed of Z-spun threads, which is not the traditional spinning direction in Nubian production. Due to the fragmentary state of the textile, it is impossible to state if the twining technique was applied to the whole fabric or if it was used only for a limited area. However, considering its thickness, the fabric was most probably a furnishing textile. The technical features identified in this fragment point to an imported item rather than a local product. This hypothesis is also confirmed by dye analysis where lac dye was identified as the main dyeing agent. In the fabrics identified as local products, the common dyestuff is madder (Wozniak et al., in preparation).

Discussion

This minute examination of "old" material has brought some new data to the Nubian textile corpus and shed new light on the group of textiles found in Meinarti.

The identification of the fibre as almost exclusively wool with the absence of cotton may be related to environmental conditions: cotton consists about 94% of cellulose, and its hygroscopic nature facilitates the colonisation of fungi and bacteria. The biological deterioration of cotton fibres can cause absence of cotton on archaeological excavation sites. But it may also be linked to historical events, such as the sack of the town by the Egyptian army during the invasion of Nubia from 1285 to 1286 CE. While wool was probably the most common fibre used for clothing, cotton was a more valuable commodity. If it was present in the Meinarti palace, it was very probably taken by the Egyptians as a part of the booty (Vantini 1975, 328) during the sack of Ibrim, at which cotton is mentioned among the goods seized by Egyptian troops. The fragments of wool textiles found in the palace – all torn rags – present similar technical features: S-spun threads for both warp and weft, tabby and weft-faced tabby weaves, and presence of coloured bands of decoration. All these point to local production.

When compared to this homogeneous group, the fragments of the pile weave, the slit-tapestry weave and the twined pieces appear as objects of non-Nubian production. Pile weaves were identified in limited quantities in Early Medieval Qasr Ibrim, mostly in funerary contexts, where they were (re)used as burial equipment (Adams 2010, 143-144; King 2011, 37-38). Interestingly, the Meinarti fragments are related to a settlement area, more precisely to an important administrative building: the eparch's palace. As previously discussed, the eparch's palace was closely related to trade and its control by the official representative of the king. It cannot be presumed that the tiny pieces found during the excavations came from carpets which decorated the palace complex itself or from one of the numerous storage rooms where goods imported from Egyptian market were kept. However, the state of preservation of the pile weave (18130b) was very worn which suggests it may have been used for a long time within the administrative building.

The kilim was recovered from the fill of Building VII, from the slightly later subphase 5c, dated to the 14th century CE. This building adjoined Building II-III and was located not far from Meinarti church VI and the cemetery. The function of this building is unknown. However, its spatial organisation in two parts (a large public suite and private smaller rooms), the wall plastering, as well as its close relation to Building VIII, tentatively identified as a chapel (both buildings were connected by a doorway), and suggests its importance in the organisation of the social and religious life of the town. During the subphase 5c, Meinarti island was briefly occupied by a nomadic Arab tribe, the Beni Ikrima (Adams 2002, 94-95; MacMichael 1922). The presence of the kilim and its relatively good state of preservation may be evidence of the temporary use of Building VII as a dwelling place by the Beni Ikrima people.

Conclusion

These fragmentary textiles from Meinarti offer an unexpected insight into the trade in furnishing commodities in Nubia. In a situation where written sources are rare and mainly mention textiles for clothing, the identification of such weaves is certainly valuable for the understanding of the goods available in the market and imported by traders for the needs of the Nubian court and its elite during the Late Christian Period (12th to 14th centuries CE). The kilim piece, with its decorative patterns and their spatial display on the fabric, appears firmly related to nomadic culture, illustrating the mobility and ethnic diversity of the inhabitants of medieval Nubia.

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Exploring the construction of a Bronze Age braided band from Dartmoor, UK

Abstract
During the excavation of a Bronze Age cremation on Dartmoor, Devon (UK), the remains of a braided band of cow hair with metallic studs were found. A study of the braid structure was made using magnified digital images. Braiding was carried out with tail hair from two heritage breeds of cattle, using construction methods considered the most appropriate, given the age of the braid. Comparison of both the practicalities of the braiding process and the resultant structures leads to a conclusion that loop manipulation was the most likely method of production of this artefact in the Bronze Age although free-end braiding remains a possibility.

Keywords: Bronze Age, band, cow hair, Dartmoor, fingerloop braiding, free-end braiding

Introduction
During the excavation of a Bronze Age cremation burial cist on Dartmoor, Devon (UK) in 2011, the incomplete remains of a braided band made of cow hair and adorned with metallic studs were found alongside other artefacts. The estimated date for the completion of the cist and incorporation of the material into it is 1730 to 1600 BCE (95% probability calculated primarily using OxCal), although the contents of the cist represent materials of different ages (Jones 2016, 237).
The cist contained the cremation including bone dated 1930 to 1740 BCE wrapped in a bear pelt dated 1740 to 1560 BCE. There was also a basketry container dated 1870 to 1620 BCE (all dates 95% probability). The cremated bone is earlier than the pelt and the basket, indicating that the cremation was not buried immediately. Inside the basketry container were beads of various materials (not dated but reported as a mixture of old and new components), four wooden studs (one dated 2210 to 1980 BCE), a textile and animal skin object (undated but described as being in very good condition) and the braided band (undated). Therefore, some of this assemblage may have predated the deceased person (Jones 2016, 222 & 237-238; Marshall 2016, 186-187).

The braided band was found lying within the exposed interior of the basketry container, in which it curved back on itself and formed an uneven and truncated oval shape (fig. 1) (Sheridan et al. 2016). It was a fragment about 185 mm long, one end of which finished in a bobble-like terminal that appeared to be complete whereas the other end was frayed. At its widest around the studs, the band was 4.5 mm wide, narrowing to 3 mm in between the studs. The band appeared to narrow at its frayed end, forming a

Fig. 1: The braided band *in situ* (fig. 14.1 in Sheridan et al. 2016) (Image: © and courtesy of Cornwall Archaeological Unit)

Fig. 2: Part of the original braid with the hairs colour-marked digitally using Paint Shop Pro ® software (Image: Celia Elliott-Minty after original © and courtesy of Plymouth City Museum & Art Gallery)

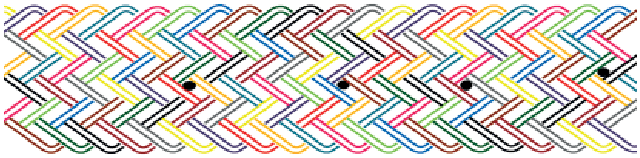

Fig. 3: The structure of the braid and positions of the studs represented by the small dots (Image: Celia Elliott-Minty)

natural point of weakness. There was no sign of any other surviving fragment. The studs, although much corroded, appeared to be dumbbell-shaped and were made of tin (Jones 2016; Sheridan et al. 2016).

The paired strands with which the band was constructed were identified by Caroline Solazzo (Smithsonian Institute, USA) as hair from the genus Bos - a type of cattle (Solazzo 2016). The length needed for the braid led to the conclusion that it is likely to have been made using tail hair. An individual hair from the braided band measured approximately 100 µm in diameter using variable pressure scanning electron microscopy (VP-SEM), while a pair of hairs had an overall width of 300 µm (measured with digital callipers) (Cartwright 2016, 269-270; Susanna Harris pers. comm. 2020).

Analysis of the braid

Susanna Harris, University of Glasgow, one of the archaeologists involved in the investigation of the cist, invited the author to investigate the braid's structure and how it might have been made. A study was made using magnified digital images taken after conservation by Plymouth Museums (UK). An area near the 'bobble' end with five studs in situ and spaces where two studs are missing is shown in fig. 2.

Each pair of hairs was digitally marked on the image with a distinguishing colour and its track through the braid followed for at least one repeat of the pattern. This showed that the structure is a two by two twill (i.e. under two, over two) made by interlacing 13 pairs of hairs. The tin studs were inserted every four or five intersections (see fig. 3 in which the small dots represent the position of each stud).

The paired strands are evenly spaced from each other with no apparent interlacing errors. Each hair within a pair of strands stays parallel and they do not cross over each other, except perhaps occasionally (see arrows in fig. 4). This indicates that the method of construction

Fig. 4: Possible cross-over of individual hairs within a pair (Image: Celia Elliott-Minty after original © and courtesy of Plymouth City Museum & Art Gallery)

was one in which the paired strands were not able to readily twist around each other.

Possible braiding method

Interlaced braids such as this one can be made by more than one technique. Likewise, a single method of braiding can be used to create more than one type of structure. Therefore, one should be wary of assumptions about either structure or methodology.

The use of loop manipulation, a technique in which loops of yarn or other material are passed from finger to finger (or hand to hand) in a defined sequence, is a strong possibility for the making of this braid. It requires no equipment other than human hands, so evidence of this method is unlikely to survive from antiquity. The earliest known depiction of loop manipulation dates from a first century BCE bronze container from China, on which two of the decorative figures appear to be loop-braiding (Carey 2003). However, it is highly likely that it has been practised since long before this date. Two wool braids from the Hallstatt salt mine circa 700 BCE were very probably made this way (Grömer et al. 2015; Grömer and Rösel-Mautendorfer 2013, 570 & 573). By its very nature, loop braiding uses two strands, which may always be moved together, as in this braid. Alternatively, the loops may be manipulated in such a way that the two strands follow different paths in order to create a braid that is, in some cases, unique to loop braiding (Boutrup 2010, Speiser 1988).

Free-end braiding is also undoubtedly an ancient technique. The simplest forms (for example, the three-strand plait that is used to keep hair tidy) need no equipment. Plaiting with relatively rigid plant material such as straw can likewise be undertaken by just one pair of capable hands, but more flexible materials such as threads may require a different approach. As with loop braiding, the individual elements are best kept under an even tension. Over time, this has led to the development of equipment such as braiding with bobbins on a support, which helps to keep the threads tensioned and in order. A portable cushion, such as that still used in Oman, would leave no archaeological trace (for comparison, see British Museum, inventory number 2011,6003.51). The earliest depiction of braiding on a stand is in a French publication from the 18th Century (Diderot and Le Rond d'Alembert 1751-1772). Such a support is particularly useful when the material is slippery or otherwise difficult to work with. Any number of strands (elements) can be used per bobbin. Carey (2003) summarises the various types of equipment that are used across the world.

In an experiment to create a replica of the Dartmoor braided band, Linda Hurcombe, University of Exeter, experimented with a method of free-end braiding that involved pinning pairs of horsehairs on a macramé board (Sheridan et al. 2016). Therefore, this particular approach was not studied further. Both loop manipulation and free-end braiding by another method were explored when trying to replicate this Bronze Age band.

Choice of hair

In the Middle Bronze Age, northern European mixed farming was based on cattle husbandry and cereal production, including the use of cattle for traction. Beef played a major role in Bronze Age diets and finds in the Netherlands and Denmark have shown that cattle contributed 75 to 80% of animal remains (Bartosiewicz 2013). The Early Bronze Age round barrows at Irthlingborough, Northamptonshire and Gayhurst, Buckinghamshire (UK) contained remarkably large quantities of cattle remains (*Bos taurus*) and a small number of skeletal elements from aurochs (*Bos primigenius*) (Towers et al. 2010). Across Europe there was increasing variability in Bronze Age horn shapes and body size, even in localised populations (Bartosiewicz 2013).

The Welsh Black breed of cattle is one of the oldest in Britain, having reportedly inhabited the hills of Wales since pre-Roman and pre-Christian times (Welsh Black Cattle Society). The majority of Welsh Blacks are horned (The Cattle Site). It has been speculated that the now extinct black cattle of Cornwall were a closely related breed to the Welsh Black.

Highland cattle originated in the Highlands and Western Isles of Scotland and were first mentioned in the sixth century CE. They have long horns and a double coat of hair - a downy undercoat and a long outercoat which may reach 33 cm, and which is well-oiled to shed rain and snow.

Samples from the tails of both of these breeds were obtained. The Welsh Black came from the bull "Llaneurgain Bolt" owned by Bridget Osborne in Conwy (UK). Highland cow hair came from a herd owned by Nigel and Tracy Bishton in Shropshire (UK). All of the hairs came directly from the animals. They were soaked in cool water to allow the dirt to float off, then rinsed several times, laid on a towel and allowed to dry naturally.

The Welsh Black tail hair was very dark brown, quite curly and formed locks. It had been cut from the bull while he was in a cattle crush for tuberculosis testing, and the lengths varied from 3 to 40 cm. Samples were wet-mounted in glycerine and examined by microscopy: the diameter of the main part of the hair was 120 µm (range: 170 µm towards the root end, decreasing to 30 µm at the tip). The pigment appeared evenly spread throughout the hair, although lighter at the tip.

The Highland cow tail was very pale and slightly less curly. This hair had been collected after it was shed naturally: the hairs were between 30 and 50 cm long. The diameter of the main part of the hair was 110 µm (range: 160 µm near the root end, decreasing to 40 µm at the tip). Towards the root end, no pigment was evident. It appeared as scattered dots which spread out to the rest of the hair towards the tip end. With the naked eye, this appeared to be a darkening of the hair from virtually colourless to a pale brown. In comparison, an individual hair from the original braided band measured approximately 100 µm diameter (Cartwright 2016).

All microscopy was carried out on a Brunel SP75P light transmitting microscope. The measurements were made using an eyepiece graticule checked with a Bressler calibration slide. Eyepiece calibration at x100 (x10 eyepiece, x10 objective) could be taken as 100 µm per marked unit i.e. 10 µm per subdivision within about 1% accuracy.

Substitutes for the tin studs

In the original investigations, tin studs were expertly crafted to replicate the dumbbell shape that allowed them to sit securely within the band (Sheridan et al. 2016). Such expertise was not available for this reconstruction. For the initial experiments with horsehair (see below), moulded and baked Fimo® modelling clay was used as a substitute for the tin studs. Later, an improved alternative was developed by gluing pairs of galvanised glass seed beads onto a fine plastic rod, which fitted more securely into the braided hair. These 'studs' were 4.8 mm long, 2.9 mm wide at their widest and 2.3 mm wide at the narrowest point in the middle. This compares with the dimensions of the best-preserved original studs which were 4.1 mm long, 3 mm at their broadest and 2.2 mm at the narrowest point of their waist (Sheridan et al 2016, 76).

Braiding trials

Loop manipulation

Fingerloop braiding was initially trialled using horsehair. Hairs were paired up in the same orientation (i.e. butt ends together) and knotted at both ends to give a defined length. It was best to avoid using the very tip of the hairs because they tended to snap at the knot. It is standard practice amongst makers of hair jewellery to orientate the hairs in the same direction and begin braiding at the root ends (Sparr 2016). Because the hair in the original band was examined only through small samples, the researchers were unable to ascertain whether the hairs were all orientated one way (Susanna Harris pers. comm. 2020). However, the narrowing of the original artefact at one end suggests that the hairs may have been orientated in the same direction.

Once prepared, 11 pairs were tied together securely with thread at the butt ends for the earlier experiments although this was increased to 13 pairs for later experiments. An overhand knot was made as close as possible to this tie. A loop of strong thread was attached just above the overhand knot and the other end of the loop secured to a clamp for loop manipulation.

Holding the hair loops directly on the fingers did not work because they sprang off. This was solved by tying loops ('handles') of nettle yarn into the horsehair loops and looping these onto the fingers. Nettle was chosen because some of the woven fabric surviving in the cist was identified as being made from spun nettle fibre.

The two by two twill could be achieved with a sequence of simple transfers between the right and left hands. The equal movement of elements across both hands produced a V-shaped fell (so called because the strands that have been braided form a V-shape) into which a stud would fit neatly, although it was not possible for the lone braider to insert one without assistance.

Various treatments were applied to the horsehair in an attempt to make it less springy. Initially, each hair was

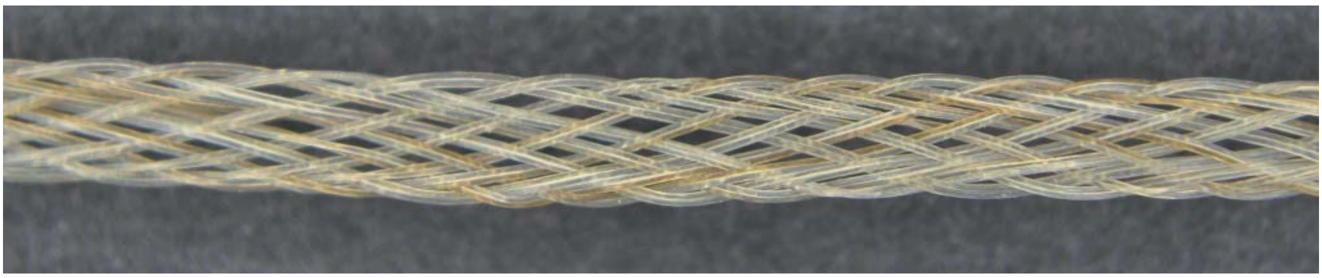

Fig. 5: Braid worked with Highland cow hair, single person loop manipulation (Image: Celia Elliott-Minty)

Fig. 6: A general view of loop manipulation of Welsh Black hair by Jacqui Carey (left) and Celia Elliot-Minty (right) with detail of the loop manipulation (Image: Jacqui Carey)

drawn across a block of beeswax to thoroughly coat it before braiding. This helped a little but not enough for the method to be pursued. Another treatment tested was to soak the horsehair in tap water or human urine for a week, then rinse it in tap water before braiding. There was no obvious difference in the way the hair behaved. This was not unexpected since hair is water resistant and dries quickly.

The Highland cow hair was set up for finger loop braiding as for horsehair with nettle 'handles'. When fingerloop braided, the paired hairs stayed together very well and the resulting braid was smooth and slightly flexible (fig. 5). It was 3 mm wide. Providing that the 'handles' were transferred between fingers correctly, the hairs within a pair stayed parallel without twisting.

In fact, the braid was so smooth and fine that the studs would not stay in place. The structure was also considerably more open than the original, indicating that it had not been held under sufficient tension during the making process.

This fingerloop method with just one manipulator was also attempted with the Welsh Black hair but the tip ends of the hairs were too weak to withstand the tension.

When just one person (the manipulator) is making a fingerlooped braid, the density of the resulting braid is highly dependent upon the type of material being used. If the braider is working with wool, for example, the scaly surface structure of the fibres will stop them from sliding past each other and the plaited strands will stay in position. Plant-derived fibres such as hemp or cotton are smoother but are still rough enough to stay in place. Horse and cow hair, however, are very smooth and there is no resistance to movement, so they slip past each other and the braid becomes very open.

However, input from a second person (the helper) can solve this problem by tightening the braided section as the work progresses. This also reduces the tension that has to be applied to the looped ends, which was observed to be a point of weakness especially when working with cow hair. For this prehistoric braid, the helper would also have served a second function, that of slipping a stud into the appropriate place as the braid grew, which a single loop braider would not have been able to do.

A subsequent group of experiments was carried out with the help of Jacqui Carey, a very experienced braider who acted as the tensioner and stud placer. A total of 26 lengths of Welsh Black tail hair were prepared in a similar way to earlier experiments to give 13 loops of hair. A 'handle' of coloured yarn was then threaded through each of the loops. The whole assemblage was carefully positioned by Jacqui Carey and the author, who sat facing each other with the hair loops stretched between them (fig. 6).

While manipulating the loops, Jacqui Carey held the grouped hairs firmly and moved the hair into place after each pass. Periodically, Jacqui Carey slipped a stud into place behind the foremost crossed hairs, as shown in fig. 7. Initially, Jacqui Carey released the braided hairs somewhat every time a pass was made, but this gave a rather open structure and did not hold

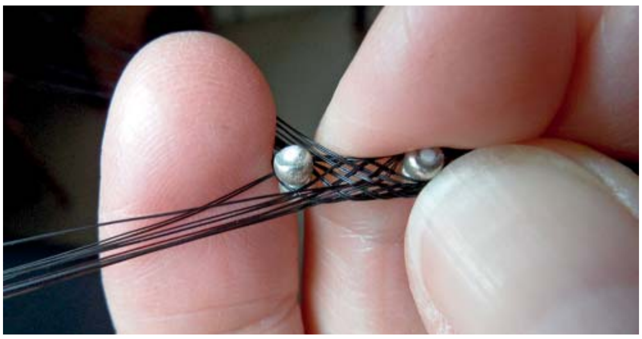

Fig. 7: Stud being incorporated into the braid (Image: Jacqui Carey)

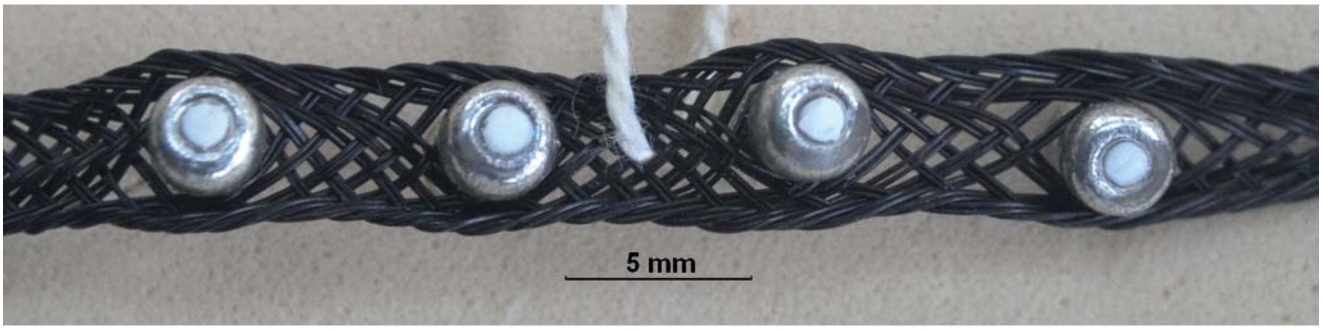

Fig. 8: The result of tighter tensioning of the braid after the second stud was inserted. Braid was worked from right to left in this image (Image: Celia Elliott-Minty)

the latest stud securely. Therefore, after the second stud, Jacqui Carey held the braid more firmly and slid each new hair into place without releasing tension, although adding a stud did create some slippage. This revised method resulted in a much firmer band (fig. 8). The band was 2.5 mm wide before the studs were added, after which it increased to between 3 and 3.5 mm wide between the studs and 4 to 4.5 mm wide at the studs. Studs were added at different intervals, generally every four to five intersections. As might be expected, the closer the studs, the more open the structure became because the hairs had to pass around the stud.

As with the single person loop manipulation, the hairs stayed parallel without twisting as long as the 'handles' were transferred correctly. In summary, loop manipulation could have been employed to create this braid but would have required cooperation between a manipulator and a helper.

Free-end braiding

Attempts to free-end braid with the hair held under only light tension produced a structure that was considerably looser than the original (details not included here). Free-end braiding was therefore explored further using a system of weighted bobbins (each 26 g) held in place over a braiding stand. It is questionable whether Bronze Age inhabitants

Fig. 9: General view of Welsh Black hair being braided on a stand (Image: Celia Elliott-Minty)

Fig. 10: Close up of Welsh Black hair being braided on a stand (Image: Celia Elliott-Minty)

Fig. 11: The entire length made on the braiding stand and finished with a loop at one end (Image: Celia Elliott-Minty)

Fig. 12: Comparison of three experimental braids with the original braid: a: Single-person loop manipulation, Highland Cow hair; b: Two-person loop manipulation, Welsh Black hair; c: Stand and bobbins, Welsh Black hair; d: Part of the original braid with the hairs colour-marked digitally. The original braid is 3 mm wide, so this was used as the unit length with which to compare the frequency of intersections (see double-headed arrows) (Image: Celia Elliott-Minty after original © and courtesy of Plymouth City Museum & Art Gallery)

of Europe had access to such technology, although groups of spools have been found in Austria, Switzerland and northern Italy. These date from the Late Bronze Age onwards and have been interpreted as most likely used for storing yarn or as weights for threads in tablet weaving (Gleba 2007). Even older finds (circa 3500 BCE) are Late Neolithic spools from Austria (Grömer 2018, fig 11.1).

For the experiment, a modern braiding stand was used to demonstrate the technique. Pairs of hairs were prepared as for loop manipulation, then each pair was attached to a weight with fine, strong, thread. At the far end, the whole group of hairs was secured to the roller on the stand (fig. 9 and fig. 10). Because the hairs were held under tension by the weighted bobbins, the hands were free to add the studs into the braid as the work progressed. The hairs were tensioned further after every move by pulling them with the fingers at the point of braiding (not via the bobbins because the hairs were liable to snap at the knots). Although in general the hairs behaved well during the braiding process, one had to be careful not to let the pairs twist. The resulting braid was 3.5 to 4 mm wide between the studs and 4 to 4.5 mm wide at the studs, and 320 mm long (fig. 11*)*.

Fig. 13: Comparison of two-person loop manipulation (top) and stand/bobbin braids (bottom) when viewed from above (Image: Celia Elliott-Minty)

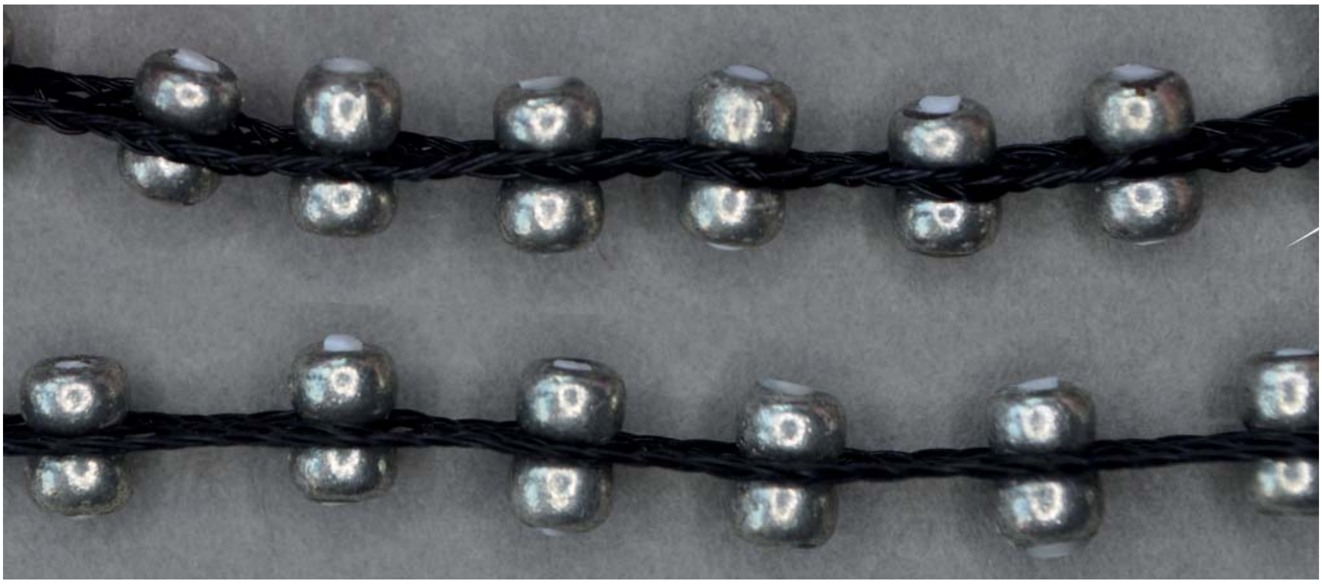

Fig. 14: Comparison of two-person loop manipulation (top) and stand/bobbin braids (bottom) when viewed from the side (Image: Celia Elliott-Minty)

Comparison between loop manipulation and free-end braiding

The braids created by these experimental methods were compared with the digital image of the original braid (fig. 12). Highland cow hair braided by single person loop manipulation (fig. 12a) was 3 mm wide and achieved 1.5 intersections per 3 mm; Welsh Black by loop manipulation using two people achieved 4 intersections per 3 mm between the studs (fig. 12b); braiding on the stand (fig. 12c) achieved 5 intersections per 4 mm between the studs, while the original braid (fig. 12d) had 5 intersections when measured outside the studs. Thus, the two-person loop manipulation and the stand-braided braids are closer to the original than are the braids made by the single person loop manipulation.

The appearance of the braids created by loop manipulation using two people and the stand/bobbin technique differs markedly (fig. 13 and fig. 14), particularly so when the braids are examined from the edge. The stand/bobbin braid is almost flat and relatively featureless whereas the one created with loops is more three-dimensional and has a prominent curl at the edges. This is probably due to the hair being stretched when weighted by a bobbin. Overall, the loop-created braid is visually more like the original as it is now, an impression confirmed by Susannah Harris who has worked closely on the original (pers. comm. 2018). In addition, pairs of hairs are more likely to stay parallel without twisting using loop manipulation compared with the bobbin method.

Conclusions

The experiments described here have shown that it is likely that this Bronze Age braid was made by loop manipulation although free-end braiding remains a possibility. Due to the springiness of hair, the result achieved with loop manipulation by a single person technique was inferior to the original. It was considerably improved by a helper who provided better tension and was also able to place the studs in the braid as it progressed.

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Dating loom weights from Százhalombatta-Földvár, Hungary

Abstract
Loom weights are difficult to date as they are fairly consistent in weight and shape over long periods. This article discusses the dating of 194 light loom weights with no contextual data from Százhalombatta, Hungary. The aim of this paper is to present previously unpublished material and identify the period to which the textile tools belong. It shows that the light loom weights in this study most likely belong to the Hallstatt period based on the find site's characteristics and comparison with loom weights from dated contexts.

Keywords textile production, Bronze Age, Hallstatt period, weaving, hillfort, tell, Százhalombatta-Sánc-hegy

Introduction

A number of loom weights have been found at the archaeological site Százhalombatta-Földvár in Hungary. Some of the textile tools at the site came to light from excavations of reliably dated contextual layers (Poroszlai 2000; Bergerbrant forthcoming; Vicze & Stig Sørensen in print) but a large number were collected by members of the public who regularly visited the site (Poroszlai 2000, 15). This article discusses the loom weights which were given to the Matrica Museum, Százhalombatta by private collectors, who found the loom weights while working on their own property.

The area has the remains of a large fortified Iron Age settlement and an Early and Middle Bronze Age tell (Poroszlai 2000; Vicze 2005, 66). The settlements are strategically placed on the Danube overlooking a bend in the river (fig. 1). The settlements of both periods are situated largely next to each other on the same natural promontory above the Danube. In order to distinguish between them the Bronze Age tell is referred to as Százhalombatta-Földvár and the Iron Age hillfort as Százhalombatta-Sánc-hegy.

Today, the Bronze Age tell site covers an area about 200 m long and 100 m wide (Poroszlai 1992, 153; 2000, 14)

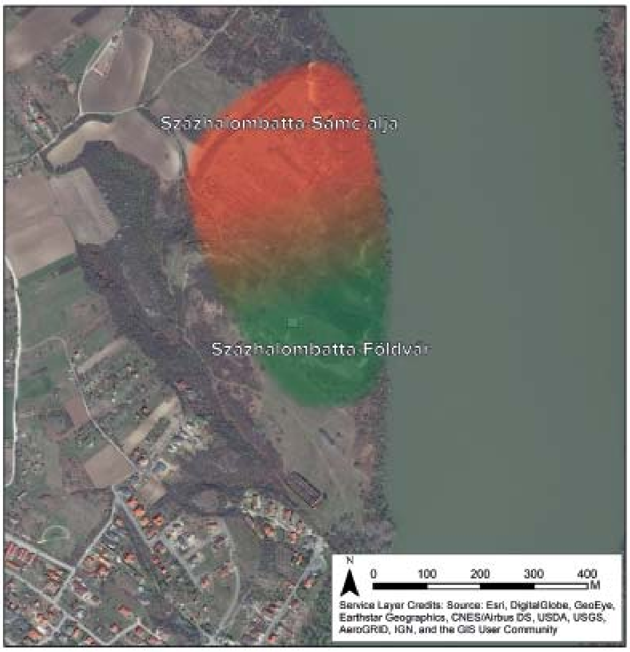

Fig. 1: The locations of Százhalombatta-Földvár and Százhalombatta-Sánc-hegy and other Hungarian sites with discoid loom weights (Image: Sophie Bergerbrant)

ID	weight/g	complete	remains	estimated weight g	height/cm	width/cm	marks
87.2.1	67	yes	all	**67**	6.1	3	
87.2.2	56	yes	all	**56**	5.6	3	
87.2.3	57	yes	all	**57**	6.1	2.9	
87.2.4	47	almost	almost	50	5.5	2.8	
87.2.5	56	yes	all	**56**	5.5	2.8	
87.2.6	57	yes	all	**57**	6	3.3	
87.2.7	54	yes	all	**54**	6.4	3	
87.2.8	53	yes	all	**53**	5.5	3.4	
87.2.9	48	yes	all	**48**	5.4	2.9	
87.2.10	51	yes	all	**51**	6	3.1	
87.64.1	132	yes	all	**132**	7.2	4.2	cross
87.64.2	104	yes	all	**104**	6.6	4.3	
87.64.3	93	yes	all	**93**	6.9	4	
87.64.4	122	yes	all	**122**	6.9	4.6	cross
87.64.5	82	yes	all	**82**	6.7	3.5	
91.1.1	65	yes	all	**65**	5.6	3.1	
91.1.2	103	yes	all	**103**	6.4	3.4	
91.1.3	134	yes	all	**134**	6.4	4	cross
91.1.4	106	yes	all	**106**	6.3	4	
91.1.5	76	almost	almost	**80**	5.8	3.3	
91.1.6	89	yes	all	**89**	6.4	3.1	
91.1.7	69	yes	all	**69**	5.6	3.2	
91.1.8	56	yes	all	**56**	5.8	2.8	
91.1.9	104	not			6.2	3.5	X
91.1.10	90	yes	all	**90**	6.7	2.7	
91.1.11	107	yes	all	**107**	5.9	3.4	cross
91.1.12	127	yes	all	**127**	7	3.4	
91.1.13	49	yes	all	**49**	5.4	2.4	
91.1.14	77	almost	almost	85	6.4	3.3	
91.1.15	125	almost	almost	130	7.6	3.6	
91.1.16	126	yes	all	**126**	7.2	3.6	
91.1.17	79	yes	all	**76**	6.2	3.1	
91.1.18	75	yes	all	**75**	5.7	4.4	cross
91.1.19	58	no	half		6.3	3.4	
91.1.20	63	yes	all	**63**	5.5	3	
91.1.21	55	yes	all	**55**	5.5	2.8	
91.1.22	70	yes	all	**70**	5.8	3.2	
91.1.23	56	almost		65	6.4	2.7	
91.1.24	97	yes	all	**97**	6.9	3.4	
91.1.25	109	no			7	3.8	I
91.1.26	103	yes	all	**103**	5.8	2.8	

Table 1a: Pyramidal loom weights. Estimates are indicated in normal text and complete weights in bold. The lengths and the widths are measured at their broadest parts

91.1.27	55	no			6.4	2.8	
91.1.28	72	yes	all	**72**	6.2	3.1	
91.1.29	125	no			8 cm	4	
91.1.30	50	no			5.5	3.1	
91.1.31	106	almost		110	5.9	4	
91.1.32	62	no			7	2.8	
91.1.33	60	no			6	2,8	
91.1.34	74	almost	almost	80	5.8	2.8	
91.1.35	85	almost	almost	90	5.8	3.1	
91.1.36	103	almost		120	7.1	4	cross
91.1.37	51	no			5.4	2.8	
91.1.38	53	no			6.9	3	
91.1.39	98	no		120	6.7	3.7	
91.1.40	112	almost		115	7.2	4.1	
91.1.41	104	almost	almost	110	6.5	3.4	
91.1.42	59	no	top missing		4.1	3	
91.1.43	100	almost		110	6.6	3.8	
91.1.44	61	almost			6	3	
91.1.45	80	no	almost	90	6.8	3.6	cross
91.1.46	103	no			6.4	4	
91.1.47	103	almost		110	7.1	3.6	
91.1.48	92	no			6.7	3.1	
91.1.49	60	no	only upper		5.6	3.1	
91.1.50	60	no		75	5.6	2.8	cross
91.1.51	44	no			6	3.3	
91.1.52	40	no			5	3.5	I
91.1.53	53	no	little		5.4	3.2	
91.1.54	44	no			5.1	2,8	
91.1.55	113	no			6.9	4	cross
91.1.57	39	no	half		4.5	3	
91.1.58	65	almost		70	5.2	3.6	
91.1.59	63	yes	all	**63**	5.9	2.9	
91.1.60	67	yes	all	**67**	5.9	2.8	
91.1.61	135	yes	all	**135**	7	4	cross
92.1.1	112	yes	all	**112**	6.6	4.6	
92.1.2	65	almost	almost	67	5.1	2.8	
92.1.3	53	no			5.1	3.2	cross
92.1.4	72	no			6.4	3.6	
92.1.5	72	almost	almost	75	6.1	3.5	
92.1.6	132	no			7.1	4.2	
92.1.7	135	yes	all	**135**	6,3	4,4	cross
92.1.8	134	yes	all	**134**	6.8	4.4	X
92.1.9	76	yes	all	**76**	6	3.2	

Table 1b: Pyramidal loom weights. Estimates are indicated in normal text and complete weights in bold. The lengths and the widths are measured at their broadest parts

92.1.10	108	no			6,3	4,1	X
92.1.11	86	almost	almost	90	5.2	4.1	
92.1.12	109	no			6.2	3.8	cross
92.1.13	108	almost	almost	111	7.3	3.8	
92.1.14	104	no			6.3	3.5	X
92.1.15	108	almost	almost	110	6.3	3.8	X
92.1.16	94	no			6.1	4.2	
92.1.17	83	no			6.3	4.6	
92.1.18	41	no			5.2	2.6	cross
92.1.19	54	no			6.1	3.1	
92.1.20	121	yes	all	**121**	6.7	4.2	cross
92.1.21	98	no		110	6	3.6	
92.1.22	101	no			6.3	4	
92.1.23	125	yes	all	**125**	7.6	4.4	X
92.1.24	90	no			6.2	4.1	cup
92.1.25	124	yes	all	**124**	6.8	4	X
92.1.26	130	yes	all	**130**	7	4.5	cross
92.1.27	100	yes	all	**100**	6.3	4	
92.1.28	125	yes	all	**125**	6.6	3.9	cross
92.1.29	122	no	all	**122**	6.2	4	cup
92.1.30	130	yes	all	**130**	6.8	4.2	cross
92.1.31	131	yes	all	**131**	7.2	3.6	cross
92.1.32	92	yes	all	**92**	6.4	3,3	
92.1.33	120	no			7	3.7	
92.1.34	118	almost	almost	125	6.8	3.3	X
92.1.35	75	almost	almost	78	7	3.2	
92.1.36	107	yes	all	**107**	6,1	3,6	cross
92.1.37	93	yes	all	**93**	5.8	4	cross
92.1.38	71	yes	all	**71**	6	3	
92.1.39	130	yes	all	**130**	7	4,5	cross
92.1.40	81	yes	all	**81**	6.6	3.1	
92.1.41	78	no	all	**78**	6	3.1	
92.1.42	79	yes	all	**79**	5.5	3.5	
92.1.43	64	yes	all	**64**	5.2	3.2	
92.1.44	67	yes	all	**67**	5	3.6	
92.1.45	123	yes	all	**123**	7	3.8	X
92.1.46	79	yes	all	**79**	6	3	
92.1.47	75	yes	all	**72**	5.6	3.4	
92.1.48	64	almost		67	5.4	3.3	
92.1.49	107	almost		115	6.8	3.4	
92.1.50	76	almost		79	6.2	3.6	
92.1.51	69	almost		71	5.9	3.6	
92.1.52	48	no			5.6	2.3	

Table 1c: Pyramidal loom weights. Estimates are indicated in normal text and complete weights in bold. The lengths and the widths are measured at their broadest parts

ID	type	weight/g	complete	remains	estimated weight g	hight/cm	width/cm	thickness
87.1.1	C	80	no			6.3	5.3	1.3
87.1.2	C	60	no			6.6	5	1.7
87.1.3	C	51	no					
87.1.4	C	81	no			5.6	5,8	1.8
87.1.5	C		no					
87.1.7	C	76	no			5	6.2	1.7
87.1.6	D	100	almost	almost	110	5.9	6.2	1.6
87.1.8	D	93	yes	all	**93**	5.2	5.5	1.8
87.1.9	C	109	yes	all	**109**	7.2	6.3	1.4
87.1.10	C	62	no	less 1/2		6.9	4.3	1.8
87.1.11	C	55	no			6.9	4.1	1.5
87.1.12	D	97	almost	almost	100	6.3	6.3	2.2
87.1.13	C	86	no			5.9	6.6	1.3
87.1.14	C	106	almost	almost	110	6.8	6.5	1.6
87.1.15	C	95	yes	all	**95**	6.8	6.3	1.8
87.1.16	D	60	no			4.7	4.3	2.2
87.1.17	C	85	no			5.7	7.6	1
87.1.18	C	102	yes	all	**102**	7.3	6.8	1.3
87.1.19	C	123	yes	all	**123**	7.2	7.4	1.5
87.1.20	C	85	no			6.2	5.6	1.8
87.1.21	D	68	no			5.3	5.7	1.7
87.1.22	C	60	no	1/2		6.9	7.2	1.1
87.1.23	C	37	no					
87.1.24	C	96	no			7.6	7.4	1
87.1.25	C	30	no					
87.1.26	C	112	yes	all	**123**	7.8	7.2	1.1
87.1.27	B	83	no			4.9	6.1	1.9
87.1.28	C	81	no			5.6	7	0.9
87.1.29	C	64	no			5.3	5.7	1.6
87.1.30	C	97	yes	all	**97**	6.8	6.3	1.3
87.1.31	C	73	no			5	6.6	1.9
87.1.32	D	95	yes	all	**95**	5.7	5.6	1.5
87.1.33	C	14	no					
87.1.34	A	74	yes	all	**74**	5	6.2	1
87.1.35	A	69	no			4.8	5.8	1.5
87.1.36	A	82	yes	all	**82**	5.2	6.2	1.5
87.1.37	transitional	64	no			4	5.7	1.7
87.1.38	A	87	yes	all	**87**	5.2	6.8	1.4
87.1.39	A	74	no			5.8	6.2	1.6
87.1.40	B	50	no	c. 1/2	100	6.4	2	1.2
87.1.41	A	74	no	2/3		6.2	6.8	0.9

Table 2a: Discoid loom weights. Estimates are indicated in normal text and complete weights in bold. The lengths and the widths are measured at their broadest parts.

87.1.42	C	58	no			4,8	6.7	1.2
87.1.43	A	87	yes	all	**87**	5.3	6.9	1
87.1.44	A	78	yes	all	**78**	6.4	6	1.2
87.1.45	A	94	no			5.6	6.2	1.3
87.1.46	A	71	almost	almost	72	6.3	5.8	1.3
87.1.47	A	68	no			6.6	5.7	1.2
87.1.48	A	64	no			6.1	5	1.7
87.1.49	A	68	no			6	5.2	2.2
87.1.50	A	92	yes	all	**92**	6.2	5.2	1.9
87.1.51	A	94	yes	all	**94**	7.2	6	0.9
87.1.52	A	82	no			5.6	6.1	1.6
87.1.54	B	61	no			4.7	6.3	1.2
87.1.56	B	94	yes	all	**94**	5.2	6.2	1.6
87.1.55	transitional	81	yes	all	**81**	4.7	5.6	1.7
87.1.57	round	51	yes	all	**51**	5.4	3.6	2.1
87.1.58	A	98	yes	all	**98**	5.3	6.7	2.4
87.1.59	A	89	yes	all	**89**	5.8	6.3	1.4
87.1.60	A	83	yes	all	**83**	6.8	6.9	1.2
87.1.61	A	90	yes	all	**90**	6.7	5.7	0,9
87.1.62	A	94	yes	all	**94**	6.1	5.3	1.3
87.1.63	A	91	almost	almost	100	5.8	6.7	1.6
87.1.64	A	21	no					
87.42.1	C	117	almost	almost	**118**	7.8	8	1.8
87.42.2	D	103	yes	all	**103**	5.5	6	1.7
87.42.3	C	113	yes	all	**113**	8.2	7.2	2
87.42.4	C	121	yes	all	**121**	8	7.1	2.2

Table 2b: Discoid loom weights. Estimates are indicated in normal text and complete weights in bold. The lengths and the widths are measured at their broadest parts.

and has 3 m to 5 m deep, well-preserved occupation levels, which date to the period from between 2300 and 1500/1400 BCE (Vicze 2013). The Middle Bronze Age tell settlement belongs to the Vatya culture (Poroszlai 2000, 13; Vicze 2013).

The Hallstatt period hillfort is triangular in shape with sides of unequal length (500 m, 600 m and 700 m) (MRT 7 1986, 231-233). The hillfort covers an area of about 10 hectares and is protected by an earth wall or rampart and a ditch, which today is 11.5 m high in places. It is regarded as having been an important centre throughout the Iron Age. The settlement was also occupied during the La Téne period. So far, the only example of Celtic stone sculpture in Hungary, a carved stone head, was found within the enclosed settlement (Poroszlai & Vicze 2004, 93; Jerem & Mester 2010, 54-56). The hillfort has the largest known Hallstatt period tumulus cemetery in Hungary (Poroszlai 1999, 376), which covers about 50 hectares and consists of close to 400 burials (Czajlik et al. 2016) of which 122, the larger ones, were visible and began to be documented as early as 1847 (Czajlik 2008, 97; Luczenbacher 1847, 286).

The geological layer under the Bronze Age settlement contains clay that was historically seen as suitable for brick making and was used in a factory situated next to and 130 m below the site. The demand for the clay has meant that some of the archaeological remains were destroyed during its extraction (Poroszlai 2000, 14; Vicze 2005, 66-68). Excavation has shown that the top of the Bronze Age tell includes a mixed level containing finds from Hallstatt C-D and La Téne D as well as some form the Middle Bronze Age. From level II and below, the material is dated to the Middle and Early Bronze Age (Poroszlai 2000, 16).

It has been pointed out that loom weights are fairly

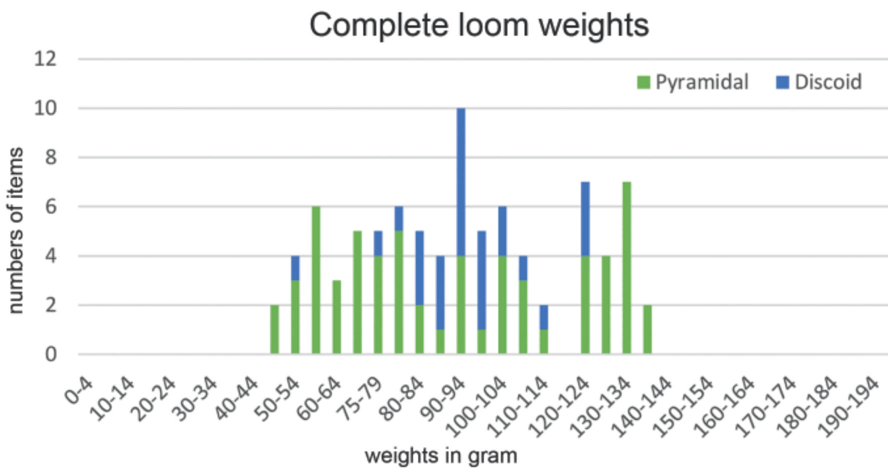

Fig. 2: The weights of the complete loom weights: green indicates pyramidal loom weights and blue indicates discoid loom weights (Image: Sophie Bergerbrant)

Fig. 3: A pyramidal loom weight (Image: Sophie Bergerbrant)

similar in weight and shape over long periods and are therefore difficult to date (Gleba 2008, 128). The tools discussed here have been registered in the Matrica Museum as belonging to the Middle Bronze Age and have been previously published as such (Poroszlai 1992; Poroszlai & Vicze 2004; Marton 2001, 300). This was based on their provenance and a brief preliminary study. The general area where the tools were found contains both Bronze Age and Iron Age remains. With no contextual data, the dating of these tools is unclear and they need to be analysed and compared with other textile tools. This article aims to present the previously unpublished work on them and an analysis of the period to which they might belong.

Method

All of the weights included in the study are held by the Matrica Museum and were examined in person. The weights were weighed to the nearest gram. In the case of fragmented loom weights, the full weight was estimated wherever possible. For those that were even less complete, only the current weight was recorded (table 1 and table 2). The loom weights' widths, heights and depths were recorded according to Mårtensson et al. (2009, fig. 7).

Material

In total, 194 loom weights were examined for this study. In each case, the loom weight has a single suspension hole. They were found outwith a closed archaeological context at the site Százhalombatta-Földvár by private collectors and given to the Matrica Museum, Százhalombatta between 1987 and 1992.

Of these, a total of 127 (see fig. 2, fig. 3 and table 1) could be defined as small pyramidal loom weights. More than half are complete or almost complete, and their original weight could be calculated. The complete or almost complete weights range between 48 g and 135 g with a mean of 90.66 g (based on 61 complete loom weights). Most of the pyramidal loom weights (Mårtensson et al. 2009, fig. 2) are of Gleba's (2008, 131) type F2a, and the bases are more or less rectangular.

A total of 35 weights have decoration on the top. The cross symbol is the most common mark; it was found on 22 weights. Nine loom weights have an X mark, two have a small round depression and two have an I mark on their tops. A total of 24 of the marked examples are complete or almost complete and they weigh between 75 g and 135 g. No differences between the marks can be discerned concerning the weight or height of the loom weights with marks. However, as a group they are among the heavier examples in the complete collection. The pyramidal loom weights measure between 4.1 cm and 8 cm in height and from 2.7 cm to 4.6 cm in width (at the broadest part). The median width is 3.6 cm and the median height is 6.3 cm.

There are 67 discoid loom weights (Mårtensson et al. 2009, fig. 2; see fig. 4-8 and table 2 for all with an estimated weight) which measure between 51 g and 123 g, with a mean 94.15 g (based on 26 complete loom weights). A discoid loom weight is one which is flat or which has a slightly convex surface, and has the suspension hole near the edge (Gleba 2008, 132; Mårtensson et al. 2009). While these major characteristics enable the pieces to be grouped among the discoid loom weight category, there are three types

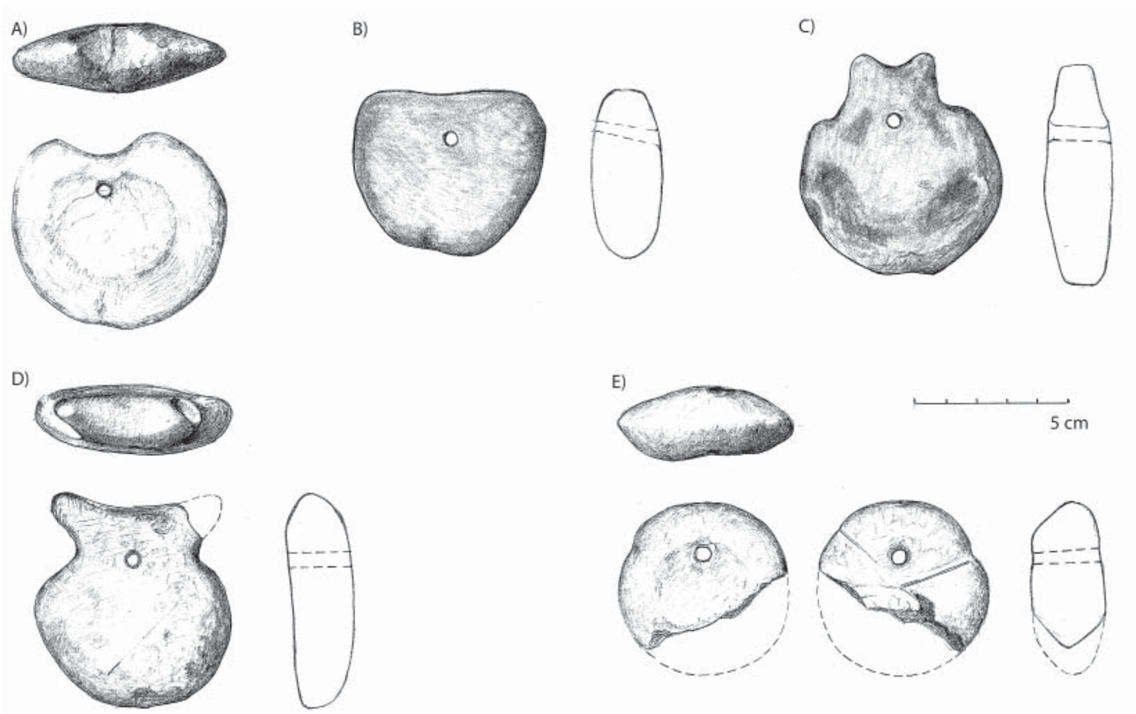

Fig. 4: The five discoid types of loom weights from Százhalombatta-Földvár, Hungary (Image: Sophie Bergerbrant)

Fig. 5: A round discoid weight (number 1); type A discoid loom weights (numbers 2 to 25) (Image: Sophie Bergerbrant)

Fig. 6: Type B discoid loom weights (Image: Sophie Bergerbrant)

Fig. 7: Type C discoid loom weights (Image: Sophie Bergerbrant)

Fig. 8: Type D discoid loom weights (Image: Sophie Bergerbrant)

that seem to be unique to this assemblage. They are all handmade and have a wide variety of individual characteristics.

The discoid loom weights can be broadly divided into five distinct types. All of them have a rounded lower part but vary in the upper part (fig. 4). The first type (A) has a depression on the top above the suspension hole (fig. 5.2-25) which can be like a small dimple that gradually widens and transforms from an almost half-circle (fig. 5.8-11, 15) to a long flat surface with two little ear-like protrusions (fig. 5.16-18, 20). It is interesting that in some cases the depression is asymmetrical, causing the ear-like protrusions to become lopsided (see fig. 5.4, 8-9, 14-15, 18, 22). Fig. 5.25 shows that this asymmetry could very well be intentional as the piece was deliberately made this way. Type B can be described as a half circle (fig. 6) with a round lower half and a straight or almost straight top part. No other example of this form has been found in Hungary so far. It is interesting to note that there are two examples that can be considered transitional pieces between groups A and B (fig. 5.19, 23). The third form has the same rounded lower part but instead of going down in the middle, the upper part goes up (C), forming, over a shoulder-like feature, a double knob, which is over the suspension hole (fig. 7). Interestingly, there are five pieces within this group, which do not have rounded lower halves but instead finish in a straight line (fig. 7.13-17). No parallels for this type have been located. A probable derivation from type C is the next type (D), where on top, above the shoulder, wide horn-like horizontal protrusions can be seen (fig. 8). The shape of these loom weights at this time is unique to the site. There is only one example of the classical (E), completely round discoid shape (fig. 4.E and 5.1). A total of 23 loom weights are of type A, while there are four of type B, 30 of type C, and seven of type D. It was not possible to categorise the single round discoid and two transitional forms. A total of 26 were complete, making it possible to determine the exact weight; these range between 51 g and 123 g. Though clear divisions between the types are difficult to discern, type A examples tend to be lighter (with an average weight of 87.3 g based on 12 pieces) while the heavier pieces (with an average weight of 110.4 g based on eight pieces) are of type C. The height of the complete examples varies from 5 cm to 7.4 cm. The width at the widest point (measured on all that had a complete middle section) ranges between 4.1 cm and 7 cm. The thickness of the discoid loom weights is between 0.9 cm and 2.2 cm with a mean of 1.15 cm and a median value of 1.5 cm (based on 61 measurements).

Dating the loom weights

The existence of warp-weighted looms is illustrated by the presence of loom weights (Gleba and Mannering 2012, 14-16). It can also be seen in the eastern Hallstatt area in the well-known depiction on a conical necked vessel in Tumulus 27 from Sopron-Burgstall (Várhely in Hungary), which shows one woman spinning and another weaving on a warp-weighted loom (Grömer 2012, 58).

The contexts, shapes, marks and weights of the loom weights were analysed to pinpoint a possible date for them. Several studies have been conducted on textile tools in the Bronze Age in the east Mediterranean (Andersson Strand & Nosch 2015; Burke 2010), and some on central and northern European examples (Belanová Štolcová & Grömer 2010; Kneisel & Schaefer-Di Maida 2019) and Italian (Gleba 2008; Sabatini 2019) of loom weights. These studies in addition to several others were the basis for the discussion which follows.

Site context

The excavations of the Middle Bronze Age tell settlement produced a small number of textile tools. They are found in a reliably dated context. The loom weights are all pyramidal in shape and weigh from 340 g to more than 1 kg (Bergerbrant, forthcoming). Excavations in the hillfort Százhalombatta-Sánc-hegy produced spindle whorls, a bobbin (?) and bone needles all dating to the latter half of the early Hallstatt period, Ha C2-D2, circa 800/750 BCE to 450 BCE (Marton 1999, 140). At least one of the spindle whorls is biconical (Marton 1999, table 2:1).

The archaeobotanical data from Százhalombatta-Földvár shows only a nominal presence of flax seeds (*Linum usitatissimum*) in the Middle Bronze Age and none in the Late Bronze Age (Stika & Heiss 2013). The seeds may have been removed before the plant was brought back to the settlement (Maier & Schlichtherle 2011, 568) and the very low quantity could indicate that flax was not processed on the site or was an unimportant crop during the period. This may suggest that flax was not a major component in fabric making. However, it must be borne in mind that an absence of evidence is not evidence of absence. In contrast, sheep are the dominant animals in the zooarchaeological record from about 2000 BCE onwards. The rise in the number of sheep occurred at the transition to the Middle Bronze Age (2000 BCE to 1600 BCE). At the same time, the slaughter age of the sheep shifted in a way that indicates a change from acquisition of meat (indicated by an early slaughter age) to wool (indicated by a predominance of older sheep). In the period 2000

BCE to 1600 BCE, more than 60% of the sheep were kept as adults; moreover, one third of these were male. The only reason for keeping older male sheep would be for their wool (Vretemark 2010, 164-166).
There are therefore indications of pre-existing textile production in both periods and this information does not help to narrow down the date of the loom weights.

Shape

Kneisel & Schaefer-Di Maida (2019) have presented a review of the published loom weights in the period 2200 BCE to 500 BCE in the area from the Rhine to Warta (west to east) and from Denmark to the alpine region (north to south). The study contains 6,734 loom weights of which 5,904 are identified as different types (Kneisel & Schaefer-Di Maida 2019, fig. 4.1). The pyramidal-shaped examples occurred from the Neolithic era onwards, and are the most common type with 4,167 examples (62%) on record (Kneisel & Schaefer-Di Maida 2019, 87, fig. 4.1). According to Belanová Štolcová & Grömer (2010, 16), pyramidal, spherical and discoid loom weights are the most common forms in the Late Bronze Age (1300 BCE to 800 or 750 BCE) and the Hallstatt period, whereas spherical and cylindrical are the most common in the Late Neolithic and Early Bronze Age (2300 BCE to 1600 BCE). In the Hungarian material, there are pyramidal loom weights from the excavated Middle Bronze Age layers from Százhalombatta-Földvár (Bergerbrant, forthcoming). Pyramidal loom weights have been found from the Neolithic era onwards in Hungary (Horváth & Marton 1998; Marton 2001; Ďurkovič 2015). It is clear that in central Europe during the Iron Age pyramidal-shaped loom weights were the dominant type, although other forms existed as well (Banck-Burgess 2018, 5; Kneisel & Schaefer-Di Maida 2019, 86). The loom weights also reduced in size and, for example, became narrower in the Iron Age than they were in the Urnfield period (Banck-Burgess 2018, 5).
At the Middle Bronze Age (1600-1350 BC) settlement site Montale in Italy, five different types have been identified: truncated pyramidal, bell-shaped, ring-shaped, bun-shaped and cylindrical (Sabatini 2019, 46). Of the 95 loom weights, only three are pyramidal (Sabatini 2019, 46-59). In Italy, pyramidal loom weights became the most common type during the first millennium BCE (Gleba 2008, 131).
Pyramidal loom weights are found at some sites in the eastern Mediterranean from the end of the Neolithic era (Burke 2010, 24) and exist at sites during the Bronze Age (Andersson Strand & Nosch 2015). They can be found at Quartier Mu, Malia, Crete (Poursat et al. 2015, 229-270), Archontiko (Papadopoulou et al. 2015, 294-295), Sigagroi (Elster et al. 2015, 304-305), Troia (Guzowsla et al. 2015, 321), Apliki (Smith et al. 2015a, 331) and Kition (Smith et al. 2015b, 340).
According to Belanová Štolcová & Grömer (2010, 16, fig. 3.9) flat oval weights with a hole on top also existed in the Late Bronze Age and the Hallstatt period. They were produced in the central European tradition and now identified as disc-shaped (Belanová Štolcová & Grömer 2010, 16, fig. 3.9). It would be surprising if the authors had put discoid loom weights similar to the types under discussion here into any of the other categories. However, as there is no written description of the type, it is difficult to be certain.
Discoid loom weights are common in the Mediterranean Bronze Age (Andersson Strand & Nosch 2015), whereas in central Europe, as argued above, they appear to first become common in the Hallstatt period. The current survey of discoid loom weights in central Europe shows that they are more common during the Hallstatt period than in the Bronze

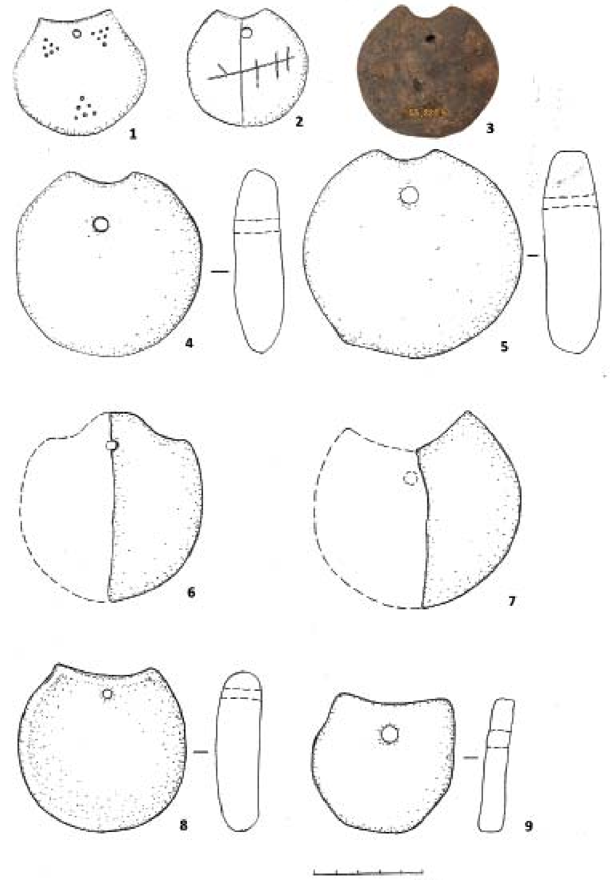

Fig. 9: Early Iron Age loom weights from Hungary: 1 & 2) Somló (Patek 1968: Pl. LIV.10-11); 3) Süttő (note image is not to scale, the diameter is 9 cm); 4 & 5) Tata (Vadász 2003); 6 & 7) Koroncó (Mithay 1970); 8) Halimba (Lengyel 1959); 9) Kajárpéc (Németh 1996)

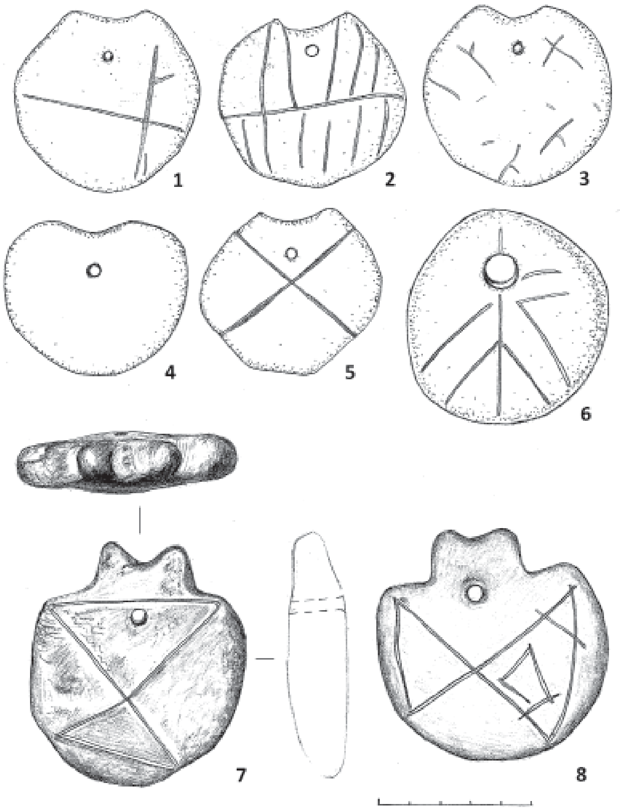

Fig. 10: Examples of incised decorations on different types of discoid loom weights: 1 to 5) Svodín, Slovakia; 6) Gór-Kápolnahalom; 7 to 9) Százhalombatta-Földvár (Image: 1-5) after Němejcová-Pavúková, 1986; 6) after Marton 2001, 7-8 Sophie Bergerbrant)

Age (Belanová Štolcová & Grömer 2010, 16; Kneisel & Schaefer-Di Maida 2019, fig. 4.2). The best and most numerous comparisons for type A from within the wider eastern Hallstatt cultural area are the flat and heart-shaped loom weights found at Molpír (Belanová Štolcová & Grömer 2010, 16; for Hungarian examples see table 3 and fig. 9) or the completely rounded ones from Devín (Studeníková 1993) type E, which would indicate a Hallstatt period date for these finds (fig. 10). Ďurkovič (2015, 89) argues that the pyramidal and discoid loom weights are characteristic for the Early Iron Age in the north-western parts of the Carpathian Basin. Therefore, the combination of pyramidal and discoid loom weights in this study would indicate an Early Iron Age date.

Marks

Marks in the form of crosses and dots are common on loom weights in eastern Hallstatt Culture (Belanová Štolcová & Grömer 2010, 16; Grömer 2012, 54). Simple marks on the top of the surface are also common in Italy (Gleba 2008, 134-135). The different types of marks found on the loom weights from Nové Košariská, Slovakia (Belanová Štolcová 2012, 313), from Győr-Ménfőcsanak, Hungary (Ďurkovič 2015, 100-103) and Százhalombatta-Földvár cannot be connected to any specific weight group. Their meaning is therefore difficult to understand. It has been suggested that marks on top of pyramidal weights could be production marks or aids in weaving a pattern (Belanová Štolcova 2012, 313). The marked pyramidal loom weights from Százhalombatta-Földvár do not provide any further information which could help in understanding their meaning.

In Italy, there are also loom weights with more advanced forms of decoration (Gleba 208, 135-136). In the case of the loom weights from Százhalombatta-Földvár which have been studied, it could be argued that the shapes of some of the discoid loom weights are decorative. However, the difference in their shape could have a similar function to their decoration, which, in keeping with that on the pyramidal loom weights, could have provided some aid to weaving. It must be noted here that the incised decoration on these loom weights is more complex in design than the ones on the pyramidal weights (fig. 10). The crosses, Xs, Is and small, round depressions on the top of some of the pyramidal loom weights seem to indicate they belong to an eastern Hallstatt culture group and date.

Weight

The loom weights in this study differ from the loom weights found during excavations of the Bronze Age tell levels (Bergerbrant, forthcoming). Even though the loom weights found in the excavated layers are all pyramidal, none are as light as these (Bergerbrant, forthcoming). Light weights from the Bronze Age exist in many other areas - in, for example, Minoan Knossos. The spherical loom weights weigh from 86 g to 710 g and, of these, ten (11%) weigh between 86 g and 130 g (Burke 2010, 51-53), which puts them in the light category. A number of eastern Mediterranean sites have produced light loom weights (Andersson Strand & Nosch 2015) - for example, the area Quartier Mu, Malia, in Crete has more than 600 loom weights. The site has different loom weight clusters, in one of which the loom weights weigh between 75 g and 150 g. The weights are of many different shapes (Poursat et al. 2015). Most of the loom weights that are complete or sufficiently preserved to estimate complete weight in the Centre for Textile Research database (from the eastern Mediterranean, which is the basis for Andersson Strand & Nosch's 2015 publication) are loom weights less than 400 g, with an emphasis on

No of loom weights	Site name	Diameter (cm)	Reference
23	Százhalombatta	5.2-8	This article
1	Budapest-Harsánylejtő	~ 6	Zsidi 2017, 62-63
1	Nagybörzsöny-Rustok-hegy	8.5	Matuz & Nováki 2002, fig. 115, 4
10	Tata	8.5-10	V. Vadász 2003, T. 5
5	Süttő	8.6-11.2	Unpublished museum collection
1	Kajárpéc	6.7	T. Németh 1996, fig. 4:22
1	Koroncó-Újtelep	~ 8.5-9.5	Mithay 1970, 10, fig. 2, 13
3	Halimba	7.8	Lengyel 1959, T. XLVII, 5-6 & 8
5	Somló	~ 5.5-6	Patek 1968, T. LXX

Table 3: Early Iron Age sites in Hungary with discoid loom weights of Type A

weights in the range 100 g to 400 g. Of the 2,280 data points, about 160 weigh less than 50 g, and the ranges 50 g to 100 g and 100 g to 150 g include about 480 loom weights each. These numbers are estimates because they are presented in a table without exact numbers (Firth 2015, 164-165).

Of the loom weights found on the Po Plain in Italy belonging to the Middle Bronze Age studied by Sabatini (2019), all but three weighed between 287 g and 1230 g. The three exceptions weigh between 134 g and 150 g. In the Late Bronze Age (1350 BCE to 1150 BCE), the weights in the area seem to get heavier (Sabatini 2019). The weights published in Bazzanella (2012, 211) for Neolithic and Bronze Age Italy are consistent with the main weights in the Po Plain. Lighter loom weights, with the exception of the three noted by Sabatini (2019), weighing from

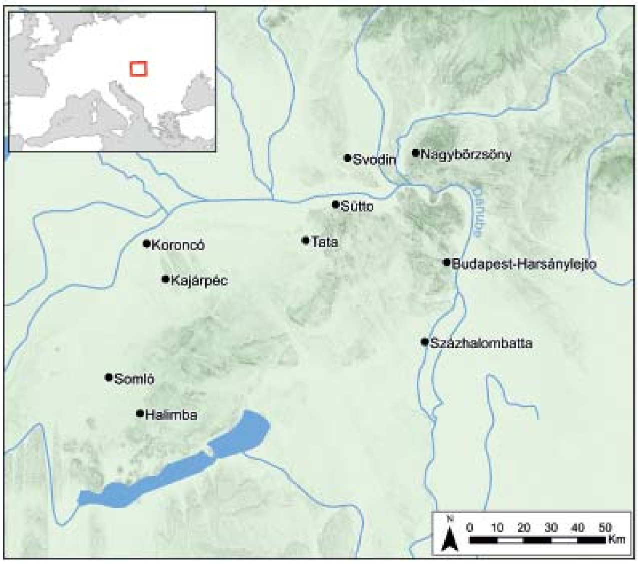

Fig. 11: Map showing the Hungarian sites with discoid loom weights (Image: Sophie Bergerbrant)

20 g seem to appear in the Final Bronze Age in Italy (Gleba 2008, 135).

According to Belanová Štolcová & Grömer (2010, 17), there is no significant change in weight between the Neolithic, Bronze Age and Urnfield, Hallstatt period loom weights as there are some variations within the periods. At the Hallstatt period site Nové Košariská, Slovakia, 170 pyramidal loom weights were found in a house. Based on their placement in the house, they have been interpreted as the remains of two looms: one with 91 heavy loom weights of about 1,300 g each and another one consisting of 79 loom weights weighing about 600 g each (Belanová Štolcová 2012, 312). Many of the publications cited regarding loom weights in central Europe are primarily concerned with shape and do not mention the weight. It is therefore difficult to achieve a complete picture of the relevant evidence.

The majority of the Early Iron Age (HaC) loom weights at Győr-Ménfőcsanak are pyramidal and generally weigh between 960 g and 1,690 g, with the majority between 1,300 g and 1,690 g (Ďurkovič 2015). The examples from the Middle to Late Iron Age (HaC2-D2) site in Gór-Kápolnadomb, Hungary, weigh from 1,200 g to 1,750 g (Marton 2001) and are therefore regarded as heavy. Examples of light loom weights can be found in the eastern Hallstatt area, for example, the 50 small flat discoid loom weights that weigh between 45.6 g and 157.9 g at Smolenice-Molpír (Belanová Štolcová 2012, 311). Another example is the single light pyramidal loom weight found at the Hungarian settlement Győr-Ménfőcsanak that weighs 112 g (Ďurkovič 2015, 91, 103).

Although light loom weights are present in the eastern Mediterranean from the Bronze Age (Burke 2010; Andersson Strand & Nosch 2015), the lighter loom weights, at less than 130 g, seem not to make their appearance in central Europe until the Late Bronze Age or Early Hallstatt period based on this literature review. Taken together, these point to a Hallstatt period date for the light loom weights from Százhalombatta-Földvár.

Date

Pyramidal loom weights seem to be the most common both in number and distribution in central and northern Europe, whereas the discoid type is limited to the eastern Alps and Czech Republic according to Kneisel & Schaefer-Di Maida (2019, 88 & 90). The small discoid loom weights seem to have a clear connection to the eastern Hallstatt culture, though at Százhalombatta-Földvár, there is one example of this type (type E). However, there are similar loom weights to types A and B presented here (fig. 4A and fig. 4B) from other hilltop settlements such as Smolencie-Molpír (Belanová Štolcova 2012, 311-312) and from burials such as Svodín (Němejcová-Pavúková 1986, 196, fig. 19: 1-6) and Tata (Vadász 2003, Plate V.), which seem to suggest a Hallstatt period date.

In addition to the previously discussed typo-chronological parallels of the loom weights from Százhalombatta, a detailed visual analysis of the clay fabric was undertaken. This concluded that the type, quality, quantity and composition of temper used for these loom weights is in line with the local Iron Age ceramic tradition.

Textile production in eastern Hallstatt area

The Hallstatt period has an unusually large number of preserved textiles. This is partly due to the finds from the Hallstatt salt mines (Grömer 2012, 42-43). Textile remains from graves also exist in other areas in Austria (Grömer 2012, 43-44; Grömer et al. 2013), Germany (Banck-Burgess 2012), Hungary (Bender Jørgensen 2005, 141-142), Czech Republic, Slovakia (Belanová Štolcová 2012, 310), and Slovenia (Bender Jørgensen 2005).

The textiles themselves are very varied and attest to the use of many weaving types, such as tabby, twill and diamond twill (Grömer 2012, 42-43). The main weave became 2/2 twill, and the fibres used were wool, linen and hemp as well as other fibres (Bender Jørgensen 2005, 138). The Hallstatt period has spin pattern twills that almost vanished with the La Téne period (Bender Jørgensen 2005, 138; Grömer 2012). In the La Téne period the textiles seem to become more uniform and possibly coarser (Bender Jørgensen 2005, 138, Belanová Štolcová 2012; Grömer 2012). Banck-Burgess (2018, 6) concludes that some of the textiles such as pieces from Hochdorf show that they were produced by specialists who contributed to the regional power structure and economy.

Spindles and occasionally loom weights can be found in graves from the period (Vadász 2003; Grömer 2012, 54; Belanová Štolcová 2012, 312; Banck-Burgess 2018, 4; Metzner-Nebelsick 2018, 16) and show the importance of the craft. The illustrations of individuals that spin or weave, such as on the conical necked vessel from Sopron-Burgstall (Grömer 2012, 58) and the Tintinnabulum, Bologna (Gleba 2008, 30) indicate that it was a female craft. Metzner-Nebelsick (2018, 16) connects the presence of spindle whorls and loom weights in some female Kalenderberg graves, a sub-group of eastern Hallstatt culture in Austria and Hungary, with their involvement in textile production and the social role as lady of the house. The importance of the craft is probably indicated in the conical-necked vessel from Sopron–Burgstall (Grömer 2012, 58). It is possible that the presence of textile tools in rich female graves is connected to control over textile production. Banck-Burgess (2018, 6) argues that Iron Age textile production centres are difficult to document based on settlement evidence. Although Belanová Štolcova & Grömer (2010, 9-20) view it differently and interpret the site Smolenice Mopír (with more than 2,100 spindle whorls and a large number of loom weights) as a textile production centre. Webley (2018, 15) argues that crafts, including textile production, are often carried out at a household level. He suggests that the common finds of spindle whorls and loom weights prove this.

The looms used in the eastern Hallstatt area could be fairly large, up to 4 m, based on the loom weights which are interpreted to be their remains (Belanová Štolcova 2012, 312-313; Belanová Štolcová & Grömer 2010, 16; Grömer 2012, 54). These looms seem to have had weights mainly in the range 350 g to 1,600 g (see above). The lighter weight group in this study (51 g to 135 g) seems to be less common, and seldom found in as large numbers as in Százhalombatta. The large looms are found both at hillforts and other types of settlements (Belanová Štolcova 2012, 313), indicating that weaving large textiles was not confined to the hillforts.

Traces of a small settlement outside the walls at the Százhalombatta-Sánc-hegy have been found (Poroszlai 1999, 16). However, the loom weights here were most probably found in an area within the hillfort's wall but farther away from the dense household area in the centre. Private or illicit excavations were known to be primarily carried out within the fortification walls. The name given as the find spot by the donor of these loom weights (Földvár) indicates the southern part of the Bronze and Iron Age site complex. The donor is the landowner of this particular part of the

site and the objects were found while he was working on his land. Current knowledge suggests it seems that the northern part (Sánc-hegy) consists of dense Iron Age settlement features without any Middle Bronze Age remains. This part is considered to have been the centre of the Iron Age hillfort. The southern part is where the Middle Bronze Age tell is, and it also contains scattered Hallstatt period and Celtic remains, which are clearly not as abundant as in the northern part.
The site Smolencie-Molpír, which seems to have fairly similar loom weights to those of Százhalombatta, is situated between two cultural spheres (north-east alpine Hallstatt and the Lusatian culture) and suggests that the site participated in long-distance trade (Belanová Štolcová 2012, 312). The Hallstatt period Százhalombatta-Sánc-hegy is not as well excavated (Marton 1999) but its strategic situation by the Danube and the finds from the nearby large Hallstatt cemetery (Czajlik 2008, 97; Poroszlai 1999, 376) suggest that the site could have been an important part of a long-distance network, probably similar to Smolencie-Molpír. An important difference so far is that Smolencie-Molpír has revealed around 2,100 spindle whorls (Belanová Štolcová 2012, 311). Only a few spindle whorls have been collected from the Százhalombatta site complex or given to the museum. From the casual finds, only about ten spindle whorls have been donated to the museum. While all the light discoid loom weights were given to the museum in 1987, the pyramidal loom weights were passed to the museum sporadically between 1987 and 1992 in three batches. Without further details about the find spots, it is difficult to say with confidence whether or not they all came from a limited area, such as a workshop or artisan's location.

Conclusion

Comparison with loom weights from dated contexts and a review of the site suggests that the light loom weights in this study most likely belong to the Hallstatt period. It seems that weaving on large looms was an activity known during this period. As the Iron Age hillfort (Százhalombatta-Sánc-hegy) only had limited excavations, it is not possible to say whether there would have been a large loom with heavier weights at the site at this time. The large number of light loom weights (more than 180) might indicate that textile production was an important factor in Százhalombatta-Sánc-hegy as well. However, without more extensive excavations of the hillfort, this is difficult to establish with certainty.

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Early Iron Age textile tools from the Požega Valley, Croatia

Abstract
This paper presents an overview of textile tools from two Early Iron Age sites in northern Croatia. The results of their analysis outline the current state of research into textile production in the Early Iron Age Požega Valley. A total of about 200 finds from both settlement and funerary contexts provide insights into a diverse range of shapes and sizes of loom weights, spindle whorls and spools. These suggest that the site at Kaptol was a settlement where textiles were produced in large numbers. Diversity among the textile tools suggests that woven textiles came in different sizes and were made from yarns of different qualities, reflecting the creativity and innovation of the Hallstatt world. A fragment of a burned wooden beam with three oblique, oval holes, next to a set of loom weights could be the remains of a loom. Spindle whorls and loom weights also appear as grave goods where they might be gender and status indicators with important symbolic value. They may also be related to different levels of skill and specialisation within the process of textile production. If that is the case, the process of textile production itself had symbolic value in Early Iron Age Croatia.

Keywords: Kaptol, Kagovac, Croatia, Early Iron Age, textile tools, loom weights, spindle whorls, spools

Introduction

Textile production in prehistoric Europe has been widely researched in the past decades (Barber 1991; Gillis and Nosch 2007; Gleba 2008; Andersson Strand 2012; Gleba and Mannering 2012; Andersson Strand & Nosch 2015; Grömer 2016) and has yielded valuable information on various textile uses, its production methods and techniques, context of finds, and last but not least, the identity of textile makers. Nevertheless, the topic of textiles and dress is quite rarely mentioned in Croatian prehistoric archaeology, although certain dress reconstructions (Milićević 1984) and important finds of textile imprints and tools have been discussed, the latter mostly in the light of experimental archaeology (Dizdar 1996; Krmpotić & Vuković Biruš 2009; Grabundžija & Ulanowska 2016; Sekelj Ivančan & Karavidović 2016).

The aim of this article is to provide new insights into Early Iron Age textile production in continental Croatia. It presents finds from two sites in the Požega Valley in eastern Croatia including the latest finds from the excavation season of 2019. The sample consists mainly of baked clay loom weights and spindle whorls and only one spool. They were discovered either in closed burial contexts or at the settlement (some from systematic excavations and others as surface finds).

According to the current literature, the Early Iron Age in the northern and north-eastern part of Croatia is marked by the Kaptol group, which is in turn, a cultural component of the Hallstatt culture, a widespread Early Iron Age phenomenon (Potrebica 2019, 504). This material culture was named after the site of Kaptol, which is one of the sites discussed in this paper. Added to this sample are the tools from another nearby site (Vetovo-Kagovac). The aim of this paper is to give an overview of the current state of textile research in the Early Iron Age of the Požega Valley based on its textile tools. Different find contexts permit a discussion of both the organisation of textile production and the potential symbolic significance of textile production tools discovered in graves.

Research history and contexts

The Požega Valley is located in northern Croatia. It is almost completely enclosed by five mountains with the river Orljava as the only natural southern exit towards to the Sava River valley, and further to the wider area of the Pannonian plain. All the finds analysed here originate from two sites located on the slopes of the Papuk mountain in the north of the Požega Valley. Aside from the strategic geographical position, prehistoric communities often settled in the Požega Valley because of rich natural resources, such as graphite on the mountains of Psunj and Papuk, which was used in pottery production by Iron Age societies (Dizdar & Potrebica 2002, 111-112).

The site of Kaptol has a long tradition of systematic excavations (Potrebica 2013, 69). Fourteen tumuli have been excavated at Čemernica, the southern necropolis, which is dated to the period between Ha C1 and Ha D1 (Potrebica 2019, 497). The excavations lasted from 1965 until 1971 (Vejvoda & Mirnik 1973). Rich finds discovered there caused the culture formerly known as Wies, Wies-Martijanec or Kaptol-Martijanec to be generally recognised as the Kaptol Culture in more recent works (Egg & Kramer 2005, Abb. 2; Potrebica 2019, 488). Textile tools analysed in this paper were discovered in six tumuli at the northern necropolis, located in the immediate vicinity of the hillfort, at the location of Kaptol-Gradca. The necropolis on Gradca has at least of 25 tumuli. Of these, 17 were excavated from 2000 to 2017 and all of them are dated to the period Ha C1 to Ha D1, which is the same era as the burials from the Čemernica necropolis (Potrebica 2019, 497). The systematic excavations at the hillfort started in 2009. Most of the finds belong to Late Hallstatt/ Early La Tene chronological phases (probably from Ha D2 to Lt B1). Although culturally this was the final phase of Hallstatt Culture, tumuli were not used at that period and the settlement was fundamentally reorganised. Nevertheless, at least some areas of the settlement were also inhabited in the classical Hallstatt period and therefore contemporary with the mound necropolises (Ha C1-Ha D1) (Potrebica & Mavrović Mokos 2016, 58).

The burial rite on both Kaptol necropolises was very similar. Incinerated human remains in an urn or a container made of organic material were placed in a wooden box or chamber (in a range of sizes) together with a variety of grave goods. In some cases, the wooden chamber was walled with dry-stone construction but all of them were covered with an earthen mound. Both necropolises are extremely rich and are thought to have been elite burial grounds. Grave goods include weapons (axes, spears and helmets), horse gear, elaborate feasting sets, exquisite ornaments and textile production tools. The quality and well-defined structure of these grave goods as well as the elaborate funerary rituals suggest high status men and women were buried under these mounds (Potrebica 2019, 490-497).

The other, smaller part of the sample presented in this paper originates from the nearby site of Kagovac near Vetovo. The first tumulus excavated at this site, Tumulus 1, contained four spindle whorls. This tumulus is dated to the Ha C1 period, and the burial custom and various grave finds are similar to the ones at the site of Kaptol which is located only 6 km to the west (Potrebica 2019, 500).

The existence of the site of Vetovo-Kagovac was previously known but with the help of light detection and ranging (LiDAR) scanning which was conducted in 2014 as part of the international project *Encounters and Transformations in Iron Age Europe* (ENTRANS), new information was revealed. The LiDAR scan and field surveys revealed that the site itself consists of a fortified hillfort on the Gradac Hill, a necropolis with about 15 tumuli located along the road leading to the settlement from the west, and a necropolis with much smaller tumuli located on the southern slopes of the hillfort (Potrebica 2019, 499). To this date, four tumuli have been excavated on the western and one on the southern necropolis, and only within one of the burial chambers were textile tools found. Several textile tools discovered in the area as well as in the filling of the mounds date back to the Eneolithic, since the Iron Age mounds were erected over the settlement of the Eneolithic Kostolac Culture (Potrebica 2019, 499).

Owing to the composition of the soil, the organic components of textile production tools, such as wooden spindle shafts and distaffs have disintegrated, although the location of a single wooden loom beam from the settlement at Kaptol has been documented (Potrebica & Mavrović Mokos 2016, 58).

Textile tools and methodology

A total of 208 finds of textile production tools were analysed. The sample consists of 81 spindle whorls, 121 loom weights and six potential spools. A total of 202 of the 208 finds originate from the settlement and the necropolis of Kaptol-Gradca. The other are six from the necropolis of Kagovac. Most of the sample is represented by loom weights (58%) and spindle whorls (39%), whereas spools are rare (3%) and their

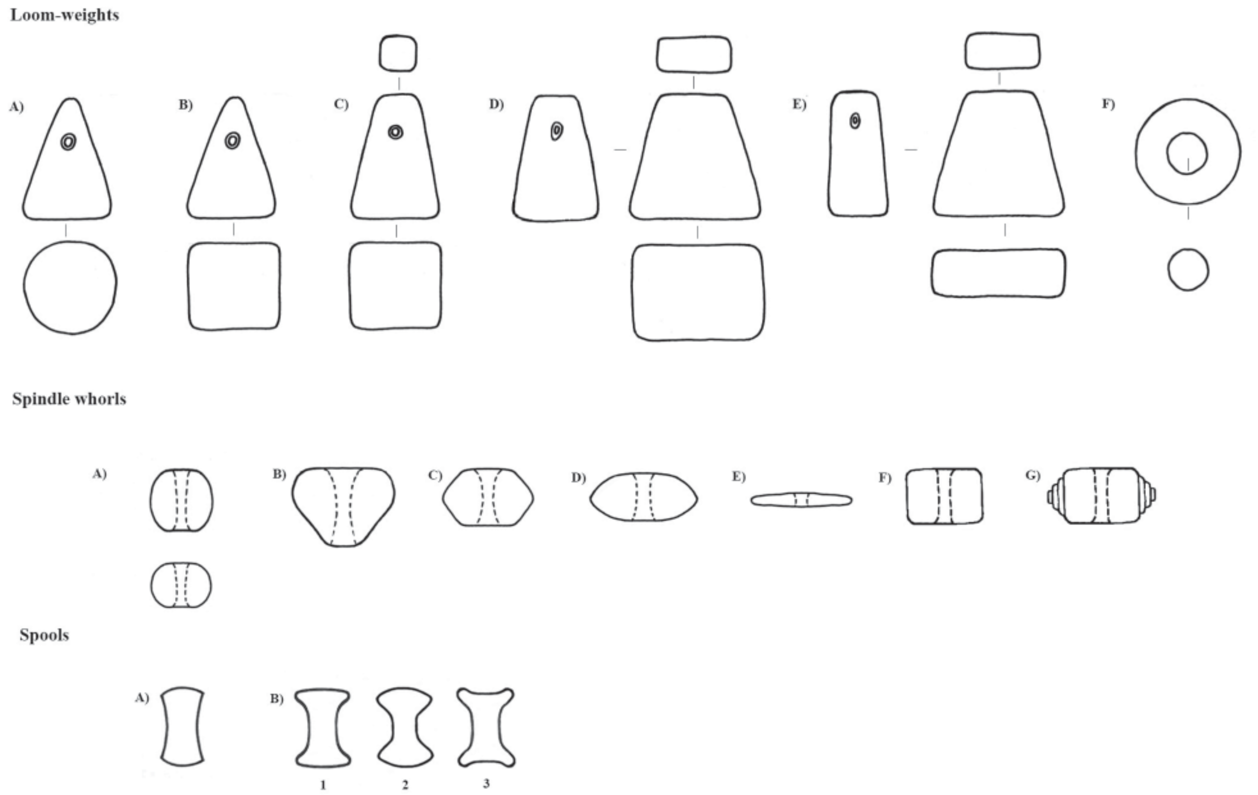

Fig. 1: Typology of textile tools from the sites of Kaptol and Kagovac. Loom weights: a) conical; b) pyramidal; c) truncated pyramidal; d) prismatic trapezoidal; e) flat trapezoidal; and f) ring-shaped. Spindle whorls: a) globular; b) conical; c) biconical; d) lenticular; e) discoid; f) cylindrical; and g) special shape. Spools: a) cylindrical body with widened ends; and b) concave body with i) convex ends; ii) flat ends; and iii) concave ends (Image: Julia Fileš Kramberger)

identification is questionable as most of the finds initially identified as spools are very fragmented. At the site of Kaptol, the material analysed was found in six excavated trenches (Trenches 1 to 7). Although surface finds come from all over the settlement area, the majority is from the location called Lisičje jame (which means fox holes). The finds from burial contexts come from six tumuli (Tumuli 1, 3, 8, 12, 13 and 17) at the necropolis at Gradca. At Kagovac, the textile tools were discovered under Tumuli 1 and 3 at the western necropolis. Nevertheless, the only clear Early Iron Age context can be attributed to the four spindle whorls found inside the burial chamber in Tumulus 1.

All the finds so far are of baked clay, and some have been documented as having signs of secondary burning. Morphological characteristics were recorded for all finds, such as their dimensions, weights (for example, fig. 3, fig. 10 and fig. 13) and shape (fig. 1). For fragmented finds, when it was possible, the total weight was calculated based on the reconstruction of the object's total volume using the percentage of its preserved volume. Height, width and perforation diameter were documented for spindle whorls, as well as any decorations on their surfaces and possible use-wear traces around and within the perforation. All the dimensions were documented for the complete spindle whorls (100%) or almost complete (90%) and fragmented (50% to 85%), but for the ones which were completely fragmented (0% to 45%), it was impossible to measure all dimensions, and, in some cases, none were documented due to poor preservation. For the loom weights, height, width, thickness and perforation diameter were measured, and use-wear traces and any kind of surface marks were documented as well. All the dimensions were measured for the loom weights that were completely (100%) or almost completely preserved (90%). For the rest, which were either partially fragmented (70% to 85%) or highly fragmented (0% to 65%), it was impossible to measure all the dimensions, and in some cases the fragmentation was so high that none were documented. Finally, in the case of spools, their height and the diameter of both their bases and the middle portion of the body were measured.

Fig. 2: Loom weights from the settlement of Kaptol (Image: Maria Vuković)

Loom weights

The shape of all the loom weights found on the two sites is generally pyramidal (fig. 2), although different categories within this shape have been formed. Therefore, they have been divided into six main categories: a) conical; b) pyramidal; c) truncated pyramidal; d) prismatic trapezoidal; e) flat trapezoidal; and f) ring-shaped (fig. 1).

Most of them were discovered in a settlement context (around 85% of the total). Only a small number of finds was discovered in graves, such as the set consisting of 16 pyramidal and truncated pyramidal loom weights from Tumulus 12 at Kaptol and by a single pyramidal or trapezoidal loom weight in Tumuli 3 and 13 at Kaptol and Tumuli 1 and 3 at Kagovac.

About half of the loom weights in the sample are of the pyramidal and truncated pyramidal type and a little over 40% of the loom weights fall into the categories of the trapezoidal type. Only 3% of the loom weights are conical and the rest, about 2%, were so fragmented that their shape was impossible to define.

A single find that was included in the loom weight group differs from the rest of the sample. It is a ceramic doughnut or ring-shaped object. This type of utensil is usually interpreted either as a cooking ring or a ring-shaped loom weight in the relevant literature (Kneisel & Schaefer-Di Maida 2020, 105-106). It has a diameter of about 8.1 cm, its width is about 3.8 cm and the diameter of the perforation is between 3.3 cm and 3.6 cm. Its weighs 225 g. The rims of the perforation are slightly worn and rounded and, in some places, additionally flattened. This may be the result of the object being suspended by a loop or thread. There is also a deep horizontal gash visible within the hole which is possibly the result of perforating the clay object and shaping the hole while it was being made. It was likely to have been used on a loom as a weight, and possibly for finer and denser textiles, although this is questionable as it is the only find of its type. It was discovered in a burnt Early Iron Age house in Trench 6. This trench is rich in textile implements, and it is also the place where the potential evidence for a

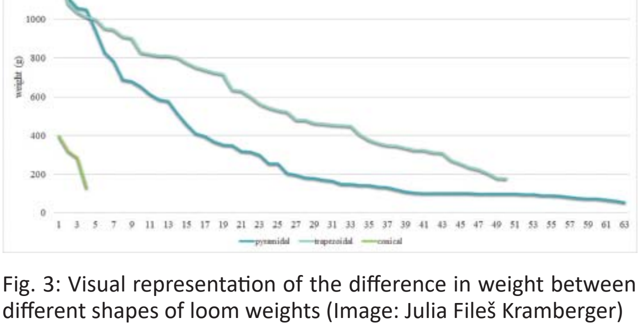

Fig. 3: Visual representation of the difference in weight between different shapes of loom weights (Image: Julia Fileš Kramberger)

loom was found. Therefore, it is quite probable that this object was used in a textile production process.
Prismatic and flat trapezoidal weights are bigger and heavier than pyramidal and truncated pyramidal loom weights (fig. 3). They all originate from the settlement at Kaptol, either from systematically excavated trenches or from the location of chance finds. Their weights range from 175 g to 1273 g, and the average trapezoidal loom weight weighs 583 g. The average weight of pyramidal weights is almost half the average weight of the trapezoidal ones, which is about 310 g. It is also noteworthy that the truncated pyramidal loom weights (about 28% of the sample) are on average the lightest, and only five of them weigh more than 400 g, the rest range from about 50 g to 250 g. The average weight of truncated pyramidal loom weights is about 190 g. About 55% of the sample weigh less than 300 g, which is quite small for loom weights. The other 45% range from about 350 g to more than 1,200 g.
The dimensions of the loom weights reflect their weights.Overall, the width of the loom weights in the sample is less than the thickness, making the width their functional morphological trait. The width was defined as the maximum size of the loom weight's side with the perforation on the surface. Therefore, depending on the loom weight's shape and desired weight, the height of individual loom weights range from about 6 cm to 14 cm. The ratio between the width and thickness is determined by each loom weight's shape. This ranges from about 3 cm to more than 10 cm.
Use-wear traces are commonly documented in the sample and mostly consist of a rounding of the loom weight's perforation rims. Especially striking are the traces of wear present on the topmost part of the hole rim on several loom weights, which confirms they were used for weaving. These traces are the result of damage produced by the loop or cord attaching the threads to the loom weight (Karavidović & Sekelj Ivančan 2018, 5). Some damage and striations around the hole rims might have been created during the production phase of the loom weights.

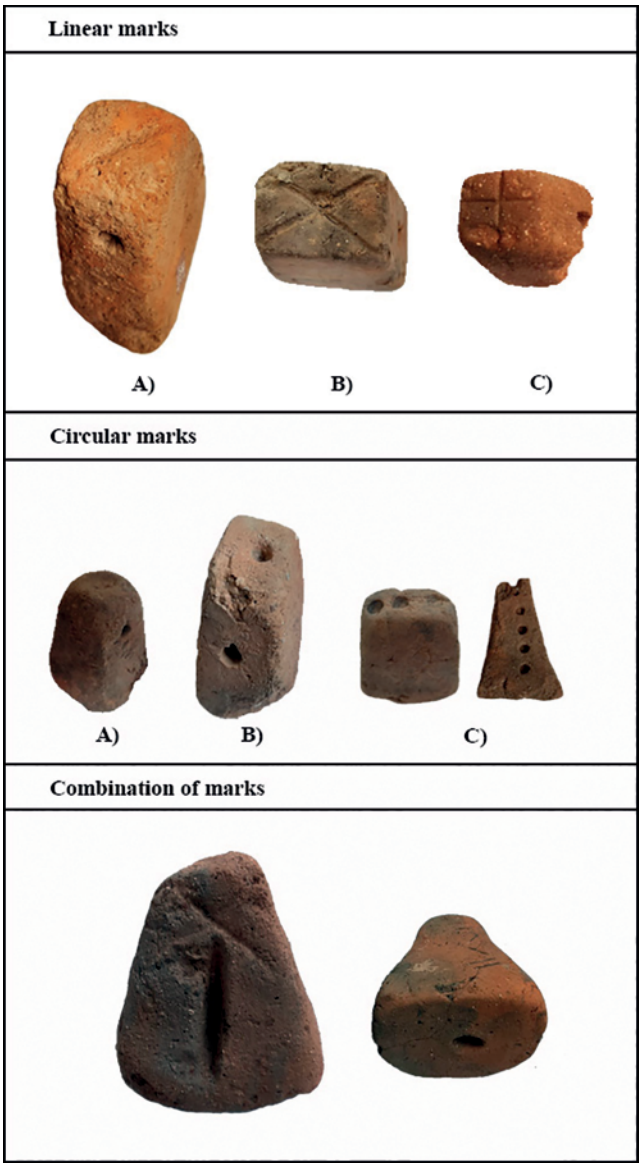

Fig. 4: Examples of marked loom weights from the site of Kaptol. Linear marks: a) single line; b) X-shaped; and c) cross shaped. Circular marks: a) shallow and wide circle impression; b) deep circular impression; and c) multiple circular impressions. Combination of marks: two examples of combined marks (Image: Julia Fileš Kramberger)

Marks on loom weights
About 35% of the sample bear marks on their surfaces. This phenomenon is relatively common in the Early Iron Age period in the eastern parts of the Hallstatt Culture, but its purpose has not yet been explained. Most commonly, these marks are lines, crosses, dots or circles on the surfaces (Belanová et al. 2007, 428), and usually on the top surface, but not limited to it (Gleba 2008, 134-135; Belanová Štolcová & Grömer 2010, 16). In some European regions from the Bronze Age onwards, impressions of gems and other objects, and even sigla appear on their surfaces (Rahmstorf 2015, 7).
They might have had a simple, aesthetic value, although more commonly the simpler motifs such as lines, dots or crosses on the top surface have been regarded as symbols of practical use. These marks could have been placed on the surfaces of loom weights as owners' or potters' marks (Rahmstorf 2015, 7), to mark certain groups or sets of weights or even to distinguish some of them from others in terms of weight (Hoffmann

Fig. 5: A loom weight from the hillfort at Kaptol with an X-shaped mark and triple horizontal lines above and below it (Image: Julia Fileš Kramberger)

1964, 20) to help in placing and organising them while warping the loom (Sekelj Ivančan & Karavidović 2016, 188-189) or patterning while weaving (Belanová Štolcová & Grömer 2010, 16).

The marks in the present sample are mostly located on the top surfaces of truncated pyramidal or trapezoidal types of loom weights. On three samples, the marks are present on the sides, and two loom weights have a combination of marks present on more of their surfaces. The only loom weight found inside Tumulus 1 at Kagovac has two parallel linear marks on its base, and, by all accounts, these marks are traces of the loom weight being set on a surface for drying during its production phase.

The shapes of the marks are quite simple, consisting of circular or linear motifs (fig. 4). About 40% of the marked weights have circular or oval indentations. These are mostly simple, wide and shallow and rarely deep indentations on the top surfaces of truncated pyramidal or trapezoidal loom weights, probably made by finger impressions. Three loom weights have much smaller circular marks on them that look as if they were made by a tool with a circular cross-section and are present in a combination of one, three or five such signs either on the top surface or the sides. Sometimes, the circular marks come in groups or combinations with other types of signs, and these are discussed as a separate category. A little over 50% of the marked loom weights have a simple linear symbol, either a single incised or grooved line or two incised or grooved lines crossed over in the shape of a cross or an X. Of those, crosses and single lines, either horizontal or diagonal, are equally present (on nine loom weights each), and only five loom weights are marked with an X symbol. Only three loom weights bear a combination of marks, in all cases a combination of a circular indentation paired with either a cross or an X and single lines. One of them is a loom weight from Trench 7 at Kaptol and its marks are present on the top and base and on one side. On the top surface, there is a barely visible shallow grooved X-shape, while in the centre of the base, a deep and symmetrical circular impression is visible. On one of the sides, there is a combination of an X-shaped incision beneath with three parallel horizontal lines above it (fig. 5). This is a single such mark present on the loom weights found at Kaptol and it is therefore impossible to compare it with the rest of the sample based on the loom weight's shape or weight. Furthermore, it was found in one of the surface layers of Trench 7 at the Kaptol hillfort and therefore has no clear context within any of the settlement structures.

As all five types of marks on loom weights from Kaptol and Kagovac appear on loom weights of different shapes and sizes and in different locations, it is impossible to link a specific symbol with a specific type of loom weight. The loom weights from Tumulus 12 are an exception because four out of 16 bear marks on their upper surfaces (fig. 6). Three marks were in the shape of a cross, and in one case the cross comes in a combination with a circular impression. The most interesting observation about these finds is that the four marked loom weights were the lightest in the whole set. Their weights range from about 70 g to 80 g, and the rest of the loom weights are between 80 g and 100 g. it is possible that these loom weights were marked precisely because they were the lightest, so the weaver could differentiate them from the rest while warping the loom. Unfortunately, this set of loom weights, although probably belonging to a single loom, was not found *in situ* where it was used for weaving. Instead, it was found inside the burial mound, where it was placed on a pyre and next to the remains of the deceased as a part of the funeral ritual. Therefore, it is impossible to say whether these four marked loom weights had specific spots on the loom when being used.

Specific sets of loom weights

Within the overall sample, two specific groups of finds should be presented in more detail. The first is the set of 16 loom weights found in Tumulus 12. None of the loom weights are higher than 8 cm, their

Fig. 6: Four marked loom weights from the set found in Tumulus 12 at Kaptol (Image: Maria Vuković)

width and depth range from 3 cm to 5 cm and they all weigh from about 70 g to about 100 g. Their average weight is 89.5 g and the sum of their weights is a little under 1.5 kg. They were all found on the remains of the funeral pyre and in the burial chamber, both inside the tumulus, and they have traces of secondary burning. This suggests that these loom weights might have been part of a single loom that was added to the funeral pyre during the cremation of the deceased and afterwards partly placed inside the grave with the remains. Very slight use-wear traces around the perforations suggest that they had been used for a short time before burning on the pyre and deposition inside the burial. Nevertheless, all of the loom weights are preserved very well with no other major traces of use. The *in situ* position of the loom weights did not reflect the position of loom weights on a loom. However, by calculating the total width of all the loom weights and dividing it by two to represent the two layers for creating a basic shed, it can be concluded that the loom might have been about 30 cm to 40 cm in width and could have been used for weaving narrow pieces of textile or bands.

The other set of finds comes from Trench 6 at the settlement of Kaptol, where about 30 loom weights were found in the remains of a house dated to the earlier, Hallstatt horizon (Ha C2-Ha D1). The site was, unfortunately, heavily damaged by erosion. A set of 12 trapezoidal loom weights certainly belonging to the same loom set were found next to the remains of a wooden beam. Ten out of 12 are very well preserved (from about 70% to 100% of their total volume) and weigh from about 780 g to more than 1,200 g. Two of them 12 weigh less than 300 g. The average weight of these 12 loom weights is about 840 g. Dimensions of sufficiently preserved loom weights were measured and it turned out that their heights are mostly between 12 cm and 14 cm, except for the two smaller ones which are about 8 cm. Their average width is around 6 cm but ranges from 4.3 cm to 7.8 cm. Their thickness, which is, in this case, the non-functional parameter, ranges from 7.3 cm to more than 11 cm, and the average thickness is about 10 cm. There are five loom weights in this set with marks on their surfaces, although no uniformity in the shape of the mark nor their correlation to the weight of the loom weights can be confirmed. This might imply that these signs marked specific spots for certain loom weights on the loom and were not used as a distinctive feature between weight classes.

More than 20 other loom weights were found in the general proximity of the first-mentioned group, although they come from different units and many of their original positions were unfortunately changed owing to those layers being damaged because of erosion. Among those, there are about 12 coming from two very similar and intermixed layers, both close to the one where the previously mentioned set was found. Half of these 12 is trapezoidal and the other half is pyramidal or truncated pyramidal. Their weights range from about 180 g to over 1,000 g but is much less uniform than the weight of the 12 described above. Their average weight is about 600 g, although the general analysis of their weights should be considered with caution, as they are all very fragmented and were only sufficiently preserved to record their weights accurately, while the rest were calculated based using an estimate of their preserved volume. These loom weights might have belonged to the same loom as the previous 12, although based on the clear differences in their morphology and the generally poor state of preservation, they might have simply belonged to the textile production space where they were found. They could have belonged to a completely different loom setup or they might have been stored in this part of the structure as spare loom weights (Karavidović & Sekelj Ivančan 2018, 4).

Spindle whorls

Another group of finds are the spindle whorls (fig. 7). They can be categorised as seven main types: a) globular; b) conical; c) biconical; d) lenticular; e) discoid; f) cylindrical; and g) special shape (fig. 8). Most of the whorls (about 42%) are biconical, followed by globular (21%), lenticular (20%) and conical (11%) whorls. The discoidal whorls are rare and represented by only three finds, while the cylindrical and the

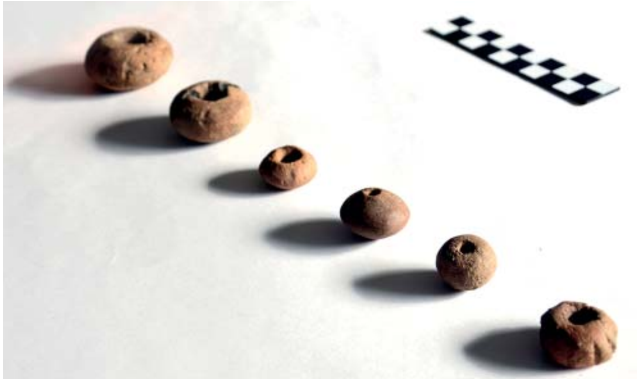

Fig. 7: Spindle whorls from the hillfort of Kaptol (Image: Maria Vuković)

Fig. 8: Special or star-shaped whorl from the hillfort at Kaptol (Image: Julia Fileš Kramberger)

special-shaped whorls are represented by only one example each. The special-shaped spindle whorl (fig. 1: G) is essentially star-shaped, as it has six conical bulges evenly arranged around the whorl (fig. 8). This is the only such find from Early Iron Age Croatia to date, although similar whorls have been found on the nearby Iron Age site of Donja Dolina in northern Bosnia (Truhelka 1914, 98). This spindle whorl shape is not as rare in prehistoric archaeological assemblages as might be expected and, to name a few examples, it is found in the Bronze Age Terramare culture of northern Italy (Sabatini et al. 2018, 374) and at settlements of the Late Bronze and Iron Age Lusatian culture in Poland (Przymorska-Sztuczka 2018, 59), where these and similar shapes of spindle whorls are sometimes described as "horned" (Przymorska-Sztuczka 2018, 59; Taras 2012).

About 10% of the spindle whorls have a so-called "hollow top" (Andersson Strand & Nosch 2015, 148, fig. 5.1.5), a depression around the perforation on the top surface of the whorl (fig. 9: A), which might have had a practical use in securing the already spun yarn on the spindle (Gleba 2008, 106). About 24% of all the whorls have a particular morphological trait comprised of a ridge around the hole on the lower part of the whorl (fig. 9: B). These two traits were not considered for identifying a special type of whorl, as they are present in various categories. The hollow top is only present in biconical and conical spindle whorls, as five and four pieces respectively. The raised ridge around the perforation on the bottom surface of the whorl is present in several biconical, globular and lenticular types and only one conical spindle whorl. It could have had a practical use too, possibly for securing the whorl on the spindle shaft or maybe even to help insert the spindle in the shed during weaving, if it was being used as a shuttle (Barber 1991, 305). Finally, it should be noted that globular and lenticular whorls

Fig. 9: a) Two spindle whorls with examples of hollow tops from the hillfort at Kaptol; and b) a spindle whorl from Tumulus 17 from Kaptol with a raised ridge around the bottom rim of the perforation (note that the whorl was photographed upside-down) (Image: Julia Fileš Kramberger)

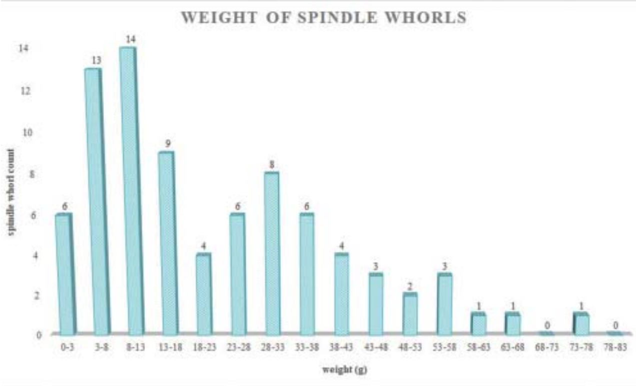

Fig. 10: Visual representation of weight of spindle whorls found at Kaptol and Kagovac (Image: Julia Fileš Kramberger)

were the only types found in a burial context. These types of whorls were also found in the settlement, in addition to the rest of the shapes.

The vast majority of the spindle whorls can be described as very small (less than 10 g), small (10 g to 25 g) or medium-sized (25 g to 50 g) based on their dimensions and weights (fig. 10) and using Mazăre's categorisation (2014, 12). Only about 6% falls into the category of large (50 g to 75 g) and 1% into the category of very large (more than 75 g) spindle whorls. More accurately, only 15 of 81 weigh more than 40 g, which fits well with the notion that in the Early Iron Age spindle whorls usually weighed 10 g to 15 g, and rarely more than 40 g (Grömer 2005, 111).

The overall dimensions of the spindle whorls correlate with their weight. In general, the height of the spindle whorls ranges from about 1 cm to a little more than 3.5 cm, and the average height is about 2.2 cm. The maximum diameter of the spindle whorls ranges from 1.4 cm to a little over 5 cm and the average maximum diameter is about 3.2 cm.

The smallest and lightest spindle whorls, weighing less than 10 g, were also included in the statistics because they are of similar shapes and have similar decorations as the larger ones. It has been proven that whorls as small and light as these could have been used for spinning (Olofsson et al. 2015; Mårtensson et al. 2006) and, in this case, they were usually found as single finds and not in clusters (Gleba 2008, 109). Theoretically, it is possible that some of them, especially the ones lighter than 3 g, could have been used as beads (Mårtensson et al. 2006, 11).

The perforation of a spindle whorl is supposed to be wide enough for attaching it to a spindle shaft and its expected diameter should fall within a range between 0.3 cm and 1 cm (Barber 1991, 52). Within the current sample, it was possible to measure the perforation diameter for 77 spindle whorls. The results showed that most of the analysed spindle whorls have slightly tapered holes, where the difference between the maximum and minimum diameter usually falls within 0.1 cm, although in rare cases it goes up to 0.3 cm. The measurements of the perforations' diameters range from 0.3 cm to 2.2 cm, with more than half the spindle whorls having a perforation with a diameter between 0.3 cm and 0.7 cm. A total of 18% of the whorls have a perforation diameter of 0.4 cm to 0.5 cm and another 13% have a diameter of 0.3 cm to 0.4 cm. This data coincides with the aforementioned spindle whorl dimensions, where small and medium-sized whorls, paired with small perforations, suggest the spinning of short and fine to medium-fine wool (Barber 1991, 52; Gleba 2008, 108-109). More accurately, the perforation diameter within these ranges belongs to smaller spindle whorls with a maximum diameter of up to 3 cm. Nevertheless, the maximum perforation diameter of about 30% of the spindle whorls is more than 1 cm, and in only two cases range from 1.6 cm to 2.2 cm. Most of these belong to spindle whorls with a maximum width between 3 cm and 5 cm. It is possible that the function of some of these objects could be interpreted as something other than spindle whorls, although their general appearance, dimensions and use-wear traces, where visible, do not differ from spindle whorls with perforations of a smaller diameter. This would imply the use of a sturdier spindle. It was possibly used for spinning longer fibres such as flax or for plying thread.

Decorations on spindle whorls

It is noteworthy that about 35% of the analysed spindle whorls are decorated with incisions, impressions or other techniques in the forms of lines, dots and other geometrical and abstract shapes (fig. 11). Nevertheless, the motifs are so varied that no conclusion related to the distribution of decorated whorls can be made. Sometimes, the surface of the whorls has been badly

Fig. 11: Various examples of decorated spindle whorls from the site of Kaptol (Image: Maria Vuković)

worn out and the decoration is barely visible. The star-shaped spindle whorl is the only one decorated with protrusions on the body of the whorl, while the rest of the whorls are decorated by merely producing shapes on the surface in diverse techniques such as incision, grooving, impression and even cord impression. The patterns include dots and circles, triangles and various lengths of straight or curved lines organised in groups, and sometimes these shapes come in combinations. The decorations are mostly present on the entire surface of the whorl and rarely only on the top surface. At the settlement of Kaptol, the decoration of spindle whorls is extremely varied in pattern and technique, especially in comparison with the ones from the burial contexts both at Kaptol and Kagovac, where whorls are mostly decorated with incised or grooved lines and V-shapes. There are even several spindle whorls with unique decoration patterns, which are not present on any other whorls within the sample. Some of them include combinations and groupings of V-shaped lines and dots, covering the entire surface of the whorl with grooved concentric circles or pierced dots or covering the whorl with deep vertical linear incisions etc. Although two whorls are decorated with cord impressions, the patterns of the impressions are quite different. As the entire sample from this settlement is quite small, it is not unusual that certain decoration patterns are present on only one or two spindle whorls. This does not mean that they are unusual for the Early Iron Age, as similar patterns have been recorded on spindle whorls throughout the Hallstatt region and beyond (Truhelka 1902; Gleirscher 2003, 61, tab. 4; Grömer 2005, 108, fig. 1; Gleba 2008).

One of the spindle whorls (fig. 11: 10), found on the surface at the settlement at Kaptol has been ascribed to the so-called West-Pannonian spindle whorl type (Preložnik 2014, 316). These can be found throughout the vast area from the Danube in the north and east to the Drava in the south. These spindle whorls are grouped into a special variant or type based on their decoration consisting of grooving or incising small lines which create three to six separate sections on the entire or only the upper surface of the whorl. These sections are then filled either with parallel grooved or incised lines or impressed dots. Another specific trait is that these spindle whorls are usually globular, biconical or lenticular in shape and have a raised ridge around the (probably) lower rim of the perforation. Based on dated grave contexts, these spindle whorls were in use in Ha C (eighth and seventh centuries BCE) period (Preložnik 2014).

The spindle whorl in question (fig. 11:10), found at the site of Kaptol, is quite small and weighs only 2 g. Slightly lenticular in shape, it has a raised ridge around one of the rims of the perforation. The upper surface of the whorl is divided into four sections by four double grooved lines which spread radially from the central perforation of the whorl. The sections are filled with small circular impressions and another pair of parallel lines, running vertically up to the main four lines. The lower surface is decorated with similar grooved lines but they are grouped into three separate fields of six up to more than ten parallel lines, and the spaces in between are filled with small circular impressions. While collecting the West Pannonian spindle whorl examples, they were considered to have the ridge around the upper perforation rim, suggesting a "neck" (Preložnik 2014, 312; 314, fig. 3; 315, fig. 4). However, the raised ridge is around the lower rim of the perforation, and it resembles conical spindle whorls with the wider surface at the upper end of the spindle whorl (Andersson Strand & Nosch 2015, 148, fig. 5.1.5). This spindle whorl has been very well preserved and shows almost no use-wear, so it was possibly not used before deposition.

Another similar spindle whorl was found in Trench 6 at the settlement of Kaptol which could also be included in the West Pannonian spindle whorl type. It is lenticular in shape, has a raised ridge around its lower perforation rim and it weighs 8 g. Although the decoration has been slightly smoothed, it is still apparent that the upper surface is divided into five sections by five single grooved lines, and the spaces in between are filled with small dot-like impressions.

Most spindle whorls have certain damage traces either on their surfaces or on the rims and inside the holes but sometimes it is hard to distinguish technological from use-wear traces. Many spindle whorls in the present sample show traces of perpendicular or horizontal striations on the rims and within the holes, as well as certain deformations of the hole shape itself. These are all possible traces of piercing or treatment to the surface of the unbaked clay at different stages of the spindle whorls' drying (Forte & Lemorini 2017, 173). On the other hand, some spindle whorls show clear traces of small spall detachment, polishing and rounding around the rim of the hole which would imply the repeated action of inserting and removing the spindle shaft and even the spindle whorls coming into contact with the spun fibre while spinning (Forte & Lemorini 2017, 174; Forte et al. 2019, 4). Finally, some traces, such as abrasive wear on protruding parts and cracks might be results of the spindle whorls coming into contact with something while being used, stored or dropped, and even through taphonomic processes after deposition (Forte & Lemorini 2017, 174).

Fig. 12: Six objects initially interpreted as pieces of spools, found at the hillfort of Kaptol. The only object identified as a spool is marked f (Image: Julia Fileš Kramberger)

Spools

Initially, six objects from the settlement of Kaptol (fig. 12) were analysed as possible spools. After further examination, it was concluded that only one of them (fig. 12:F) was definitely a spool. Since the other five objects are fragmented, the preserved pieces could constitute between 40% and 70% of complete spools similar in shape to three types defined by Gleba's typology (2008). However, such shapes correspond to ornamental protrusions on handles of Late Hallstatt pottery vessels typical for this area (Balen-Letunić 2004, 267, fig. 16; 310, fig. 27.2). These vessels are quite common for the period of Ha D2 and somewhat later and they usually break at the narrowest point, which is the case here. They could also be central handles of clay lids (Rebay 2006, 112), which are also quite a common type on Kaptol hillfort. A good indicator could be the pottery's quality because, in general, vessels are of much higher quality than lids. Mistaking ornamental protrusions on handles for spools is quite common, so a statistical analysis of the state of fragmentation should be taken into account when analysing textile tools from comparative sites.

The only completely preserved spool has a cylindrical body and slightly widened, flat ends (fig. 1: Spindle whorls A) and is quite roughly shaped. Its height is 2.65 cm, the width of the central part of its body is 2.3 cm, and its flat bases or ends are 2.5 cm wide. It weighs 23 g. Although it was discovered in Trench 6 next to the loom weight set, it is unlikely that it was functional part of it (Gleba 2008, 140; Ræder Knudsen 2012, 259-260), since it is the only find of that kind. The fact that there are no clear use-wear traces visible on it certainly suggests this, although it is noteworthy that all textile production tools from this context were burned with the house, and their surfaces were heavily damaged.

Discussion

The finds presented here originate from burial (two tumuli at Kagovac and six at Kaptol) and settlement (surface finds and six excavated trenches at Kaptol) contexts. Judging by the distribution of the various tools, it can be determined that in tumuli containing textile tools within the burial chamber, spindle whorls were a norm, while the loom weights present a peculiarity. Nevertheless, in four tumuli there were finds of loom weights outside the burial chamber, mostly fragmented and in the surface layers of the burial mound, which implies that they might have been placed there accidentally while building it. On the other hand, in the settlement context, the ratio of spindle whorls to loom weights cannot be determined with any certainty, as there are very different numbers of textile tools found in various trenches of different size in the settlement location. For now, this reflects the status of the ongoing excavations and is not necessarily an accurate representation of textile production processes within the settlements. Furthermore, although the Kaptol settlement has been investigated to a certain extent, it should be taken into account that the one at Kagovac has not been investigated at all.

Based on the fact that the weight and the dimensions of the loom weights largely influence the final product (Mårtensson et al. 2009), the occurrence of two basic shapes (pyramidal and trapezoidal) and loom weights of generally diverse dimensions, suggest that in the settlement of Kaptol the production of textiles was not standardised. It seems that the trapezoidal weights, which are quite large and heavy but quite narrow, might have served for weaving larger pieces of fabric, possibly using thicker threads. On the other hand, the pyramidal ones, which are generally lighter and smaller, might have served for smaller looms used for weaving dense but lighter and finer fabric, possibly using finer threads. It has been suggested that thread diameter is influenced, among other things, by the weight of the spindle while spinning (Grömer 2005, 109-111). Based on this, it should be noted that spindle whorls in the settlement of Kaptol are very varied in their dimensions. The predominance of whorls under 40 g could suggest intense production of finer threads made of wool, while the presence of larger ones could also imply some coarse thread production, possibly even the spinning of flax and plying. Nevertheless, thread diameter is not in direct correlation only with

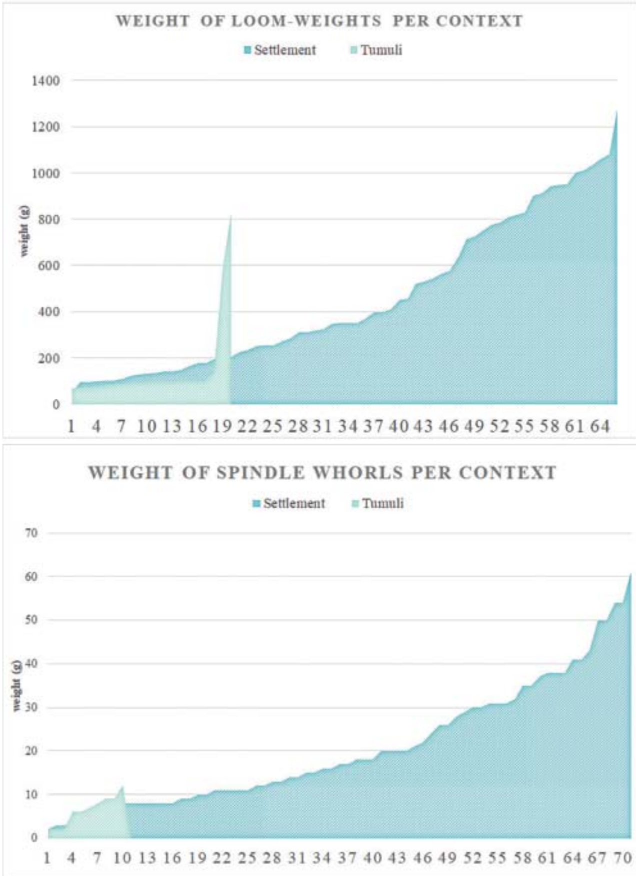

Fig. 13: Comparison of the presence of small spindle whorls and loom weights in a funerary context with finds at the settlement (Image: Julia Fileš Kramberger)

the choice of the spindle whorl based on its weight, but is a result of a combination of factors, such as the fibre material, the moment of inertia of the spindle and even the human factor of the spinner (Kania 2013, 13). Given the notion that thickness and quality of thread may not be influenced by the spindle itself at all (Kania 2013, 27), caution is advised when interpreting the possible outcome of spinning based only on spindle whorls from the archaeological record.

When comparing dimensions of loom weights and spindle whorls in the settlement and burial mounds, it should be stressed that both types of tools are represented by samples which are considered small (fig. 13). The loom weights from Tumulus 12 at Kaptol all weigh under 100 g. Even though the loom weights in Tumulus 12 are especially small and that this set might have been prepared only for funerary purposes, such loom weights are not uncommon throughout the settlement, which would imply that the production of fine fabrics on small looms was an activity within this community.

A similar situation can be observed in the case of spindle whorls, where only the ones falling into the category of very small and small whorls were added to graves. Such spindle whorls are present in large quantities in the settlement too, which leads to the conclusion that those smallest spindle whorls added to graves were not necessarily produced for the funeral but were carefully selected from the assemblage used for spinning in the settlement. The selection of the smallest whorls as burial goods may even be based on their potential symbolic significance – these being the ones used in producing the finest and most delicate threads.

The settlement context of textile tool finds from the sample analysed here suggests that textile production in the Early Iron Age of the Požega Valley area was a common activity. Moreover, based on the fact that these implements were found throughout the settlement of Kaptol and in various possible structures, it can be argued that textile production was an activity carried out on the level of household industry with possible attached specialist production (Andersson Strand 2009, 3; Grömer 2016, 280-281), which does not exclude the possibility of the existence of a more specialised workshop somewhere in the settlement. Nevertheless, as the trenches in the settlement of Kaptol were mostly situated on the slopes of the hill and the material has eroded, specific and closed contexts with textile tools have not been defined yet (Potrebica 2019, 498).

As spinning is a dynamic activity due to the spindle and distaff being light and mobile, the spinners could have moved about freely while spinning thread (Grömer 2005, 109). Therefore, the spots where the spindle whorls are found today reflect the places where they might have been purposefully or accidentally left during spinning. These could have been within or outside certain settlement structures but also in the neighbouring area. This is why spindle whorls are quite common finds within the Iron Age settlement of Kaptol within relatively well defined structures and also in unclear contexts.

On the other hand, the loom itself is a large and heavy device, usually leaning on a wall inside a house, and is therefore a construction not easily moved once it has been set up for weaving. That is why weaving is a static activity, which does not allow the weaver to move about carrying their work with them, which in turn, results in loom weights usually being found in the place where they were last used on a loom, or possibly where they might have been stored (Grömer 2016, 282). Although the tools for spinning and weaving are completely different and even though these two stages of textile production are not mutually dependent,

Fig. 14: The *in situ* find of a wooden loom beam at the settlement of Kaptol (Image: Maria Vuković and Julia Fileš Kramberger)

they belong to the same production process and it is therefore believed that these two operations within textile production were mostly carried out together simultaneously (Gleba 2009, 72). This may be why many spindle whorls at the settlement of Kaptol are found close to larger quantities of loom weights, where they might have been used in specially designated structures or rooms for textile production, particularly in the case of Trench 6, where there is a possible part of a loom found *in situ*.

Trench 6 is situated on the southern edge of the settlement. In terms of chronology, stratigraphic units excavated there belonged to two basic horizons: a later one, dated to the Late Hallstatt (Ha D2 to Lt B1) (late sixth to fourth century BCE); and an older one possibly dating to the Ha C2-Ha D1 period and contemporary to the tumuli burials (Potrebica & Mavrović Mokos 2016, 58). Parts of a burned house damaged by erosion were found in this older horizon. Around 30 loom weights in total were discovered within the house, scattered in a few groups, with a set of them found next to the burned wooden beam with three oval, oblique perforations (Potrebica 2019, 498). This could be interpreted as the wooden remains of an upright loom with visible holes for heddle rod supports (fig. 14). Owing to erosion, the loom was damaged and about 30 loom weights found on the surface of the house remains come from groups divided into several stratigraphic units. Based on the results of the analysis of these loom weights discussed earlier, it could be proposed that a larger fabric was woven on this loom and that it was possibly either made of fine, densely packed threads or a sparser fabric made of coarser threads. Based on the finds of several lighter loom weights within the set, it could be argued that either not all of these loom weights belonged to the same loom or that the loom setup consisted of specifically grouped or paired loom weights, to compensate for the difference in weight (Sekelj Ivančan & Karavidović 2016, 199-200).

Textile tools from burial contexts

The grave context of this type of finds, which comprises about 15% of the whole sample, gives them a completely different symbolic dimension. It has been argued that throughout prehistory and onwards, textile production was a female activity (Barber 1991, 283-298; Rebay 2006; Gleba 2009; Sofroniew 2011; García-Ventura 2014; etc) and that textile tools found in graves indicate that the deceased buried there were women (Barber 1991, 289; Gleba 2009, 69; Grömer 2013, 39; Rebay 2006, 192; etc). It is indeed confirmed by the fact that textile implements have been found mostly in female graves, with some rare exceptions (Ramsl 2002, 90; Grömer 2013, 40; Brøns 2013, 57). Traditionally, grave chambers featuring weapons are interpreted as male and those featuring textile tools as female (Gleba 2009, 69).

Further attention should be given to the different number and type of textile tools discovered in burials, since there is possibility that the number of textile tools implies the range of specialisation in the textile production process. It is possible that only one spindle whorl in a grave marks the deceased as female (Gleba 2013, 9; Grömer 2013, 32) and a larger number of spindle whorls, especially if found in combination with loom weights, spools or distaffs, might indicate a higher level of skill and specialisation of the deceased in this profession (Gleba 2013, 9; Grömer 2016, 272). This information is crucial for examining the textile tool assemblages from Tumuli 1, 8, 12 and 17 at Kaptol and Tumulus 1 at Kagovac. Two to four spindle whorls within the burial chambers might indicate that the women buried in these tumuli were extremely skilled spinners. The addition of a loom weight set to one spindle in Tumulus 12 implies that the deceased was a skilled weaver and spinner or was possibly highly visible within the textile production process to the community (Gleba 2009).

As the tumuli necropolises of both Kaptol and Kagovac are essentially graveyards of the elite, it is safe to assume that all the individuals buried there (including women) were of the highest social ranks. Two spindle whorls in addition to many pottery fragments were found in Tumulus 8, representing the lowest rate of finds which might be due to its partial devastation before excavation (Potrebica 2007, 87). The spindle whorls are both lighter than 10 g and globular in shape, while the larger one also has a raised ridge around the bottom rim and is decorated with incisions (fig. 15: 2). The smaller one weighs less than 2 g and might also be a bead, even though it is unlikely as there was only one like it in the burial. Tumulus 1 contained large quantities of pottery, a bronze fibula, several iron objects (among them an iron trunnion axe), as well as two spindle whorls (Potrebica 2011, 3). Both are small, and while the smaller one is conical, the larger one is globular or almost lenticular with a raised ridge around the lower perforation rim. In Tumulus 17, which also yielded only two ceramic vessels and some metal fragments, three small spindle whorls were found. They all have raised ridges around the lower perforation rims. One is essentially globular in shape, while the other two are lenticular with barely visible vertical grooves (fig. 15: 4). On the other hand, the grave with the largest number of grave goods at the necropolis of Kaptol, Tumulus 12 (fig. 15: 3), had one very small spindle whorl and 16 loom weights together with pottery and metal fragments, a wooden button and various bone pieces probably linked to the funeral attire of the deceased (Potrebica 2019, 495-406).

In Tumuli 3 and 13 at Kaptol, the single small loom weights were found in the surface layers of the earthen mound. Apart from these loom weights, these tumuli did not have any particular finds inside the burial that would describe them as typically male or female (Potrebica 2013, 106). It is uncertain whether these loom weights marked the deceased as being female as they were found in surface layers and in no clear context, and thus might not be symbolically connected with the burial but were accidentally thrown in while constructing the mound.

Grave goods under Tumulus 1 at Kagovac (dated to Ha C1) included a large feasting set and a number of other Hallstatt pottery vessels. A bowl with the remains of the deceased was surrounded by seven bronze fibulae (probably holding together original wrapping of the urn). The bowl probably fell from

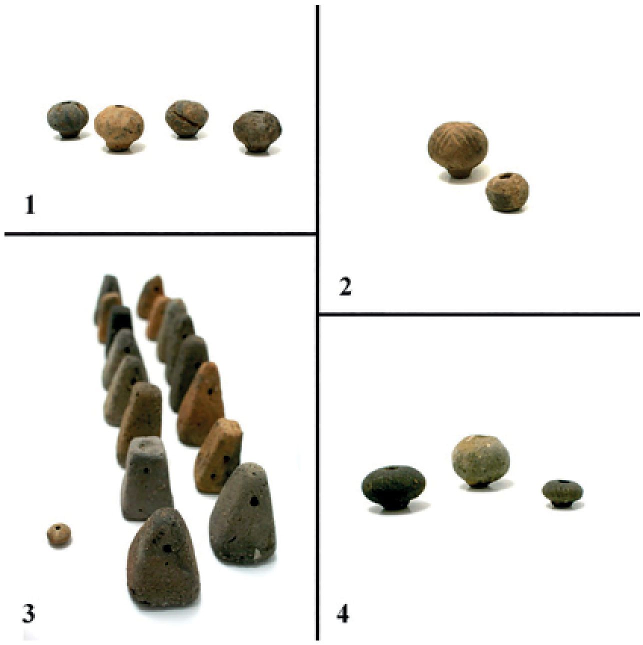

Fig. 15: Examples of textile tool sets from within burial chambers at Tumulus 1 at Kagovac (1) and Tumuli 8 (2), 12 (3) and 17 (4) at Kaptol (Image: Julia Fileš Kramberger)

some kind of organic pedestal and was discovered upside down. Four almost identical spindle whorls were probably placed over the burned bones since they were found under and just beside the upturned urn (Potrebica 2019, 499). Their shapes are generally globular with a raised ridge around the lower rim of the perforation and they all weigh between 6 g and 9 g (fig. 15: 1). They have traces of secondary burning, which suggests they were burned on the pyre with the body of the deceased and replaced next to the urn during the burial. Very slight traces of a rounded and flattened rim of the perforation are visible on all four spindle whorls, so it should be assumed that they were used for spinning prior to the burial. It should also be noted that they are all slightly damaged and deformed due to secondary burning, so the rounding and flattening of the surface might have been partly obscured by the deformation. All four were decorated with vertical or V-shaped grooves but, on some of them, they have unfortunately been rendered almost invisible by use, fire or taphonomic processes. They were found *in situ* next to the upturned urn. The four almost identical spindle whorls possibly belonged to a personal set of the deceased, which could have served for storing yarn. During spinning, the already full spindles could have been replaced by new ones and used as shuttles for weaving without the need to unwind the yarn to be able to continue spinning (Barber 1991, 305; Gleba 2008, 140).

In addition to the spindle whorls, a large pyramidal loom weight was found inside the stone structure of the same burial chamber. This loom weight probably did not form a part of the intentionally contributed grave goods but was possibly placed in the stone structure as part of the building material, originally coming from the earlier Eneolithic layers in the surrounding area. A similar conclusion was reached concerning a loom weight found in Tumulus 3 at the same site. There, a very fragmented piece of a large loom weight of a basically pyramidal shape was found in the bottom-most layers of the tumulus. More accurately, it was found on the periphery of the earthen mound of the tumulus, well outside of the confines of the Iron Age wooden burial chamber and on the surface of an Eneolithic settlement layer on which the tumulus was originally built. Although the loom weight was found while investigating the tumulus, stratigraphically it did not belong to the burial itself. The two loom weights found in Tumuli 1 and 3 at Kagovac are essentially similar, pyramidal and medium-sized to large, weighing more than 500 g.

Unfortunately, the cremated human remains from the tumuli on Kaptol and Kagovac are extremely fragmented, in some cases almost pulverised, and so far have received only preliminary anthropological analysis. However, it is interesting to note that five of the tumuli regarded as female graves also contain textile tools. Therefore, textile tools could have a gender-related connotation. The discord between relatively plain and simple spindle whorls in those graves and exquisite grave goods apparently supports this possibility. However, the loom weights are a completely different matter since those have been added to spindle whorls in one single grave – a likely female grave with the largest quantity of prestigious grave goods at the necropolis.

For now, it can be proposed that the individuals in Tumuli 1, 8, 12 and 17 at Kaptol and Tumulus 1 at Kagovac were women highly skilled in textile production and revered for it within the community. The presence of other, more prestigious goods, specifically in Tumulus 12 (Potrebica 2013, 73) at Kaptol-Gradca and Tumulus 1 at Vetovo-Kagovac (Potrebica 2019, 499), as well as addition of a weapon (iron trunnion axe) in Tumulus 1 at Kaptol-Gradca (Potrebica 2013, 107), suggest these women had high status within the community which was not directly related to their skills as textile makers. As suggested before, this could be more than just a symbolic representation in the funerary practice, but could even reflect some aspects of everyday life (Gleba 2009, 76). In a simple way, this could be described as: spindle whorls mark gender, while loom weights mark status. In the case of Kaptol (based on current research), this might suggest that organised textile production took place within the households of the elite rather than the ordinary people, which is common in many societies (Costin 2013, 192). Further studies on this matter are necessary before coming to any certain conclusions.

Conclusion

The purpose of the general overview of textile tool finds from these two sites is to present the current state of research into textile production of the Early Iron Age Požega Valley and to offer some issues for further investigation and possible future comparative studies. The specific position of the Požega Valley makes it potentially an ideal area to study textile production processes. It is a geographically closed area but still large enough to give statistically relevant results and models describing Early Iron Age textile production. On the other hand, the Požega Valley is located at the crossroads of three large cultural zones of Early Iron Age Europe: the eastern Alps to the west, the central Danube region to the east and the Balkans to the south (Potrebica & Rakvin 2019, 56). This makes it an extremely important point in the long-distance as well as regional communication network which is reflected in abundant archaeological material. Therefore, it could also reveal communication threads related to textile products, technological traditions, and textile production tools within and far beyond the valley.

Based on the results presented here, it can be summarised that the site of Kaptol might have been a settlement where textiles were produced within households. The diversity of shapes and sizes of loom weights and spindle whorls suggests that a variety of types and sizes of textiles from different yarn qualities were produced in the settlement. Thanks to a find of a partially preserved loom with a loom weight set and the remains of a wooden beam at the settlement, there is now a much more in-depth view into the textile production processes of the site. Further intensive field investigation might uncover textile production spaces and their organisation. In addition, the presence of textile tools finds in burial contexts, including richly equipped tumuli, suggests that in the Early Iron Age in this area of Croatia the process of textile production had symbolic connotations. It was possibly not only a profession or everyday activity but also a symbol of the female gender. The graves of Kaptol and Kagovac may themselves be a reflection of the social roles and status of certain women within the community. These two sites and their assemblage of textile tools are a perfect starting point for further research into the dynamics of textile production of the Early Iron Age in this part of central Europe and with it the distribution of textile craft and its products through a regional and possibly even wider communication network.

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Late La Tène and Early Roman textile tools from Dorno, Italy

Abstract
This paper presents late Celtic and Roman textile tools from the territory of Dorno, a small town in northern Italy. Sheep shearing and spinning are very well documented activities at this site with 21 pairs of iron shears and 88 clay spindle whorls recorded. These implements come from burial contexts dating from between the second century BCE and the first century CE. The spindle whorls show a great variety of shapes and weights, and, with their large number, they contribute to an understanding of the local economy. The association of textile tools with other burial goods, in both men's and women's graves, provides further information not only about the role of the textile industry within this community but also about social organisation and burial rituals.

Keywords: Celtic textile tools, Roman textile tools, Dorno, Po Valley archaeology

Introduction

This paper presents all late Celtic and Roman textile tools found in the territory of Dorno, a small town in Lomellina, in the province of Pavia between the river valleys of the Ticino, Po and Sesia in Italy. The modern centre corresponds to the Roman Duriae, a post village between Ticinum (Pavia) and Laumellum (Lomello) along the so called "via delle Gallie", a Roman route retracing a Celtic pathway towards France (fig. 1). This route is well documented by several written sources dating to the second, third and fourth centuries CE (Banzi Mirella 1999).

This region, Lomellina, was inhabited by a Celtic group of La Tène culture with unique cultural characteristics, evident from at least the third century BCE (Arslan 1991, 461-464). Examples of typical local objects are provided by some pottery vessels, such as the *vaso a trottola*, and by the local diffusion of *fibula pavese,* a characteristic large brooch. Further cultural features can be found in other sites in the same territory (Arslan 2007, 131; Grossi & Luliano 2010, 26-27; Poletti Ecclesia 1999). The main economic activities were possibly vine cultivation, wine production and animal husbandry.

The funerary practice was to cremate dead bodies and then collect the ashes to be buried in trench graves, sometimes in ossuary bowls. The grave goods were put on a funeral pyre near the corpse or directly in the grave. These objects suggest an agro-pastoral society, headed by a warrior elite: in this area, local chiefs had the right to bear arms until the end of the Celtic phase (Arslan 1991, 461; Arslan 2004, 145-153).

From the second century BCE, a general impoverishment of the area is recorded. Weapons were less frequently included in burials and the pottery shapes were simpler and showed less variety (Arslan 1991, 467; 2004, 152). The Roman settlement in the Po Valley entailed a gradual assimilation of foreign customs. This integration process had already come to a conclusion in the Augustan age (by end of the first century BCE) (Arslan 2002).

Although the territory of Dorno was investigated by several archaeological excavations, undertaken in different sites, textile tools were only recorded in the cemeteries of Cascina Grande (west of the river Terdoppio) and San Materno (east of the river Terdoppio). They come from 65 burials in total.

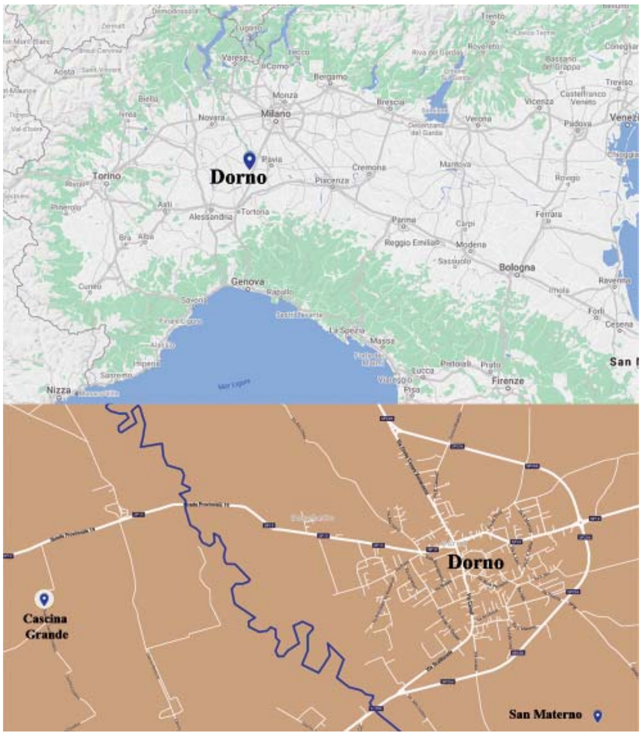

Fig. 1: The site of Dorno in northern Italy and the position of Cascina Grande and San Materno (Image: Courtesy of MIBACT - Polo Museale della Lombardia)

At San Materno a group of 15 burials was excavated in 1972 (Antico Gallina 1985), while another six burials were found in 1980. The extended necropolis of Cascina Grande, composed of more than 200 burials, was excavated in 1984 (Allini 1985). Overall, most of these archaeological findings date to between the second century BCE and the first century CE. The first phases of textile manufacture are the best documented, with 21 pairs of shears and 88 clay spindle whorls, although weaving is only represented by one loom weight. All burial goods from Dorno are held at the Museo Archeologico Nazionale della Lomellina in Vigevano (Pavia, Italy).

Sheep shearing

Spring shears, the shape of which does not change over centuries, appear in Switzerland and in Lomellina – at Garlasco, for example – in rich male inhumations dating back to La Tène C, possibly as a symbol of power and wealth (Rast-Eicher 2012, 391-392; Arslan 2002, 127; 134-135), and they are widely documented in the whole Celtic area. All shears from Dorno are of the same design with two triangular blades on a simple U-shaped spring. Although these tools could have had a wide range of functions, all the shears from Dorno may be connected with livestock, because their blades are between 11.3 cm and 16.3 cm long, and they are between 19.5 cm and 28.5 cm long in total. Caution is necessary in interpretation, however, a blade length of about 15 cm is indicated as the ideal for sheep shearing (Gleba 2008, 94; Spangiari, Francisci & Busana 2019). The number of shears found at Dorno (21) is quite high; in the whole Venetia region, for example, only 18 pairs of Roman shears suitable for shearing have been recorded. They all come from the province of Brescia (Busana et al. 2012, 413-417). With the exception of one tool from San Materno, all the Dorno shears were found in the necropolis of Cascina Grande (fig. 2). There was one pair per burial in both rich and poor graves, mostly in late Celtic burials, but also in three Roman graves: Cascina Grande, burial 75 (with *terra sigillata*), burial 34 (with an Augustan coin) and burial 192 (with Roman pottery). About half of the shears have mineralised textile remains on one or both sides (Scansetti 2018) and similar textile fragments are also present on razors, sickles and knives. Altogether, these have been recorded on 27 objects from Dorno. Among them is a pottery bowl with some mineralised textile

Fig. 2: Iron shears, Cascina Grande, burial 118 (Image: Courtesy of MIBACT - Polo Museale della Lombardia)

fragments adhering to it. Flax is the most common fibre but wool is also documented (Castiglioni & Rottoli 2019).

In the 27 textiles from Dorno, the most common weave is tabby, in some examples it is dense and in others loose, but there are also two twills. Where it has been possible to determine it, both warp and weft threads are single and Z-spun. Single Z-spun tabbies are also predominant in the Roman cemetery at Solduno (Tessin, Switzerland) and in Late La Tène finds from Switzerland, where twills were more common during the Early La Tène period (Rast-Eicher 2012, 388). All the textiles are central parts of the cloth: they do not have selvedges or irregularities that suggest the warp direction. However, in one linen tabby fragment (Cascina Grande, burial 95, La Tène D1), there is a regular space between two threads. This could be a mistake or a decorative feature made intentionally by the weaver. A 2/2 wool twill is recorded on a metal brooch from an inhumation of the Augustan period (burial 8bis) from Cascina Grande. A small wool fragment on a brooch from burial 186 (La Tène D2) could also be a 2/2 twill.

Since the dead bodies were cremated, it is possible that most of these textiles (except perhaps the two examples on the brooches) were not parts of clothing. They could have been scrap cloths in which some precious objects were wrapped. In some cases, the fabric is on one side of the object, as if it were a covering; in other cases, it is present on both sides, as if wrapped around it. The fabric is single or double-layered, and in some cases, there are traces of different tabbies wrapping the same object. The wrapping of particular objects is widely documented in several European Iron Age sites: for example, in some sites of southern Italy, in Austria, and in the cemetery of Třerbusice, in Bohemia (Belanová-Štolcová 2012, 322; Gleba 2008; Grömer 2012, 49). In Switzerland, during the Halstatt period, the wrapping of metal objects was a common practice, which continued during the La Tène period and into the Early Middle Ages (Rast-Eicher 2012, 385, 390).

In central and southern Italy, cremated bones were also wrapped in textiles, according to a practice adopted from Greek colonists, which spread among the Etruscan and Italic elites (Gleba 2008, 88; Gleba 2012, 231-233). By then, shears were not buried with the deceased at Dorno but wrapped in textiles or enclosed in fabric bags before they were placed inside the graves. They played a significant role in the identification of the dead: they showed his occupation and his particular abilities. Animal shearing requires specific skill: it could be carried out by the owner of the flock (*magister pecoris)* or it could be entrusted to skilled relatives or to itinerant professionals, the *tonsores pecorum* (Busana et al. 2012, 413-414). Still today, in some Italian regions, sheep shearing is carried out by travelling professionals.

Fig. 3: Set of spindle whorls, San Materno, burial 3/1980 (Image: Courtesy of MIBACT - Polo Museale della Lombardia)

Fig. 4: Set of spindle whorls, San Materno, burial 5/1980 (Image: Courtesy of MIBACT - Polo Museale della Lombardia)

It is interesting that in at least two cases shears were deposited in rich burials together with weapons: in burial 77 and 144 of Cascina Grande, they were associated with a large knife and a spear cusp. Shears were also present in burial 116 and 118, together with two large knives in each; these could however be butler utensils for carving or food preparation, and not weapons. This association is also documented elsewhere in Lomellina (for example, at Garlasco Bozzole and Valeggio, Tessera, burial 189) and in the Roman world (Arslan 2002, 127; Gleba 2008). This practice seems to indicate that – at least for some people – war was an elitist but not exclusive activity. Military practice was perhaps an occasional occupation, and in other periods, animal husbandry was a possible alternative.

In two other burials from Cascina Grande, shears are associated with female objects (three glass beads in burial 10 and a bracelet in burial 74). Without bone analysis, it is impossible to determine whether these objects were burial goods belonging to a female shepherd or a man's burial goods with a funerary gift from a beloved woman. Similar associations are also documented in other Iron Age Italian sites, such as at Murlo, Rome, Narce, Rocella Jonica. In these cases, spindle whorls were interpreted as offerings deposited by female relatives of the deceased man (Gleba 2008, 173).

Many sheep bones with evidence of slaughter have been found in a late Roman context at Lomello (Pavia) and were analysed by A. King (Blake et al. 1987, 5). Most of them came from adult animals, indicating that sheep were not just farmed for meat but possibly for milk and wool too.

Together with archaeological records, written sources show that wool was not the only textile fibre known in the territory. Flax cultivation is documented by Pliny the Elder (*Naturalis Historia*, 19, 9), who describes the production of quality flax fibre in *regione Alliana,* corresponding to modern day Lomellina.

Spinning

Spindle whorls, small clay objects that were placed at the end of the spindle to help their rotation, are very common tools among women's burials in Lomellina, and, given the large number of them, they contribute to the understanding of the local economy. Finds of spindle whorls are not so common in other regions of northern Italy during the Roman era. The University of Padua's *Pondera* project analysed the spindle whorls from the Veneto region (Busana, Cottica and Basso 2012; Busana and Tricomi 2016). Only one has been found in the province of Vicenza (Zentilini 2012, 575) 50 come from the province of Brescia (Paderno 2012), 19 from the province of Verona (Gottardi 2012, 568; Marella 2012, 601-602) and 85 from the province of Rovigo (Tricomi 2012, 588).

No human bone analysis has been carried out at Dorno, but the presence of spindle whorls in many burials is taken as a gender indicator, since spinning is traditionally associated with women. This interpretation is supported by archaeological and iconographic evidence in Italy, where the placement of spindle whorls in women's burials as a way of expressing the owner's prowess in spinning textile fibres and hence her useful role in the community was a common practice from the Late Bronze Age. This particular significance of spindles continues in the Roman period. According to Pliny the Elder (*Naturalis Historia,* 8, 194), Roman brides carried spindles and a distaffs during wedding processions (Gleba 2008, 173-174; Larsson Lovén 1998, 85-110; 2007, 229-236; Poletti Ecclesia 1997; Rossi 2018, 381-393).

The distribution of the 88 clay spindle whorls found at Dorno is not uniform across the two necropolises. At Cascina Grande they come from 31 burials among more than 200, and 81% of them (24 spindle whorls) are present as a single item per burial, together with other objects: only three burials contained three or more spindle whorls (burial 207/8 with three spindle whorls; burial 8 with four and burial 37 with six). In the smaller San Materno necropolis, 37 spindle whorls were found in 13 of 21 burials. Here burials with a single spindle whorl comprise 30%, while the

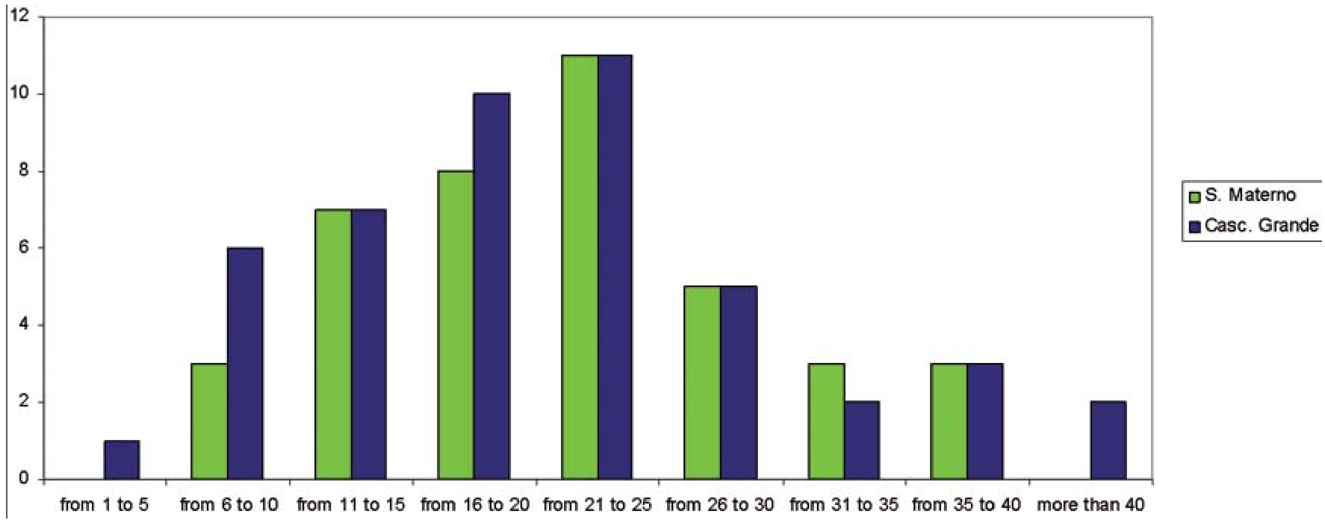

Fig. 5: Spindle whorls - weights in grams (Image: Serena Scansetti)

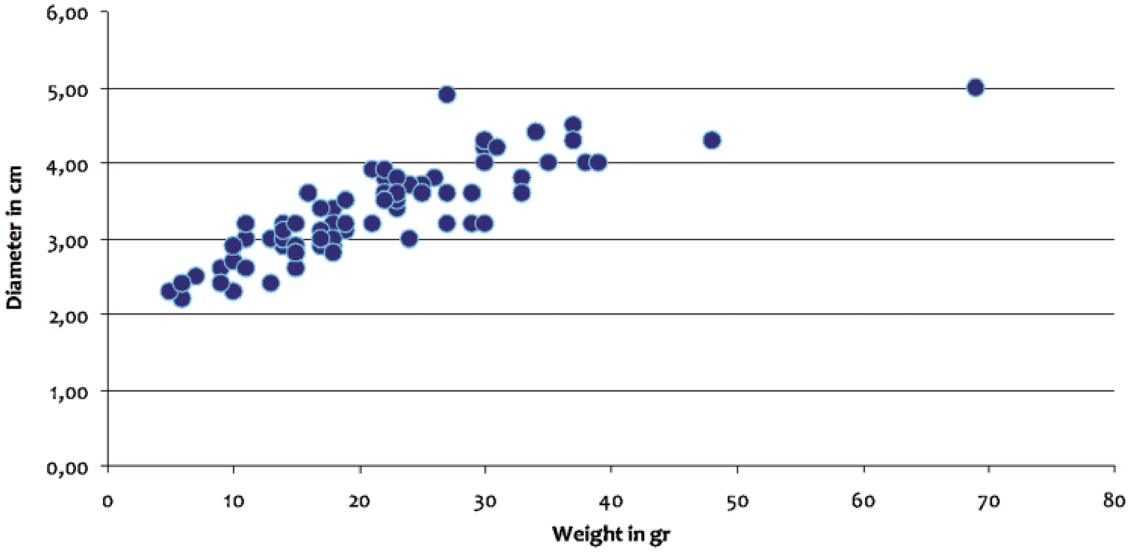

Fig. 6: Spindle whorls' diameters and weights (Image: Serena Scansetti)

sets are more frequent, and they reveal a significant weight variety (fig. 3 and fig. 4). Burial 1980/1 had three spindle whorls; burial 3 had four spindle whorls; burials 4, 5, 1980/3 and 1980/5 had five spindle whorls each.

This difference in distribution could be attributed to personal choice in the selection of grave goods or it could emphasise a particular specialisation in the San Materno community, compared to that of Cascina Grande. Each set is composed of spindle whorls of different sizes, shapes and weights: these differences suggest the skill of the owner in spinning different kinds of yarn. Spindle whorls were found in both rich and poor graves. In some cases, they were the only female component of the grave goods, while in other burials they are associated with mirrors, *unguentaria* (small perfume bottles) and other female objects. In burial 8 of Cascina Grande, for example, four spindle whorls (weighing 9, 14, 15 and 19 g) are associated with a razor, usually considered a male object. Pliny the Elder (*Naturalis Historia,* 19, 18) states that spinning flax is a respectable occupation for men but these spindle whorls seem too small and light to be used for flax (Gleba 2008, 193). As already indicated for shears, they could have belonged to a female relative and became a last burial gift for the deceased.

Considering the weight of the spindle whorls, it is possible to speculate with caution on the kind of yarn that was produced (Gleba 2008, 106; Walton Rogers 1997, 1743-1745). At Dorno, the weights range between 5 g and 69 g, with a significant percentage between 10 g and 30 g. These values are particularly suitable for spinning fine or medium-fine animal fibres (Gleba 2008, 106). The two heaviest spindle whorls (48 g and 69 g) could be used to spin flax or hemp, which have longer fibres and need more weight (fig. 5 and fig. 6) or they could be used for plying threads. However, mineralised textiles from Dorno show just regular, plain, Z-twisted and not too thin yarn (Castiglioni & Rottoli 2019). In the surviving examples, there is no evidence of plying. Evidence from Austria shows similar weights. During the Hallstatt and La Tène periods, spindle whorls range from 5 g or 8 g to 40 g or 50 g, with the majority weighing 10 g to 30 g (Grömer 2012, 51).

The most common shapes at Dorno are biconical, cylindrical, truncated conical, lenticular and ovoid but there are also two star-shaped spindle whorls (fig. 7) from Cascina Grande, burial 207/8 and from San Materno with no context. A discoid whorl, carefully removed from the bottom of a black glazed vessel (fig. 8) comes from Cascina Grande, burial 188 (second half of the first century BCE). This is a unique

Fig. 7: Spindle whorls from Cascina Grande: Left: Star spindle whorl from burial 207/8. Right: Spindle whorl possibly cut from the bottom of a black glazed vessel, burial 188 (Image: Courtesy of MIBACT - Polo Museale della Lombardia)

find in the territory but the reuse of pottery shards to make spindle whorls is very common in the La Tène cultural area and it is attested in many examples from Old Virunum/Magdalensberg in Austria (which flourished from 50 BCE to 50 CE), where only 36 of 902 whorls are not made from recycled pottery (Gostenčnik 2012, 68). All these shapes are also present in Austria, where the biconical shape with a hollow top is typical for the Urnfield culture and the Hallstatt period, while the La Tène period whorls are mostly spherical in shape (Grömer 2012, 54). At Dorno, however, there does not appear to be a chronological evolution.

Seven twisted glass rods were also found at Cascina Grande: burial 129, green-yellow glass with white thread; burials 220 and 231, light blue glass; burial 237, amber glass with white thread; burial 239, a yellow rod and a light blue rod; and another one in light blue glass with white thread, plus many more in Lomellina. If found unbroken there, these rods have twisted bodies and flattened ends. In other regions, plain versions have been found too. The only complete one, among those found at Dorno, comes from burial 231 of Cascina Grande and it is 22.5 cm long. The length of such intact rods found in Italy ranges between 15.6 cm and 26 cm. This type is especially common in northern Italy from the Augustan age to the beginning of the second century CE (Larese 2004, 43).

An opaque white glass thread twisting around the body of a glass rod (as is the case for many of these) may suggest an actual thread twisting around a distaff. Nevertheless, the function of these objects is still debated. They have been interpreted by different Italian scholars as hair pins, ointment mixers or symbolic distaffs specifically made for the funerary context (for a summary of the different interpretations, see Isings 1957, form 79 "stirring rod"; Roffia 1993, 206; Gostenčnik 2012, 70).

In other areas, such as Austria, similar glass rods with ring endings are considered distaffs, and the luxury material of which they are made suggests the high social status of their owners (Gostenčnik 2012, 70). In Italy, glass rods with ring endings have been found at Montebelluna (intact, 15.6 cm long in Casagrande and Ceselin 2003, 18-19; 122; tav. V, catalogue number 136) and Aquileia, where other broken glass rods with traces of mortar had been used as wall decorations (Mandruzzato 2008, 20; 54). Distaffs made in precious materials such as bone, amber, silver and bronze were already well known among the female elite in central Italy during the ninth to the seventh centuries BCE. Despite their high value and their fragility, they could be used in everyday practice, as experimental archaeology has demonstrated (Caufield 2018, 521; Gleba 2008, 174).

Weaving

Weaving is only represented by a single loom weight which was used together with other similar weights, to keep warp threads under tension on vertical looms. This single example comes from "burial" 3 of Cascina Grande. It is possible however that this "burial" was a Roman rubbish dump, rather than a grave. The clay loom weight has a cylindrical shape and only half of it is preserved. The lack of implements associated with weaving, despite the many spindle whorl finds, should not be attributed to the fortuity of the discoveries. In the territory of Dorno, only necropolises have been found, and in funerary contexts spinning instruments are usually much more common than weaving tools. A similar situation is documented in the Roman Venetia region (Busana & Tricomi 2016). This difference between the number of spindle whorls and loom weights is also quite common in Lomellina, where settlements have been found with very few loom weights. However, it is not possible to completely exclude the possibility that other varieties of weaving looms were used, such as two-beam looms (Grömer 2016, 139-140). Another hypothesis suggests that weaving was a less common activity than spinning, and that homespun yarn was woven in specialised workshops, locations for which have not yet been identified.

Conclusion

Among the productive activities carried out in the territory of Dorno between the Late Celtic and Early Roman Imperial Age, flax cultivation, sheep husbandry and textile production must have played a primary role in the local economy. Archaeological evidence demonstrates that sheep shearing and spinning were common activities for this community. The presence of a relatively high number of spindle whorls in a large number of burials, suggests that wool or flax spinning must have been a widespread skill. The production was probably organised on a household level, either for their own consumption, or for trade. This model has been recognised in Austria, and at Magdalensberg, where spinning was carried out on a large scale in the countryside, and textile tools were often found mixed with household refuse (Gostenčnik 2012, 68-71). The presence of groups of spindle whorls of different shapes and weights in many burials of San Materno seems to indicate a higher degree of specialisation and mastery among some women in this community. In the Roman period, twisted glass rods were found in a few women's burials: their function is still debated but it is very likely that they were symbolic distaffs expressly made to emphasise the high status and the good qualities of their owners. Spring shears were not so common. Sheep shearing was a seasonal activity carried out by a small number of skilled men, some of whom were probably also warriors. These precious objects played a significant role in the identification of the deceased, demonstrated by their being wrapping in textiles before placement in the graves.

Mineralised textiles found in the cemeteries at Dorno are uniform and not very fine. These characteristics, also present in La Tène graves of Austria and Switzerland (Grömer 2012, 56; Rast-Eicher 2012, 392-395), may represent a standardisation of weaving techniques, or – more likely – could be specific to the burial fabrics. Such fragments are mostly not parts of real garments but simple cloths in which precious objects were wrapped. Weaving is only documented by one single loom weight. It is hoped that further studies will aid a greater understanding of this phase of the textile manufacture.

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Animal hair evidence in an 11th century female grave in Luistari, Finland

Abstract
Luistari cemetery in southwestern Finland, is one of the most significant Iron Age and Early Medieval period (seventh to 15th centuries CE) sites with nearly 1,300 excavated inhumation burials. The cemetery has been of great importance for textile research because of the cloth fragments preserved in contact with metal items. The first scientific reconstruction of dress in Finland, the ancient dress of Eura, was based on finds from the 11th century female Grave 56. This paper presents the rich fur and hair finds preserved in Grave 56. The hair and fibre material was identified by their morphological features, using polarised light and scanning electron microscopy (SEM). It is suggested that fur was used for furnishing the grave and for accessories such as a knife sheath and a pouch. The possible remains of fur garments which enhance the current understanding of the outfit of the woman in Grave 56 are also discussed.

Key words: animal hair, hair identification, furs, microscopy, Viking Age, Finland

Introduction

Animal pelts and fur were long assumed to have decayed in archaeological contexts in Finland due to the acidity of the soils. Contrary to this deeply rooted belief, fur remains have proved to be a relatively common find material in the Late Iron Age (800 CE to 1100/1300 CE) and Early Medieval period inhumation burials (Kirkinen 2015; 2019). The Medieval period started in western Finland in 1150/1200 CE and ended in the 1520s CE. The Early Medieval period, also referred to as the Crusades period, prevailed during the period 1025/1075 CE to 1150/1200 CE. In eastern Finland, the dates are some decades later (Haggrén et al. 2015).

Large animal pelts were used for wrapping or covering the deceased, and furs were used for garments and accessories such as sheaths, scabbards and pouches. Instead of sheep or cattle pelt garments, which have been found in Danish bogs (Mannering et al. 2010; 2012; Brandt et al. 2014) and even in Bronze Age Danish oak coffin burials (Brandt et al. 2014; Harris 2014, 122–124; Frei et al. 2015), the most commonly exploited species in Finland were wild animals such as European elk (*Alces alces*) and reindeer (*Rangifer tarandus* sp.), various fur animals (Mustelidae, *Vulpes vulpes, Castor fiber, Sciurus vulgaris*), brown bear (*Ursus arctos*), seals (Phocidae), and mountain hare (*Lepus timidus*) (Schwindt 1893; Tallgren 1931, 170; Tomanterä 1978; Riikonen 1990; Asplund & Riikonen 2007; Kirkinen 2015; 2019).

Despite the number of finds, knowledge about the use of fur garments is relatively limited. The reason for this is that fur has been most often preserved in contact with metal items, where toxic (copper) alloys have prevented the growth of bacteria and fungi (Edwards 1989; Solazzo et al. 2014). In these cases, sometimes only a couple of hairs were found attached to a brooch, which makes the interpretation of findings difficult. The material presented here indicates that in Finland there have been at least two fur clothing traditions: the one here termed Eurasian, in which seal pelts were exploited for trousers or gaiters and reindeer skins for coats; the second is here termed Scandinavian or north European, which applied fur animal skins as collars

Fig. 1: The ancient dress of Eura reconstructed from the evidence of the textiles found from Grave 56 (Image: U. Moilanen - *Peek into the past* project)

and linings while favouring cattle, goat and sheep skins for garments (Kirkinen 2019).

In this paper, the find material from the 11th century Grave 56 in the Luistari cemetery in Eura, southwestern Finland, was analysed for fur and hair remains. This burial is of particular interest because it is the richest grave in Luistari for metal finds and offered good preservation conditions for animal fibres. This can be seen in the quantity of relatively well-preserved textile fragments, which have been a source for a dress reconstruction (fig. 1) (Lehtosalo-Hilander 1978; Tomanterä 1978; Lehtosalo-Hilander et al. 1982). The aim here is to complement the dress with its fur garments for the first time in Finland.

Luistari inhumation cemetery

Luistari cemetery is located in Eura, southwestern Finland, about 80 km north of the city of Turku (fig. 2). With its nearly 1,300 excavated inhumation burials, Luistari is one of the most significant Iron Age and Early Medieval period sites in Finland. The cemetery was discovered in 1969 on a construction site, which opened the way for a full-scale excavation during the period 1969 to 1992 by Pirkko-Liisa Lehtosalo-Hilander (Lehtosalo-Hilander 1982a; 1982b; 1982c; 2000). During recent years, the abundant and well-published find material has provided an ideal basis for the study of osteological remains (Salo 2005), aDNA by the work group Päivi Onkamo (Översti et al. 2019), stable isotopes by the work group Laura Arppe (*Elämänhistoriat hampaissa, 2015-2017*), and microfossils (Juhola et al. 2019).

Evidence for the change from cremation burials to inhumations in Finland first appears in the Eura-Köyliö region during the sixth century CE. In Luistari, the first inhumation burials have been dated to about 600 CE (Lehtosalo-Hilander 2000, 227). From then on, Luistari was in use for several hundred years. In the richest burials, women were clothed in peplos-type dresses, which were fastened by brooches, and supplemented with bronze spiral ornamented aprons, undergarments, and shawls. They also wore ornaments such as necklaces, bracelets, pendants and finger rings made of bronze and silver (Lehtosalo-Hilander 2000, 208–220). In male graves, weaponry and the remains of cloaks, fastened by penannular brooches, have been detected (Lehtosalo-Hilander 2000, 207). In children's burials, bell pendants and sleigh bells, as well as small-sized ornaments, were typical finds (Lehtosalo-Hilander 2000, 221–226). The find material from the graves also included tools such as axes, grinding stones, sickles, and vessels, to name but a few. However, about 70% of the burials were unfurnished, representing the final phase of the cemetery during the 13th to 15th centuries CE (Lehtosalo-Hilander 1997; Salonen 2014, 6, 67).

Luistari has been interpreted as a prosperous peasant community, which acquired wealth through trade as a transit thoroughfare (Lehtosalo-Hilander 1982c, 55, 67–68, 74–76). The role of hunting has been estimated to have been of minor importance in Luistari because no wild animal bones were found in the graves (Lehtosalo-Hilander 1982c, 68). However, analysis of animal hairs and fur from burials provide evidence that wild animal products were supplied either through trade or by hunting (Kirkinen 2015; 2019).

On the basis of the number of burials and the differences in burial customs, Lehtosalo-Hilander (1982c, 57) has interpreted Luistari originally as a graveyard for two families. In the middle of the

11th century, contemporary with the subject of this research, female Grave 56, the estimated population of the nearby Kauttua village was about 30 persons (Lehtosalo-Hilander 1982c, 55).

Female Grave 56

Female Grave 56, known as the "Eura Matron" (*Euran emäntä* in Finnish), was excavated in 1969 by Pirkko-Liisa Lehtosalo (later Lehtosalo-Hilander). The burial has been radiocarbon dated to between 940 CE and 1021 CE (Poz-101914, Juhola et al. 2019), the final phase of the Viking Age (from 800Ce to 1050/1100 CE). Since its discovery, it has been the best known grave in Luistari as a result of the dress reconstruction based on its textile finds (fig. 1).

The rectangular grave pit was WSW-ENE oriented, and the deceased was placed on the back, with arms crossed over the waist. The bone material is relatively scarce because of the acidic soils in Finland, and also because the grave was partly destroyed by a later burial. Wood and birch bark remains provide evidence of a simple wooden structure and that the grave was covered with birch bark (Lehtosalo-Hilander 1982a, 89–94).

The grave goods and dress details (National Museum of Finland NM 18000:1624–1792) consist of a necklace made of 34 glass beads, 11 silver coins, two silver pendants – threaded on a wool string (NM 18000: 1624, 1625). Her peplos-type dress was fastened with convex round brooches, joined together by chains made of bronze. The chains were fastened by two pendants and an equal-armed brooch. On her arms, she wore spiral bracelets, she had two finger rings on each of her hands. At her waist she carried a wide bronze-plated knife sheath. Additionally, there were bronze spiral ornaments sewn into her apron. Some stray spirals suggest that she also had a square shawl and or a headdress. On her left side, there was a broken clay vessel, a shear and a sickle. As a whole, Grave 56 has been estimated to be the richest one in the cemetery (Lehtosalo-Hilander 1982a, 89–94; 1982c, 44).

Owing to the number of bronze and silver items, which prevent the decay of organic material in archaeological contexts, a reasonable quantity of wool textile remains were preserved for research. Inside the spiral bracelets, the remains of sleeves had survived (NM 18000:1683, 1689). This woven fabric was dark blue (rich indigotin) tabby of sz/z-spun yarns with a thread count of 13/9 to 10 yarns per cm. The sleeves were interpreted as the remains of a long-sleeved dress according to ethnographic evidence, although the same fabric did not exist elsewhere in the burial (Lehtosalo-Hilander 2001, 54, 87).

Fig. 2: The location of Luistari cemetery in Eura together with other sites included in the survey (Image: Krista Vajanto)

Fragments from a peplos dress (NM 18000:1648, 1652–1676) contained less indigotin and had a greenish hue. Remains of this dress were found especially around the brooches, chains and pendants, and it was possible to define that the upper edge of the dress had been folded. This garment was made in 2/2 twill of sz/z twisted yarns using 9/8 yarns per cm. The warp ran horizontally in the garment, but the starting and finishing borders had not survived – which made it impossible to define whether or not the dress had been tubular or open at the sides. Tubular selvedges were found, bordered with tablet-woven bands in three colours (NM 18000:1691, 1754), which were situated in the hem and at the rim of the fold. The visible colours of the tablet-woven bands are reddish, light coloured and blue, forming some kind of meander pattern. These were woven using 17 tablets with four yarns in each (Lehtosalo-Hilander et al. 1982; Lehtosalo-Hilander 1982a, 89–94; 2001, 51–52, 57, 87). Light greenish fragments with indigotin originated from a bronze spiral decorated apron (NM 18000:1730–1763). The spiral decoration was made of drawn bronze thread which formed spiral tubes bordering all the fabric edges and forming rosettes decorating the apron's hem. These fragments were 2/2 twill with tubular selvedges, woven of sz/z-yarns, 9/8 yarns per cm. The warp of this fabric ran vertically and the yarns were finer than those in the peplos dress. The apron had starting and finishing borders, woven with nine tablets in a brick wall pattern. The apron was held at the waist with a strongly reddish tablet-woven band (NM 18000:1690, 1707–1710, 1713, 1715), which had been made with sz-yarns in the warp and zs-yarns in the weft and using 12 tablets with four yarns in each (Lehtosalo-Hilander et al. 1982; Lehtosalo-Hilander 1982a, 89–94; 2001, 53, 87).

Attached to the bronze-plated knife sheath, finger rings and birch bark pieces, there were three coloured fragments made in the needlebinding technique (NM 18000:1680, 1696, 1698, 1700, 1701, 1702). The red and light-coloured yarns have an sz twist, but the blue is s-spun. The red colourant was from madder (*Rubia tinctorum*) or local bedstraws (*Galium* species), the blue was indigoids, while the light-coloured yarn contained very low amounts of red and blue colourants – most likely contamination from surrounding yarns (Vajanto 2014). These fragments might have belonged to striped mittens (Lehtosalo-Hilander 2001, 53, 88). Alternatively, these fragments could be the remains of a pouch, since a detailed examination of the striped structure reveals that there are no remains of a mitten thumb (Vajanto 2014), which was suggested in an earlier interpretation (Vajanto 2003). Birch bark has been explained as the grave's covering (Lehtosalo-Hilander 1982a, 89–94). However, it is worth considering that there was a birch bark lining in the pouch. It has been suggested that this kind of lining material was used in Finnish women's Iron Age conical headdresses (Riikonen 2006, 32).

Some bronze spirals and textile fragments (NM 18000:1765, 1766, 1769, 1789) might be the remains of a square shawl or cloak (Lehtosalo-Hilander et al. 1982, 30). This type of twill shawl, often decorated with bronze spirals, is a common garment in Finnish Iron Age female burials in other inhumation cemeteries (Hirviluoto 1973). Conical wool headdresses are also common (Vahter 1952; Tomanterä 1984; Lehtosalo-Hilander 2001, 68; Riikonen 2006, 26–27), and usually made of a blue textile woven in broken twill. The fragments (NM 18000:1785, 1788) might indicate the same kind of veil or headdress was found in the Luistari Grave 56 too (Lehtosalo-Hilander 2001, 63).

Material and methods

Collection and preparation of samples

The Luistari Grave 56 find material is divided into two groups with the most spectacular finds on display at the National Museum of Finland. This collection was examined visually and the observations documented photographically. Owing to the fragility of the finds, they were not moved from the exhibition for testing such as SEM analysis. The rest of the material, the fragmented metal artefacts, small textiles, pieces of fur, organic dirt and soil samples, are archived in the Archaeological Collection at the Finnish Heritage Agency. The fur and hair finds, which were large enough to be detected by the naked eye, were documented, together with minuscule animal hairs other than wool which were examined with a microscope.

A number of the archived archaeological finds were selected for sampling. The sampling material can be characterised as comparatively fragile and fragmented, especially with regard to the condition of the organic remains, as were the inorganic metal finds, primarily bronze ornaments or fragments of such artefacts. The condition of the sampling material was fairly stable although some of it appeared more degraded than others.

Sampling was prepared and performed on the premises of the Finnish Heritage Agency by a researcher and a conservator. All finds chosen for sampling were photographed with a digital camera before removal. Next, individual finds were placed onto the stage of a stereo microscope (a LEICA S6D StereoZoom microscope with magnification range of 6.3x to 40x with a digital camera, a Leica DMC2900) for sampling.

Before removing the samples, the finds were examined, and their degree of deterioration estimated. The areas for potential sampling were determined by visual inspection under the microscopic. The effects of sampling were considered carefully. The method is invasive, so it is important to perform the sampling in locations where it is considered possible without causing prominent damage to the find.

Each area for sampling was captured in a digital microscopic image including a scale (fig. 3). Image processing allowed for the recording of the sampling location as well as indicating a single sample depicted in each image. Viewed through the microscope, single fibres were separated from the finds with dental instruments and samples were collected with fine metal tweezers or, if necessary, cut with a scalpel. The samples were each put into individual Eppendorf tubes which were labelled appropriately for the sample and the find.

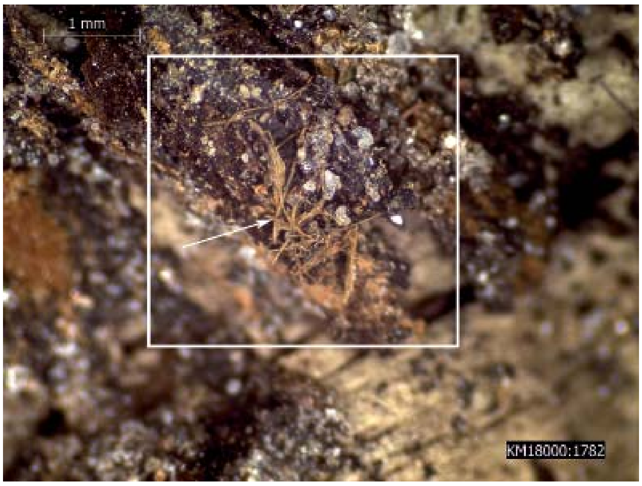

Fig. 3: Microscopic image showing a bundle of hair on the surface of birch bark and other organic matter (NM 18000:1782) from Grave 56. The arrow indicates the location of the sampling (Image: Stina Björklund, National Museum of Finland)

The quantity of sampling material was limited. The fragility and fragmentary nature and degree of deterioration of the material determined the quantity as well as the quality of samples. Considering the characteristics and condition of each find, samples with varying features such as colour, shape, size and texture were removed. The aim was to obtain only the quantity needed to address the research questions.

The sampling was further documented in find specific conservation reports with all the essential information. All the documentation and the sample slides for analysis were organised and archived according to the practice of the organisation responsible for the maintenance of the finds. The samples were prepared for transmitted light microscopy examination by mounting them in transparent nail polish on objective glasses. The material was studied with visible and polarised light microscopy, using a Leica DM 2000 LED microscope with 100x to 400x magnification. The material was documented with Leica ICC50 W. The same fibre materials were also prepared for scanning electron microscopy imaging by soaking the objective glasses in acetone to remove the nail polish. Revealed fibres were plucked with sharp tweezers and placed on double-sided carbon tape that had been fixed on aluminium stubs. The SEM samples were coated with Leica ACE 600 sputter coater with a 12 nm layer of carbon, to diminish the charging effect and drifting while imaging. SEM imaging was performed with Zeiss Sigma VP, with a secondary electron detector and using an acceleration voltage of 3 kV.

Fibre identification

The morphological identification of animal hairs was based on the diameter of the hair and the structures of medulla and cuticular scales (Goodway 1987; Chernova 2002; Tridico 2005). For the identification, the keys on Teerink (2003), Rast-Eicher (2016) and Tóth (2017) were applied. The terminology mainly follows Tóth (2017). Next, the samples were compared with a reference collection of Fennoscandian species, collected at the Natural History Museum, University of Helsinki. For the identification of domestic animals, the material was referenced with samples collected from north European domestic breeds. Proteomics, MSPS or other scientific methods were not considered for species identification because of the minuscule size of the samples and limited number of hairs.

Results

Animal hair and fur

The evidence for the use of fur and pelts in the furnishing of the grave, clothing the corpse, and manufacturing grave goods consisted of three kinds of source material (fig. 4 and table 1). First, relatively large pieces of fur and clumps of loose hair were already recorded during the excavation and listed in the find catalogue. Second, minuscule hair fragments were detected when viewing the finds microscopically. Finally, hair impressions on the surfaces of metal items such as brooches were recorded. A soil sample (NM 18000:1779) taken from a dark structure on the leg area of the grave was analysed by Juhola et al. (2019). No remains of animal hairs were found in that sample.

<u>Pieces of Furred Skin and Clumps of Loose Hair:</u> Three pieces of furred skin (NM 18000:1742) measuring 10.9 mm x 7.4 mm, 13.5 mm x 2.3 mm and 19.3 mm x 4.6 mm were excavated near the deceased's waist. Furry skin remains were also detected inside a wide bronze-plated knife sheath (NM 18000:1703; Lehtosalo-Hilander 1982b, 48). Finally, clumps of loose hair (NM 18000:1706, 1721, 1743, 1749, 1750; Lehtosalo-Hilander 1982c, 68) were preserved in contact with the bronze-plated knife sheath and the apron's bronze spiral decorations, as well as on the bottom layer of the grave. Lehtosalo-Hilander (1982c, 68) interpreted the hairs as the remains of a deer pelt.

<u>Minor Hair Fragments:</u> Long hair fragments measuring 0.6 mm to 4 mm, with some even 15 mm to 30 mm, were detected from 30 contexts through the microscopic examination of the textiles, metal items and organic dirt. From three contexts, tiny pieces

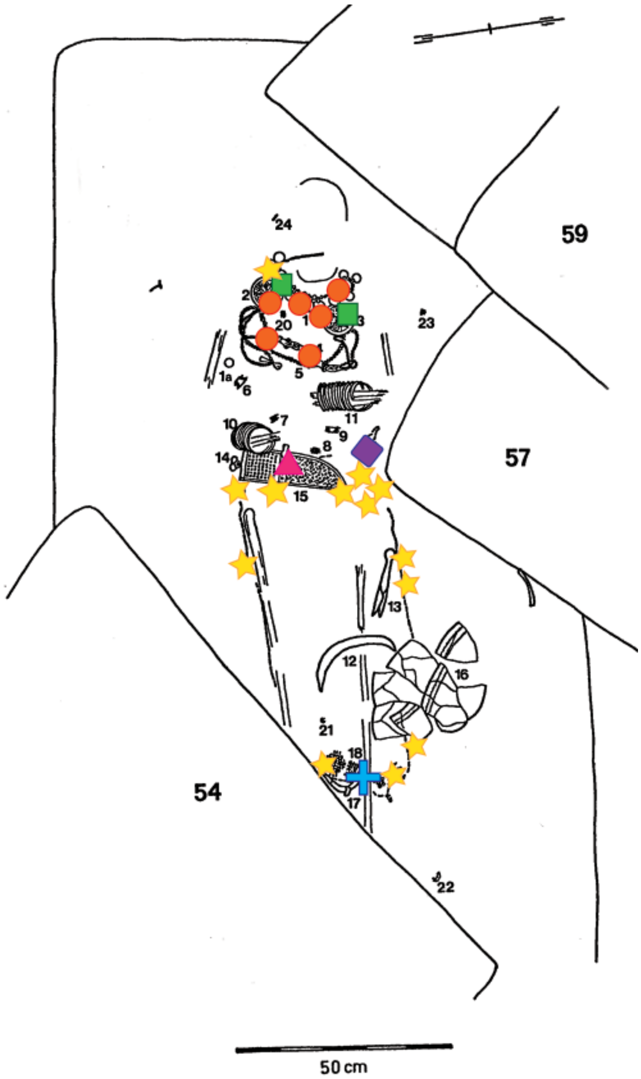

Fig. 4: The distribution of hair and fur in Grave 56 in Luistari, Eura: Star = reindeer; triangle = *Felidae*; rhomboid = otter; circle = brown bear; cross = *Canidae*, square = *Mustelidae* (Image: Tuija Kirkinen; map after Lehtosalo-Hilander 1975, 65)

of furred skin were found (fig. 4). In addition, some loose hairs were detected in the material that was on display at the National Museum of Finland. Hairs were present especially on the hem of the apron, close to its bronze spiral decorations.

Hair Impressions: Hair impressions were detected on the underside surfaces of round convex brooches (NM 18000:1652, 1660), and on the upper surfaces of a finger ring (NM 18000:1681) and spiral bracelets (NM 18000:1682, 1685). The impressions look like loose, relatively long hairs (1 cm to 2 cm). No further analyses were made because of the fragile nature of these items.

Identification of hairs

Wild Forest Reindeer Hair: The most numerous and best preserved loose hairs and hair clumps were identified as (wild forest) reindeer (*Rangifer tarandus*). The guard hairs were identified as *Cervidae* by the bottleneck shaped base and filled multiserial, spongoid type medulla with round cells (fig. 5a). The medullary index is almost 1. Scales are mosaic-like and scale margins smooth. *Rangifer tarandus* sp. was differentiated from *Alces alces* (Tóth 2017, 220–221) by the width of the hairs (maximum 390 µm) and by the number of rows of medullar cells (≤ 10). In addition, the average value of the width of scales is lower in reindeer (in the reference samples the mean is 14 µm) compared to European elk (25 µm), so the measurements (12 µm to 14 µm) of Grave 56 material support the hypothesis that this is a reindeer pelt. Because reindeer and European elk were the only *Cervida*e species present in Finnish fauna during the Viking Age (Ukkonen & Mannermaa 2017; pers. com. Kristiina Mannermaa 2019), comparisons to other *Cervidae* species were not made. However, there is still room for consideration of whether the pelt was of a wild forest reindeer (*Rangifer tarandus fennicus*) which was still living in the southern Finland area during the 17th century, or a semi-domesticated reindeer (*Rangifer tarandus*) living in the northern parts of Fennoscandia.
Reindeer hairs were found on the top of the apron's bronze spiral decoration, beside the body and under the knife sheath in a total of 21 different places in the grave (fig. 4). This suggests that the lower body of the deceased was covered with a reindeer pelt. It seems that the impressive knife sheath was not covered by the pelt; instead, it was placed above it in order to be seen. Single *Cervidae* hairs were also found in the neck area of the deceased but not in contact with the metal items in the chest area. Therefore, these are likely to be loose hairs from the pelt.

Felidae Fur-Lined Knife Sheath: A wide bronze-plated knife sheath (NM 18000:1703) was placed on the right side of the body's waist. According to Lehtosalo-Hilander (1982a, 92; 1982b, 48), inside the sheath, there were two layers of furred skin, the lower one of which was placed with the furry side inside, while the upper one had the skin side inside, with the hairs against the bronze plate.
The fur was identified as *Felidae*, which is lynx (*Lynx lynx*) or domestic cat (*Felis catus*), which are the two possible species in Finland. The identification of guard hairs was based on the fine grained structured multicellular medulla with large air sacs (fig. 5e). The

Catalogue sub number (NM)	Sample	Species identification	Diagnostic features of hair	Identification references
1644 (a)	Organic material under a silver coin pendant on the neck.	*Carnivora/ Ursus arctos*	Guard hair, dark brown in colour. No medulla. Scale pattern irregular waved, scale margins rippled. Width 59 µm, length 2.2 mm.	Tóth 2017; Rast-Eicher 2016
1644 (b)	Organic material under a silver coin pendant on the neck.	*Mustelidae* sp.	Underhair. Medulla structure is unicellular ladder. Scale pattern in the proximal part is rhomboidal (diamond) petal and in the distal part broad petals and coronal. Width 13.1 µm, length 13 mm.	Teerink 2003; Tóth 2017; Rast-Eicher 2016
1646 (a)	Organic material on the top of a silver coin pendant on the neck.	*Carnivora/ Ursus arctos*	Guard hair, dark brown in colour. Medulla not visible, scales badly preserved. Width 51.1 µm, length 3 mm. Fine hair, light yellow in colour. No medulla, broad petal and rhomboidal scales. Width 21.1 µm, length 3 mm.	Tóth 2017; Rast-Eicher 2016
1646 (b)	Organic material on the top of a silver coin pendant on the neck.	*Cervidae* sp./ *Rangifer tarandus*	Guard hairs. Medulla is multiserial, spongoid type with round or polygon shaped cells, medullary index is almost 1. Scales mosaic-like, scale margins smooth. Width 155 µm, length 0.7 mm.	Tóth 2017
1646 (c)	Organic material on the top of a silver coin pendant on the neck.	Unidentified/ *Ursus* ?	Guard hair, dark brown in colour. Medulla not visible, scales badly preserved. Width 61.3 µm, length 1.7 mm. Fine hair, yellowish in colour. No medulla, scales badly preserved, some broad petal-like scales. Width 19.4 µm, length 1.7 mm.	Tóth 2017; Rast-Eicher 2016
1652	Hair sampled from the organic material excavated under a round convex brooch on the shoulder.	*Mustelidae* sp */Mustela erminae*	Guard / intermediate hair, dark in colour. Medulla structure in the central shaft is chambered multicellular (crescented), medulla margins scalloped. Scale pattern in the shaft is rhomboidal petal, in the shield irregular waved with rippled margins. Width 37.9 µm, length of a complete hair is 15 mm.	Teerink 2003; Tóth 2017; Rast-Eicher 2016
1654 (a)	Organic material from the top of a round convex brooch on the shoulder.	Unidentified	Guard hair, root section, light brown in colour. Root bulb knobby-like, medulla amorphous continuous, medullary index 0.3. Scales irregular mosaic. Width 44.8 µm, length 0.6 mm.	
1654 (b)	Organic material from the top of a round convex brooch on the shoulder.	*Carnivora/ Ursus arctos*	Guard hair, dark brown in colour. Medulla estimated as relatively thin, hollowed out. Scale structure diagonal waved. Width 46.7 µm, length 1.4 mm.	Tóth 2017; Rast-Eicher 2016
1670	Organic material under the iron pendant on the chest.	Unidentified/ *Ursus arctos?*	Guard hair, brown in colour and underhair, light yellow in colour. Guard hair medulla hollowed out, no scales preserved. Underhair are non-medullated, scales rhomboidal and broad petal. Width 50.9 µm (guard hair) and 23.7 µm (underhair), length max 0.9 mm.	Tóth 2017; Rast-Eicher 2016
1674	Organic material from the top of a bronze chain on the chest.	*Carnivora/ Ursus arctos*	Guard hair, dark brown in colour. Medulla badly preserved and hollowed out. Scale structure rhomboidal petal and irregular waved/chevron-like. Width max 54 µm. Underhair, light yellow in colour. Medulla thin, continuous/interrupted, scale pattern broad petal. Width max 27.8 µm. Several pieces, lengths 1-2 mm.	Tóth 2017; Rast-Eicher 2016

Table 1: Description and identification of hair and fur excavated from the Luistari cemetery in Eura, Finland in 1969 now in the Archaeological Collection at the Finnish Heritage Agency

Catalogue sub number (NM)	Sample	Species identification	Diagnostic features of hair	Identification references
1703	A small piece of fur inside the bronze-plated knife sheath.	*Felidae* sp.	Guard hair, yellowish in colour. Medulla is fine-grained structured, chambered multicellular, medullary index 0.7, medulla margins fringed. Scale pattern is broad petal and irregular waved mosaic. Width max 61.1 µm, length max. 4 mm.	Teerink 2003; Tóth 2017; Rast-Eicher 2016
1706	Hairs on the top of textile near the bronze-plated knife sheath on the waist. No sample was taken.	*Cervidae* sp.	Flattened light brown hairs were microscopically identified as *Cervidae* hairs.	Tóth 2017
1711	A small amount of hair was preserved under the bronze-plated knife sheath. No sample was taken.	*Cervidae* sp.	Flattened light brown hairs were microscopically identified as *Cervidae* hairs.	Tóth 2017
1712	Organic material and textile remains preserved under the bronze-plated knife sheath.	*Cervidae* sp./*Rangifer tarandus*	Guard and underhairs. Medulla is a multiserial, spongoid type with round or polygon shaped cells, medullary index is 0.9-1. Scales mosaic-like, scale margins smooth. Width max 162 µm (guard hair), length max 1.2 mm.	Tóth 2017
1714	Organic material and some hairs near the tip of the bronze-plated knife sheath near the waist. No sample was taken.	*Cervidae* sp.	Flattened light brown hairs were microscopically identified as *Cervidae* hairs.	Tóth 2017
1721	Hair below the bronze-plated knife sheath near the waist.	*Cervidae* sp./*Rangifer tarandus*	Guard hairs. Medulla is multiserial, spongoid type with round shaped cells, medullary index is almost 1. Scales mosaic-like, scale margins smooth. Width 300 µm, length 15 mm.	Tóth 2017
1724	Organic material beside a finger-ring on the right hand. Fibres were too small for sampling.	Unidentified	No sample.	
1726	Organic material in contact with bronze-plated knife sheath near the waist.	Unidentified	Guard and underhairs. The medulla of the guard hair is hollowed out. In underhairs, the medulla is thin continuous. Width 81 µm (guard hairs) and 29.9 µm (underhairs).	
1732	Fibres in contact with apron's bronze spiral ornament.	Unidentified	A possible piece of skin tissue with guard and underhairs. Width (guard hairs) 32.3 µm, and (underhairs) < 10 µm.	
1736 (a)	Hair in contact with apron's bronze spiral ornament near the waist.	*Cervidae* sp./*Rangifer tarandus*	Guard hairs. Medulla is multiserial, spongoid type with round shaped cells, medullary index is almost 1. Scales mosaic-like, scale margins smooth. Width 182 µm, length 18 mm.	Tóth 2017
1736 (b)	Piece of fur in contact with apron's bronze spiral ornament near the waist.	Unidentified	Badly preserved black guard and underhairs.	

Table 1 (cont.): Description and identification of hair and fur excavated from the Luistari cemetery in Eura, Finland in 1969 now in the Archaeological Collection at the Finnish Heritage Agency

Catalogue sub number (NM)	Sample	Species identification	Diagnostic features of hair	Identification references
1741	Organic material under apron's bronze spiral ornaments near the waist. No sample was taken.	*Cervidae* sp.	Flattened light brown hairs were microscopically identified as *Cervidae* hairs.	Tóth 2017
1742 (a)	A hair from the surface of a piece of fur from the left side of the body, near the waist (see below).	*Lutra lutra?*	A long guard hair, dark brown pigmented in colour. Medulla is chambered multiserial by structure, the width of the medulla varies, medullary index max 0.6. Medulla margins strongly scalloped. Scale pattern irregular waved mosaic, scale margins rippled. Width 52.3 µm, length 13 mm.	Teerink 2003; Tóth 2017; Rast-Eicher 2016
1742 (b)	A small piece of fur from the left side of the body, near the waist (see above).	Unidentified/*Lutra lutra* ?	A tiny sample of fur, underhair 25 µm in width, no medulla, scales not preserved. The width and the lack of medulla match with otter (see above).	Rast-Eicher 2016
1743	Hair under apron's bronze spiral ornaments on the top of the hip bone.	*Cervidae* sp./*Rangifer tarandus*	Guard hair. Medulla is multiserial, spongoid type with round shaped cells, medullary index is almost 1. Scales mosaic-like, scale margins smooth. Width 370 µm, length 12 mm.	Tóth 2017
1745	Hair in contact with apron's left side bronze spiral ornaments.		Badly preserved guard and underhairs, length max 3.3 mm. In guard hairs, medulla is multiserial, spongoid type with round shaped cells, medullary index is almost 1.	Tóth 2017
1746	A small amount of hair in contact with apron's left side bronze spiral ornaments. No sample was taken.	*Cervidae* sp.	Flattened light brown hairs were microscopically identified as *Cervidae* hairs.	Tóth 2017
1748	Organic material in contact with apron's bronze spirals. The material consists mostly of (coffin) wood.	Unidentified	Guard hair. Thin medulla partly destoyed. Width 56.6 µm, length 6 mm.	
1749	Fur remains from the left side of the body were listed in the find catalogue. The NM sub-number was not found from the archaeological collections.			
1750	Hair in contact with apron's left-side bronze spiral ornament.	*Cervidae* sp./*Rangifer tarandus*	Guard hair. Medulla is multiserial, spongoid type with round shaped cells, medullary index is almost 1. Scales mosaic-like, scale margins smooth. Width 390 µm, length 11 mm.	Tóth 2017
1751	Hair and organic material under the bronze spiral ornament. No sample was taken.	*Cervidae* sp.	Flattened light brown hairs were microscopically identified as *Cervidae* hairs.	Tóth 2017

Table 1 (cont.): Description and identification of hair and fur excavated from the Luistari cemetery in Eura, Finland in 1969 now in the Archaeological Collection at the Finnish Heritage Agency

Catalogue sub number (NM)	Sample	Species identification	Diagnostic features of hair	Identification references
1759 (a)	A hair from apron's hem in contact with bronze spiral ornaments.	*Canidae* sp.	Guard / intermediate hair, dark brown pigmented in colour, bicolorate or banded. Medulla uniserial regular to uniserial chromosomal in the shaft, and chambered multiserial in the shield. medullary index in the shield is 0.7. Scales rhomboidal petal and diagonal mosaic in the proximal shaft, petal-like and irregular waved in the shield, scale margins rippled. Width 34.5 µm, length 30 mm.	Teerink 2003; Tóth 2017; Rast-Eicher 2016
1759 (b)	A small amount of hair from the apron's hem in contact with bronze spiral ornaments. No sample was taken.	*Cervidae* sp.	Flattened light brown hairs were microscopically identified as *Cervidae* hairs.	Tóth 2017
1762	Organic material and hair on the top of apron's hem. No sample was taken.	*Cervidae* sp.	Flattened light brown hairs were microscopically identified as *Cervidae* hairs.	Tóth 2017
1764 (a)	Hair in between the coffin wood and the apron.	Unidentified	Guard hair, brown in colour. No medulla. Width 41.4 µm, length 0.56 mm.	
1764 (b)	A small amount of hair under the apron. No sample was taken.	*Cervidae* sp.	Badly preserved flattened light brown hairs were microscopically identified as *Cervidae* hairs.	Tóth 2017
1780	Organic remains from the grave, no information about their precise location, probably on the top of the head / chest area.	Unidentified/ *Carnivora*	A piece of skin with guard and underhairs. Guard hair dark brown in colour. Medulla continuous amorphous, medullary index 0.3. Scale structure mosaic transversal regular with smooth edges and waved regular with rippled edges. Width max 42.7 µm, length 0.76-1.9 mm. Underhair possibly same as 1736.	Teerink 2003; Tóth 2017; Rast-Eicher 2016
1782 (a)	Hair from the surface of birch bark in the upper part of the grave.	Unidentified	Badly preserved hairs, light yellow in colour. Widths 21.2 and 27.3 µm, lengths 0.8-1.9 mm.	
1782 (b)	Hair from the surface of birch bark from the upper part of the grave.	*Cervidae* sp.	Badly preserved flattened light brown hairs were microscopically identified as *Cervidae* hairs.	Tóth 2017
1784	A small amount of hair and organic material on the right hip of the deceased. No sample was taken.	*Cervidae* sp.	Flattened light brown hairs were microscopically identified as *Cervidae* hairs.	Tóth 2017
1787	A small amount of hair and organic material on the back side of the deceased. No sample was taken.	*Cervidae* sp.	Flattened light brown hairs were microscopically identified as *Cervidae* hairs.	Tóth 2017

Table 1: Description and identification of hair and fur excavated from the Luistari cemetery in Eura, Finland in 1969 now in the Archaeological Collection at the Finnish Heritage Agency

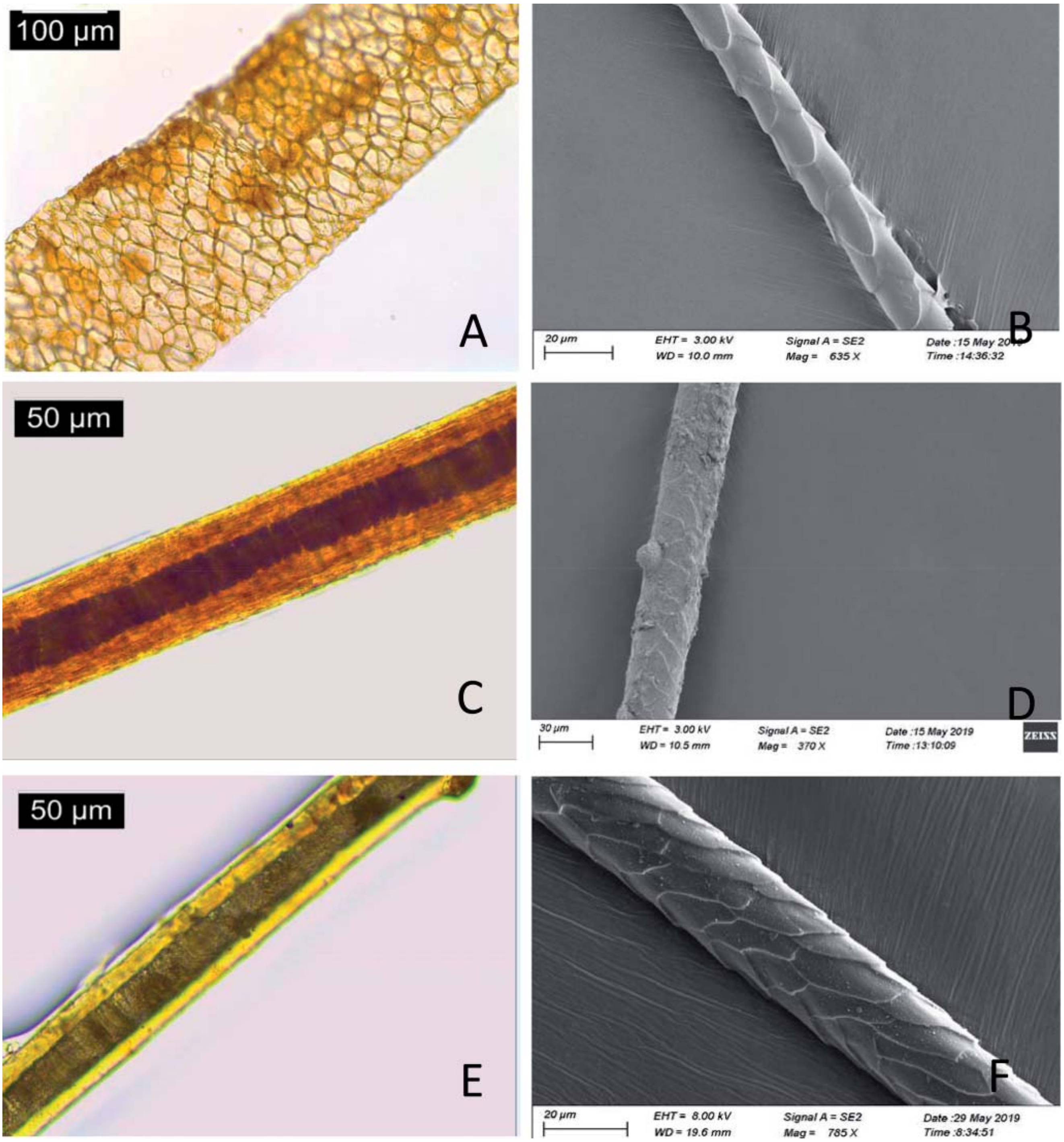

Fig. 5: a) Reindeer, sample NM 18000:1721; b) *Mustelidae*, sample NM 18000:1652; c) Otter, sample NM 18000:1703; d) Predator/brown bear, sample NM 18000:1674; e) *Felidae*, sample NM 18000:1703; and f) *Canidae*, sample NM 18000:1759 (Images: Tuija Kirkinen and Krista Vajanto)

medullary index is 0.7 with fringed medulla margins. The scale pattern is broad petal and mosaic in type.

Otter Fur: Three pieces of fur (NM 18000:1742), excavated from the corpse's left side waist, were identified tentatively as otter (*Lutra lutra*). The identification of guard hair was based on the chambered multiserial medulla structure with air sacs. The medullary index is a maximum of 0.6, and the medulla margins are strongly scalloped (fig. 5c). The scale patterning is irregularly waved, where it is preserved. The underhairs are non-medullated.

Brown Bear/*Carnivora* Hair: On the upper half of the body, minuscule guard and underhairs are preserved above the bronze, silver and iron ornaments. The hairs are fragile and poorly preserved. The medulla of the guard hair is hollowed out. The original width of the medulla can be regarded as relatively narrow, with a maximum medullary index of 0.3, which excludes most fur animals. The scale pattern is irregularly waved mosaic. The underhairs are non-medullated, and their scale structure is broadly rhomboidal (fig. 5d). These hairs were identified as *Carnivora*, and tentatively as brown bear (*Ursus arctos*).
Hairs were sampled from five contexts above the silver coin pendants on the neck area (NM 18000:1644, 1646), the convex round brooch on the shoulder (NM 18000:1654), the bronze chain (NM 18000:1674) on the chest, and under an iron pendant (NM 18000:1670) on the chest. This suggests that the upper half of the corpse was either covered with a brown bear pelt, or she was wearing a fur garment.

Mustelidae sp. Hair: Single guard and underhairs were recovered under the necklace (NM 18000:1644) and the round convex brooch (NM 18000:1652). These hairs were long (maximum 15 mm) and relatively well preserved. The guard hair was identified as *Mustelidae* on the basis of a chambered multicellular, crescented (Teerink 2003, 10) medulla structure in the central shaft, with scalloped medulla margins. The scale pattern in the shaft is rhomboidal petal while in the shield it is irregularly waved with rippled margins. In the underhairs, the medulla structure is unicellular ladder. The scale pattern in the proximal part is rhomboidal (diamond) and in the distal part broad rhomboidal coronal (fig. 5b).

Canidae sp. Hair: A single 3 cm long guard or intermediate hair was identified as *Canidae* sp. The hair is dark brown pigmented in colour, bicolorate or banded. The medulla is uniserial regular to uniserial chromosomal in the shaft, and chambered multiserial in the shield. The medullary index in the shield is 0.7. The scales are rhomboidal petal and diagonal mosaic in the proximal shaft, and petal-like and irregularly waved in the shield, with rippled scale margins (fig. 5f). The hair was found at the hem of the apron (NM 18000:1759).

Discussion

The investigation provided evidence that reindeer, brown bear, *Felidae*, *Mustelidae*, otter, and *Canidae* hairs and fur were present in the find material excavated from female Grave 56 in Luistari. Besides the fur and pelt remains noted during previous research, the microscopic examination of the finds revealed numbers of minuscule fibres other than sheep's wool. However, the identification of these hairs is uncertain owing to their length and, as a result, the limited number of diagnostic features available.
In addition to differences in the quantities of preserved fibres, there were also discrepancies in the preservation of the hairs depending on their location and the species in question. For example, *Cervidae* hair preserves relatively well in Finnish acidic soils (Kirkinen 2015, 106), which was the case in the Luistari Grave 56. Accordingly, the hairs which were found under the metal items were in better condition than the ones preserved above the artefacts. The *Canidae* hair (NM 18000:1759), which was found on the hem of the apron, was exceptionally well preserved. As a single hair, it was interpreted as contamination. In the following section, each of the identified species is discussed in detail with interpretations about the original function of the fur and hair.

Reindeer pelt

Most of the hairs were identified as wild forest reindeer or *Cervidae*. The distribution of the hairs indicates that the lower half of the deceased was covered with a reindeer pelt, except the impressive bronze-plated knife sheath which was placed above it.
Furnishing a grave with reindeer and European elk pelts was a relatively common tradition in Finland during the Viking Age and Early Medieval period (Tallgren 1931, 170; Asplund & Riikonen 2007; Kirkinen 2015; 2019). In northern Finland among the Sámi, reindeer pelts were still in use during the 17th century (Leppäaho 1937; Kirkinen et al. 2019). *Cervidae* pelts have also been found in the Luistari cemetery in graves 90, 377, 381 and 404 (Lehtosalo-Hilander 1982c, 68; Kirkinen 2015, Appendix 1). The covering and wrapping of bodies in *Cervidae* skins has been interpreted as a long-standing north Eurasian tradition, which facilitated a transition from the realm of the living to that of the dead (Kirkinen 2015; 2019).

Brown bear pelt or garment

Brown bear hairs, which were detected from the organic material excavated above the metal items, hypothetically indicate the covering of the deceased's

Fig. 6: a) Traditional sieppuri made of bear pelt. Utsjoki, Finnish Lapland (S3168:34) (Image: Tuija Kirkinen); b) Traditional garment made of a whole bear cub pelt. Acquired by JohanTuri in the Russian part of Lapland in 1914. Belongs to the National Museum of Denmark (NM K.264) (Image: Roberto Fortuna, National Museum of Denmark)

upper half with a bear pelt. In Finland, bear pelts are known to have been used in cremation burials especially from the fourth to the 11th centuries CE, where the burnt third phalanges (the remains of claws) indicate the presence of bear skins together with the corpse (Petré 1980; Schönfelder 1994; Mäntylä-Asplund & Storå 2010, 62; Kirkinen 2017). In inhumation burials, bear hairs have been found only occasionally from Luistari, from the Kekomäki cemetery in the Karelian Isthmus, and from Ristimäki cemetery in southwestern Finland (Kirkinen et al. 2020). Bear pelt remains have also been found in the 17th century Mukkala forest Sámi cemetery in eastern Lapland (Kirkinen et al. 2019).

Bear hairs might also originate from a fur garment, which is familiar from ethnographic sources among the Sámi. Sámi men especially used to wear a traditional *sieppuri*, a short cape made of bear or wolverine pelt. It was a simple garment, which was usually made of the front part of a bear by cutting a V-shaped hole for the neck. The garment was lined with a red wool fabric, which formed a pouch used for carrying hunting equipment (Schwindt 1893, 145; Sirelius 1912, 47-52; Itkonen 1948a, 339). The bear's head skin with its ears, nose and eye holes was placed in the front (fig. 6a). A whole skin might be used for a similar type of a garment (fig. 6b).

Whether as a pelt or a garment, a bear skin must have been a bold statement for the mourners. First, it was by no means a common grave gift. Second, the bear had a central role in Finno-Karelian epic tradition, at the core of which was the idea of the bear's divine origin and its relationship to humans as a forefather and as an ancestor. The special relationship between women and bears has been identified, especially in the case of the ritualistic slaying of a bear, which culminated in the wedding of the bear and a maiden (Tarkka 2005, 272–282; Pentikäinen 2007, 65, 71; Siikala 2012, 389). This was said to be the origin of heroes with human mothers and bear fathers (Pentikäinen 2007, 25; Frog 2014, 402). Therefore, it is reasonable to assume that the bear pelt in Grave 56 had a strong symbolic function.

Mustelidae garment

The well-preserved *Mustelidae* hairs, which were found on the neck (NM 18000:1644) and shoulder (NM 18000:1652) areas, are difficult to interpret. The hairs were found under both the necklace and the round convex brooch, and no fibres were found above these artefacts. Accordingly, on the background of the round convex brooches, 1 cm to 2 cm loose hair impressions, different from textile impressions, were detected (fig. 7). These impressions cannot, however, be separated

Fig. 7: Hair impressions on the background of the round convex brooch (NM 18000:1652) (Image: Tuija Kirkinen)

from sheep hairs without further investigation. Similar kinds of hair impressions were found on the surfaces of spiral bracelets and on one finger ring. It is highly unlikely that the peplos-type dress was fur-lined in its upper part. The *Mustelida*e hairs may originate from an as yet unknown fur or fur-lined garment in the grave. It is also possible that the *Mustelidae* hairs come from a garment which the “Eura Matron” used during her lifetime.

Otter fur pouch

The location of the pieces of otter fur near the deceased’s waist may indicate that the fragments were remains of a pouch. These kinds of pouches, made most often of leather or *Mustelidae* fur, have been found in Late Iron Age burials in Finland (Schwindt 1893, 146–147; Lehtosalo-Hilander 1982b, 67; Kirkinen et al. 2019). The pouches were carried at the waist, tied with a tablet-woven belt, and used for carrying silver coins and fire-making supplies, for example. However, in Grave 56, no such finds that might have been kept inside the pouch were found.

Felidae-lined bronze-plated knife sheath

Compared to simpler sheaths, which were manufactured of leather or birch bark, a wide bronze-plated knife sheath undoubtedly represented wealth. Pirkko-Liisa Lehtosalo-Hilander (1982b, 48-49) has noted that the uniform design of this sheath type indicates they were manufactured by only a limited number of workshops. Fur-lined knife sheaths have been excavated from southwestern Finland cemeteries, for example, from Ristimäki, where they were lined with *Canidae* fur (Kirkinen et al., forthcoming) and Kirkkomäki, where they were lined with red squirrel, seal, and *Bovidae* pelts (Riikonen 1990, 25–26; Lehto 1993, 33; Kirkinen 2015).

Conclusion

Harris (2008) has drawn attention to the fact that of the total amount of organic material found in burials, textiles have received much more attention than fur remains. Harris has suggested the reason for this phenomenon by reference to a hierarchy of interest in research which values weaving as a developing technology and sees animal skins as insignificant and unchanging. In Finland, research on Iron Age and medieval clothing cultures have largely concentrated on textiles, whereas fur garments have not been taken into account when, for example, making reconstructions of Iron Age clothing (see Lehtosalo-Hilander 1984; Luoma 2003).

Evidence for fur is nevertheless plentiful in Finnish Late Iron Age and medieval burials, where pelts were used for furnishing the grave, for accessories and furlinings, and for garments such as mittens, coats, trousers, and shoes (Kirkinen 2015; 2019). Compared to Danish bog finds, which provide evidence for the dominance of domestic animal pelts (Mannering et al. 2010; 2012; Brandt et al. 2014), in Finland, most of the identified furred skin remains originate from wild species, especially from *Cervidae*, predators, and small fur animals.

In this paper, fur and hair remains excavated in 1969 from female Grave 56 at the famous Luistari cemetery has been analysed. This research shows that fur and pelts were essential materials in this richly furnished grave. The covering or clothing of the corpse with reindeer and brown bear pelts before the coffin was closed with a layer of birch bark must have been visually impressive. In addition, the use of fur for garments and accessories such as a pouch and a fur-lined knife sheath correlates with the estimated wealth of the burial. This method of using birch bark and reindeer pelts in burials is familiar from Viking Age and Early Medieval graves in southern Finland (Schwindt 1893; Cleve 1978, 82; Lehtosalo-Hilander 1982a, 35; Kirkinen 2019). In the research literature, these materials have been commonly connected to Sámi ethnicity and Sámi burial practices (Itkonen 1948b, 350; Manker 1961; Storå 1971, 87, 95–96, 106; Zachrisson 1997; Svestad 2007; 2011). This is an interesting hypothesis in line with the assumed distribution of southern Sámi groups, based on historical records, place names and recently by aDNA analysis (Aikio 2012; Taavitsainen 2014, 1074–1075; Lamnidis et al. 2018).

However, the question of whether Grave 56 can be identified as Sámi remains an open one. Thus far, there is no aDNA analysis from the burial. In addition, the way in which the *Cervidae* pelts were used to furnish the graves exceeds the known distribution of early Sámi groups. Therefore, to connect reindeer pelts to any specific ethnic group is highly questionable. Finally, the microscopic examination of the samples collected in the vicinity of the metal items revealed minuscule hair fragments for further analysis. This result demonstrates the need to systematically collect the soil and dirt around metal items during excavation. In order to acquire a more detailed picture of the role of fur garments in burials, these questions could be better answered by a more thorough analysis of the evidence from Luistari.

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High Medieval textiles of Asian and Middle Eastern provenance at Prague Castle, Czech Republic

Abstract

A total of 18 medieval textiles produced in Asia and the Middle East were found in the tomb of St Wenceslaus and the royal crypt in St Vitus Cathedral at Prague Castle, Czech Republic. For the most part, the fabrics correspond to contemporary classifications of Asian and Middle Eastern textiles and, with the exception of two, they were woven using the lampas technique from pure silk. Fabric patterns were woven with a main *liseré* weft, a silk pattern weft in various colours and a pattern metal weft, typically from a gilded strip of an animal substrate. Plant patterns dominate, in some cases accompanied by animals, geometric elements and inscriptions in Arabic script. Most of the fabrics were made in the 13th and 14th centuries. While the origin of one of the fabrics can be traced directly to northern China, the majority was woven in central Asia or northern China, with a smaller number in central Asia or the Middle East. The interpretation of the assemblage demonstrates the wealth of the medieval court and church dignitaries under the Přemyslid and Luxembourg rulers at Prague Castle which enabled them to acquire these highly luxurious goods from distant lands.

Keywords Prague Castle, tomb, St Wenceslaus, royal crypt, medieval textiles, lampas, Asia, Middle East, High Middle Ages

Introduction

The Prague Castle collections contain a valuable and relatively extensive assemblage of medieval textiles produced in Asia and the Middle East that was found in the tomb of St Wenceslaus (four fabrics) and the royal crypt in St Vitus Cathedral (14 fabrics).

Although the textiles were retrieved as early as the first third of the 20th century, their Asian origin remained unidentified for years, as the fabrics were mostly regarded as Italian (Gollerová-Plachá 1937, 12-13). The lone exception was a fabric with lotus blossoms, tendrils and Chinese birds (table 1, n7). Further progress came in 1993 (Bažantová et al. 1993) with the study of two double weaves - a fabric with Chinese dragons and clouds (table 1, n8) and a fabric with birds (table 1, n9). Their Asian origin was then confirmed during their conservation at Abegg-Stiftung in Switzerland (Flury-Lemberg & Illek 1995). A textile conservation workshop was built at Prague Castle in 2000 and the intensive conservation of textiles from archaeological contexts commenced. During this work, an Asian origin was determined for a fabric with palmettes, a plant motif and blossoms with small diamonds (table 1, n12) (Bravermanová & Plátková 2016). The same provenance was attributed to a fabric with palmettes and a diamond mesh (table 1, n6) (Wetter 2016). Other fabrics of Asian origin were then tentatively identified in connection with the completion of the conservation of the collection from the royal crypt and its display in 2016 (Bravermanová 2016).

Historical contexts

Tomb of St Wenceslaus

St Wenceslaus, prince of the Přemyslid family, was murdered on 28 September 935 in Stará Boleslav, where he was initially buried. According to legend, Prince Boleslav I had the remains of St Wenceslaus brought to Prague Castle within three years and had them buried in the southern apse of St Vitus Rotunda, which was built before 930. Afterwards, Prince Wenceslaus began to be referred to as a saint. When the rotunda was rebuilt as a romanesque basilica in 1060, the tomb of St Wenceslaus was left in its original place and a new chapel was built around it. The first report on the modification of the surrounding area comes from 1245, when the altar above the grave was repaired and newly consecrated. The cult of St Wenceslaus quickly expanded, and, by the 12th century, the prince had already become the patron saint of the Czech dominions.

A major change was made to the burial site from 1346 to 1348 during the reign of the Luxembourg kings. A lead chest containing a smaller lead case was deposited beneath the floor under a stone slab. Above the floor, a wooden box was placed on the altar. The gothic chapel of St Wenceslaus was founded in 1366 as part of the new cathedral, at which point a new altar with a tomb was established. A contemporary report makes it clear that this was an extraordinarily expensive undertaking. By the end of the 14th century, the tomb had begun to deteriorate, and, after 1425, only a bare container shrouded with covers stood in the St Wenceslaus Chapel. It was reconstructed in 1671.

A decision was reached in 1905 to renovate the chapel; work began in 1911. After the altar was opened, it was determined that it contained remnants of a trunk from 1671 on which textiles were placed. The chapel also contained a gothic chest with relics. The underground crypt contained a lead chest, two textiles and two inscription plates. The saint's relics were deposited in the cathedral treasury in 1911 (Podlaha 1911). A new altar was built from 1912 to 1913 on the remnants of the gothic altar table and tomb.

Otavská and Spittel conserved a total of 18 fabrics of various provenance and date from 2002 to 2003; their preliminary evaluation was conducted in 1996 (Bažantová 1996), followed by a detailed analysis from 2019 to 2020 (Bravermanová et al. 2020). Four of the textiles from this location have been identified as Asian or Middle Eastern and are described below (table 2, n2, n3, n14 and n15).

Royal crypt

The graves of most Bohemian kings from the Luxembourg dynasty and their family members are located in St Vitus Cathedral, which was founded in 1344 on the site of the romanesque basilica. The following individuals were progressively buried in the tomb built in front of the St Vitus Altar around 1350: Blanche of Valois (died 1348), Anne of Bavaria (died 1352), Anna von Schweidnitz (died 1362), Charles IV (died 1378), Joanna of Bavaria (died 1386), Elizabeth of Pomerania (died 1393), John of Görlitz (died 1386), Wenceslaus IV (died 1419), Ladislav Pohrobek (died 1457) and several small children.

The new royal crypt was built from 1566 to 1589 and the remains were transferred from the old crypt in 1590. The large sarcophagus of Rudolf II was set in the new royal crypt in 1612 and the contents of the coffins of Charles IV's wives, John of Görlitz, Wenceslaus IV, and Joanna of Bavaria were placed in a single chest. The crypt was subsequently opened in the years 1677, 1743, 1804, 1824, and 1851. Records report that the coffins were replaced several times and that the individuals entering the tomb often removed some of the funeral furnishings as "souvenirs".

Reconstruction of the crypt commenced in 1928 towards the end of the renovation of the cathedral, and on this occasion remains and the remnants of burial furnishings were removed. The reconstruction of the crypt was completed in 1935 and the remains were returned along with the coffin of Rudolf I of Hapsburg (died 1306), which until this time had been deposited in the Chapel of the Holy Cross. However, the grave goods were not returned to the new sarcophagi and they became part of the Prague Castle collections. Their state of preservation has degraded on account of the unfavourable deposition conditions, and many artefacts have also disappeared over the years. The greatest decline occurred in the 1930s, at which time, for example, some textiles were handed over to various institutions (especially to secondary textile schools) for the purpose of obtaining documentation and to weave copies. However, most of the originals were never returned to Prague Castle. Moreover, restoration work performed prior to 1989 was not always carried out at the highest professional level (Bravermanová 2005; Lutovský & Bravermanová 2007).

In light of the unsatisfactory situation described above, the Office of the President of the Czech Republic contacted the Abegg-Stiftung Textile Centre, Riggisberg, Switzerland, in the mid-1990s, where the burial outfits of Rudolf I of Habsburg and Wenceslaus IV were subsequently conserved. Restoration workshops were opened at Prague Castle in 2000 and the entire collection of 36 high medieval patterned fabrics from the royal crypt were gradually conserved. The fabrics were analysed by Mechthild Flury-Lemberg (Flury-Lemberg & Illek 1995), Karel Otavský (Flury-Lemberg & Otavský 1994), and subsequently by Milena Bravermanová (for example, Bažantová & Bravermanová et al. 1993; Bravermanová & Plátková 2016; Bravermanová & Brabcová et al. 2017). A total of 14 of the textiles retrieved from the burials in the crypt are now considered to be of Asian or Middle Eastern origin and are described and discussed below (table 1, n1, n4 to n13, n16 to 18).

No.	Inv. No.	Dimension (h x w; cm)	Technique	Characteristics		WARP					WEFT					
				ground	pattern	propor-tion	main (MW)	binding (BW)	thread count/cm	*décou-pure*	proportion /*passée*	ground (GW)	pattern (PW)	pattern l. (PW l.)	thread count/cm	*décou-pure*
1	PHA 120/3, HS 25848	49 x 29; 4 small fr.	lampas, double weave in ground	twill 2/1 S (MW+GW)	twill 1/3 S (BW+ wefts)	3 pairs MW to 1 BW	silk, z-twist	silk, twistless	36 MW 12 BW	2 pairs MW	2 GW to 1 PW to 1 PW l.	silk, twistless	*lancé*, silk, twistless	*lancé* (?), metal thread (?)	18 *passées*	1 *passée*
4	PHA 4/13, HS 25857A	78 x 36; 29 x 27	lampas, BW interlaces in ground and in pattern *par passée*	twill 3/1 Z (MW+GW)	twill 1/2 S (BW+ wefts)	4 pairs MW to 1 BW	silk, z-twist	silk, twistless	64 MW 16 BW	4 MW	1 GW to 1 PW	*liseré*, silk, twistless	*lancé* (?), gilded strip of an animal substrate		12 *passées*	1 *passée*
5	PHA 4/13, HS 25857B	68 x 46; 30 x 13; 57 x 41.5; 55 x 20; 63 x 32	lampas, BW interlaces in ground and in pattern *par passée*	twill 3/1 S (MW+GW)	twill 1/2 Z (BW+ wefts)	4 MW to 1 BW	silk, z-twist	silk, twistless	64 MW 16 BW	4 MW	1 GW to 1 PW	*liseré*, silk, twistless	*lancé* (?), gilded strip of an animal substrate		12 *passées*	1 *passée*
6	PHA 41/6, HS 25847	66.5 x 40; 35 x 29; 22 x 20; 29 x 20; 18 x 32; 33 small fr.	lampas, BW interlaces in ground and in pattern *par passée*	satin 4/1, *décoche-ment* 3 (MW+GW)	tabby (BW+ wefts)	3 pairs MW to 1 BW	silk, z-twist	silk, twistless	42 MW 14 BW	3 pairs MW	1 GW to 1 PW to 1 PW l. or 1 GW to 1 PW l.	silk, twistless	*lancé*, *interrompu*, silk, twistless	*lancé*, gilded strip of an animal substrate	12 *passées*	1 *passée*
7	PHA 4/6, HS 25804	78 x 29; 29.3 x 16; 3 small fr.	lampas, BW interlaces in ground and in pattern *par passée*	satin 4/1, *décoche-ment* 3 (MW+GW)	tabby (BW+ wefts)	5 MW to 1 BW	silk, z-twist	silk, z-twist	45 MW 8-9 BW	5 MW	1 GW to 1 PW to 1 PW l.	*liseré*, silk, twistless	*lancé*, *latté*, silk, twistless	*lancé*, gilded strip of an animal substrate	14-15 *passées*	1 *passée*
8	PHA 49, HS 13886	99 x 80; 200 x 92; 195 x 91.5; 141 x 78.4; 84 x 61.6; 84 x 61.6; 6 small fr.	double weave	tabby (warp A + weft A)	twill 2/1 Z (warp B + weft B)	2 warp A to 1 warp B	warp A silk, z-twist	warp B silk, z-twist	34 warp A 17 warp B	2 warp A	1 weft A to 1 weft B	weft A silk, twistless	weft B gilded and silver-plated strip of an animal substrate		16 weft A 16 weft B	1 weft A

Table 1a: Prague Castle, Cathedral of St Vitus, royal crypt: Technical details of the fabrics

No.	Inv. No.	Dimension (h x w; cm)	Technique	Characteristics		WARP					WEFT					
				ground	pattern	propor-tion	main (MW)	binding (BW)	thread count/cm	*décou-pure*	proportion/ *passée*	ground (GW)	pattern (PW)	pattern l. (PW l.)	thread count/cm	*décou-pure*
9	PHA 49, HS 13887, HS 13888, HS 13889	55 x 40; 90 x 40; 30 x 40; 58 x 30; 68 x 25; 60 x 15; 60 x 22; 72 x 26; 45 x 28; 40 x 23; 1 small fr.	double weave	tabby (warp A + weft A)	twill 2/1 S (warp B + weft B)	2 warp A to 1 warp B	warp A silk, s-twist	warp B silk, s-twist	32 warp A 16 warp B	2 warp A	1 weft A to 1 weft B	weft A silk, twistless	weft B gilded and silver-plated strip of an animal substrate		16 weft A 16 weft B	1 weft A
10	PHA 41/5, HS 25851	53,5 x 34; 20 x 20; 59.5 x 21; 20.5 x 15; 44 x 34; 36 x 21; 60 x 54; 47 x 28; 50 x 42; 51 x 26.5; 41 x 45; 6 small fr.	lampas, BW interlaces in ground and in pattern *par passée*	twill 3/1 S (MW+GW)	tabby (BW+ wefts)	4 MW to 1 BW	silk, z-twist	silk, z-twist	48 MW 12 BW	un-identif.	1 GW to 1 PW	silk, twistless	*lancé*, gilded strip of an animal substrate		12-13 *passées*	un-identif.
11	PHA 41/7, PHA 41/8, HS 25850, HS 25868	85.2 x 60; 53.5 x 37.3; 50 x 35.2	lampas, BW interlaces in ground and in pattern *par passée*	twill 3/1 Z (MW+GW)	twill 1/2 Z (BW + wefts)	4 MW to 1 BW	silk, z-twist	silk, z-twist	52 MW 13 BW	un-identif.	1 GW to 1 PW	silk, twistless	*lancé*, gilded strip of an animal substrate		20-23 threads	un-identif.

Table 1b: Prague Castle, Cathedral of St Vitus, royal crypt: Technical details of the fabrics

No.	Inv. No.	Dimension (h x w; cm)	Technique	Characteristics		WARP					WEFT					
				ground	pattern	propor-tion	main (MW)	binding (BW)	thread count/cm	*décou-pure*	proportion /*passée*	ground (GW)	pattern (PW)	pattern l. (PW l.)	thread count/cm	*décou-pure*
12	PHA 4/9, HS 25807	105 x 93.5; 56 x 14; 51 x 23; 32 x 18; 17 x 12; 45 x 28	lampas, BW interlaces in ground and in pattern *par passée*	twill 3/1 S (MW+GW)	tabby (BW+ wefts)	4 MW to 1 BW	silk, z-twist	silk, twistless	60 MW 15 BW	4 MW	1 GW to 1 PW to 1 PW l.	silk, twistless	*lancé*, silk, twistless	*lancé*, gilded strip of an animal substrate	14 *passées*	1 *passée*
13	PHA 120/7, HS 25852	59 x 49; 15 x 20	lampas, BW interlaces in ground and in pattern *par passée*	twill 3/1 S (MW+GW)	tabby (BW+ wefts)	4 MW to 1 BW	silk, z-twist	silk, twistless	64 MW 16 BW	4 MW	1 GW to 1 PW	*liseré*, silk, twistless	*lancé*, gilded strip of an animal substrate		10 *passées*	1 *passée*
16	PHA 5/1, HS 13639	120 x 80; 90 x 80; 58 x 77; 32 x 56; 22 x 35; 10 small fr.	lampas, double weave in ground; 2 systems of main warps and 2 systems of ground wefts	tabby (MWa+ GWa or MWb+ GWb)	tabby (BW+ wefts)	2 MWa to 2 MWb to 1 BW	silk, z-twist	silk, z-twist	56 MW 14 BW	4 MW	1 GWa to 1 GWb to 1 PW	silk, twistless	*lancé*, gilded strip of animal substrate S-wound around a flax core		20 *passées*	1 *passée*
17	PHA 120/9, HS 25854	51 x 22; 5 small fr.	lampas, BW interlaces in ground and in pattern *par passée*	satin 4/1, *déco-chement* 3 (MW+GW)	tabby (BW+ wefts)	5 MW to 1 BW	silk, z-twist	silk, z-twist	100 MW 20 BW	5 MW	1 GW to 1 PW	*liseré*, silk, twistless	*lancé*, gilded strip of animal substrate S-wound around a flax/cotton core (?)		*20 passées*	1 *passée*
18	PHA 4/10, HS 25808	6 x 12.5; 5 x 5.5; 16 x 12; 36.5 x 46.5; 8.5 x 12.5; 6.5 x 6	lampas, BW interlaces in ground and in pattern *par passée*	tabby (MW+GW)	tabby (BW+ wefts)	3 MW to 1 BW	silk, twist-less	silk, twistless	48 MW 16 BW	3 MW	1 GW to 1 PW or 1 GW to 1 PW to 1 PW l.	silk, twistless	*lancé*, silk, twistless	*broché* (?), metal thread	22 *passées*	1 *passée*

Table 1c: Prague Castle, Cathedral of St Vitus, royal crypt: Technical details of the fabrics

No.	Inv. No.	Dimension (h x w; cm)	Technigue	Characteristics: ground	Characteristics: pattern	WARP: propor-tion	WARP: main (MW)	WARP: binding (BW)	WARP: thread count/cm	WARP: *décou-pure*	WEFT: proportion/ *passée*	WEFT: ground (GW)	WEFT: pattern (PW)	WEFT: pattern I. (PW I.)	WEFT: thread count/c	WEFT: *décou-pure*
2	PHA 2/1e, HS 25785	12.5 x 31.8; 12 x 3; 2 small fr.	lampas, BW interlaces in ground and in pattern *par passée*	satin 4/1, *déco-chement* 3 (MW+GW)	tabby (BW+ wefts)	5 MW to 1 BW	silk, z-twist	silk, twistless	75 MW 15 BW	5 MW	1 GW to 1 PW	*liseré*, silk, twistless	*lancé*, gilded strip of an animal substrate		17-18 *passées*	1 *passée*
3	PHA 2/1f, HS 25786	26.3 x 13.5; 25,6 x 14	lampas, BW interlaces in ground and in pattern *par passée*	twill 3/1 S (MW+GW)	tabby (BW+ wefts)	4 MW to 1 BW	silk, z-twist	silk, z-twist	68 MW 17 BW	4 MW	1 GW to 1 PW to 1 PW I.	silk, z-twist	*lancé*, silk, twistless	*lancé*, gilded strip of an animal substrate	15-16 *passées*	1 *passée*
14	PHA 2/1b, HS 25782	26.8 x 4; 27.4 x 23; 11.6 x 26.8; 11.7 x 15; 10 small fr.	lampas, BW interlaces in ground and in pattern *par passée*	twill 2/1 S (MW+GW)	tabby (BW+ wefts)	3 pairs MW to 1 BW	silk, z-twist	silk, twistless	33 MW 11 BW	3 pairs MW	1 GW to 1 PW to 1 PW I. or 1 GW to 1 PW	silk, twistless	*lancé*, silk, twistless	*lancé*, *interrompu*, silk, twistless	9-10 *passées*	1 *passée*
15	PHA 2/1a, HS 25781	5.5 x 8.5; 2.5 x 5; 6.2 x 9; 9 x 5; 16 small fr.	lampas, BW interlaces in ground and in pattern *par passée*	satin 4/1, *déco-chement* 3 (MW+GW)	tabby (BW+ wefts)	4 pairs MW to 1 BW	silk, z-twist	silk, z-twist	96-100 MW 24-25 BW	4 pairs MW	1 GW to 1 PW	silk, twistless	*lancé*, silk, twistless		28-35 *passées*	1 *passée*

Table 2: Prague Castle, Cathedral of St Vitus, the tomb of St Wenceslaus: Technical details of the fabrics

Textile analysis

The basis of the professional processing of textiles was the implementation of research, which included technical analysis and detailed documentation. This was followed by an evaluation, the collection of contemporary analogies and the placement of the specimens in the overall framework of period textile production. Relevant historical reports were also incorporated into the final interpretation. If the fabric was originally a garment, in addition to the collection of period iconographical sources, the existing cut and tailoring traces of preserved and similarly dated garments were compared.

The main focus was on finding analogies to textile techniques. One factor was the character of metal patterning wefts, with the methodology described in Wardwell (1988 to 1989) being used as the basic work. The next step was the reconstruction of the pattern, with similar decorative motifs or their individual elements again being sought. An evaluation of the monitored parameters was the basis for determining the date and provenance.

From the perspective of the original use of fabrics, it was assumed that the textiles from the tomb of St Wenceslaus were reliquary fabrics, while those from the royal crypt were the remains of burial robes. The interpretation was complicated by the fact that the archaeological textiles had degraded as the result of long-term storage in unsatisfactory conditions. The royal crypt in particular was problematic, as coffins were exchanged here over the centuries and thus the remains and burial furnishings were transferred, and the contents of several coffins were even moved to a common chest at the beginning of the 17th century. Efforts to connect textiles with specific historical figures were therefore only partially successful. The evaluated fabrics (tables 1 and 2, n1 to n18) were then sorted based on the areas in which their source of production was established: northern China, central Asia or northern China, central Asia or the Middle East, and the Middle East. More precise locations, such as individual countries, were not possible, with minor exceptions, as a sufficient quantity of comparative material is missing for such conclusions.

Northern China

Lampas with octopuses and dragon fish (n1; table 1; fig. 8)

Lampas refers to a figured textile with a pattern composed of weft floats added to a ground fabric (a main warp and a ground weft) with a binding warp (CIETA 2006, 45). The fabric can be identified as northern Chinese from the second half of the 13th century to the 14th century. Besides the sea dragon/ *makara* motif, a Chinese origin can also be determined on the basis of the type of metal threads. As nothing was preserved on the fragments of fabric, it could be a silver or gold-plated strip of paper, which was used in Chinese workshops.

Although the fabric has retained traces of tailoring (folding and needle marks), its original shape and function can no longer be determined. It is also not known from which coffin in the Royal Crypt the fabric originally came.

Analogies to fabric 1: A similar technique, albeit without a double weave base, is found on a Chinese lampas with dragons and phoenixes from the 14th century. The side selvedge here consists of a strip of multiple warp threads and a strip of single warp threads, both of which are interlaced by the ground weft (Cleveland Museum of Art, Cleveland; Watt & Wardwell 1997, 153, catalogue number 42). Similarly, a selvedge is present on a Chinese lampas with a bird motif from the mid-13th to mid-14th century (Abegg-Stiftung, Riggisberg: Otavský & Wardwell 2011, 203-204, catalogue number 71).

The sea dragon/*makara* motif from Buddhist mythology appears on Chinese fabrics at least from the 10th century (Kuhn and Zhao Feng 2012, 288) and can be supplemented with additional elements, for example, lions, as in the case of two samite fabrics, one of which is dated to the 10th or 11th century, the second to the 11th to the early 13th century (Abegg-Stiftung, Riggisberg: Bayer & Sue-ling Gremli 2007, 151-168, catalogue number 2). Along with phoenixes and flowers, a similar creature also appears on a Chinese or central Asian lampas dated to the 13th century (Cleveland Museum of Art, Cleveland: Watt & Wardwell 1997, 152, catalogue number 41).

Central Asia or northern China

Lampas with vertical stripes with palmettes, rosettes and heart-shaped motifs (n2; table 2; fig. 1 and fig. 8)

The fabric can be identified as central Asian or northern Chinese from the first half of the 14th century. No traces of tailoring were preserved on the fabric, which could have been part of the original furnishings of the Chapel of St Wenceslaus as an older cloth over the tomb or a vestment that was placed in the interior of the tomb during renovation of the saint's grave in the 14th century.

Analogies to fabric n2: The same binding technique and pattern arranged in stripes is found on the lampas of the so-called "Saint Himerius toga", which is identified as Turkestani from the 14th century (Kloster Mariastein: Schmedding 1978, 149-151, catalogue number 119). It is also similar, for example, to the fabric of a dalmatic with a pattern of oblique lotus blossoms and small flowers. The fabric is interpreted as central Asian or northern Chinese from the first half of the 14th century (Kulturhistorisches Museum der Hansestadt Stralsund, Stralsund: Fircks 2008, 72-91, catalogue number 1/II). A similar pattern composition with slightly different elements is also found on the fabric from the St Servatius assemblage identified as Chinese or Turkestani from the turn of the 14th century (St Servatius, Maastrich: Stauffer 1991, 180-181, catalogue number 106).

Lampas with lanceolate leaves and medallions (n3; table 2; fig. 8)

The fabric can be identified as central Asian or northern Chinese from the first half of the 14th century. A weft from a gilded strip of an animal substrate was used, which is characteristic of central Asia. A motif

Fig. 1: Fabric n2 - fragments on panel (Image: © Prague Castle Administration, Jan Gloc)

reminiscent of a stylised symbol of longevity set in a round medallion is also a typical Chinese element. No tailoring traces were preserved on the fabric. According to the find context, this is a remnant of fabric that was to have covered the outside of the gothic container found inside the altar. It apparently reached the tomb of St Wenceslaus during renovation of the saint's grave in the 14th century.
Analogies to fabric n3: A very similar binding technique is found on fabric with a plant motif from which a maniple was sewn. The fabric is interpreted as central Asian from the first half of the 14th century (Kulturhistorisches Museum der Hansestadt Stralsund, Stralsund: Fircks 2008, 92-95, catalogue number 2). Several elements of a similar pattern, especially lanceolate leaves and small medallions filled with plant ornament, are found on a lampas interpreted as Persian or from the western part of central Asia from the end of the 13th century and the first half of the 14th century (Abegg-Stiftung, Riggisberg: Otavský & Wardwell 2011, 250-251, catalogue number 94).

Lampas with palmettes, tendrils and small leaves (n4; table 1; fig. 2 and fig. 8)
The fabric can be identified as central Asian or northern Chinese from the first half of the 14th century. Part of a sleeve, originally with a hanging sleeve, was sewn from one fragment of fabric. On the front part at the level of the elbow is an arch-shaped cut-out; the hem is faced with a strip of unpatterned fabric. The hanging sleeve has not survived and may have been made from a different material. The second symmetrically-cut fragment was a gore used for widening the skirts to the hemline. The fragments are apparently the remains of a woman's gown. Given the similar pattern, it is possible to consider a connection with fragments of fabric with palmettes and small leaves (table 1, n5) from the lower part of a woman's gown. It could also be one garment sewn from two fabrics. The garment evidently belonged to one of the first two wives of Charles IV: Blanche of Valois or Anne of Bavaria, a determination made possible by the dating of the fabric and a description of the character of the garment.
Analogies to fabric n4: A dalmatic and a tunicella were made from a central Asian lampas from the first half of the 14th century woven using a similar technique (Kulturhistorisches Museum der Hansestadt Stralsund, Stralsund: Fircks 2008, 206-221, catalogue numbers 17, 17a/II). Similar elements and compositions are found on two central Asian or Chinese lampas fabrics from the first half of the 14th century (Kulturhistorisches Museum der Hansestadt Stralsund, Stralsund: Fircks 2008, 72-91, catalogue number 1/I, II).

Fig. 2: Fabric n4 - fragments on panel; gore (left); sleeve (right) (Image: © Prague Castle Administration, Jan Gloc)

Lampas with palmettes and small leaves (n5; table 1; fig. 8)
The fabric can be identified as central Asian or northern Chinese from the first half of the 14th century. The fragments are from the lower part of a woman's gown, evidently the back part with a slight extension into a train. Given the similar pattern, it is possible to consider a connection with fragments of fabric with palmettes, tendrils and small leaves (n4), which are the remains of a sleeve and a gore. It could also be one garment sewn from two fabrics. Hence, the assignment of the gown to either Blanche of Valois or Anne of Bavaria is the same.
Analogies to fabric n5: The closest analogy to the technique and pattern is the lampas with palmettes, tendrils and small leaves (n4).

Lampas with palmettes and a diamond mesh (n6; table 1; fig. 3 and fig. 8)
The fabric can be interpreted as central Asian or northern Chinese from the first half of the 14th century. The largest fragment of fabric was apparently once a long and wide sleeve, while another larger fragment is possibly a remnant of a wide gore. It is not possible to identify the garment part to which any of the other fragments once belonged. Given the characteristics

Fig. 3: Fabric n6: detail of interlacing of patterning wefts (Image: © Prague Castle Administration, Jan Gloc)

of the sleeve and the find context, it is probable that this was part of a ceremonial royal garment, likely a dalmatic from the coffin of Charles IV. Early written reports support this interpretation.

Analogies to fabric n6: A similar technique was used to make, for example, the lampas of a dalmatic from Stralsund interpreted as central Asian or northern Chinese from the first half of the 14th century. There are also oblique palmettes in rows offset by half their spacing (Kulturhistorisches Museum der Hansestadt Stralsund, Stralsund: Fircks 2008, 72-91, catalogue number 1/II). The meander ornament against the background of a larger pattern occurs, for example, on a damask with a pattern also woven with a strip of gilded paper identified as Chinese from the 13th to 14th century (Abegg-Stiftung, Riggisberg: Otavský & Wardwell 2011, 201-203, catalogue number 70).

Lampas with lotus blossoms, tendrils and Chinese birds (n7; table 1; fig. 8)

The fabric can be identified as central Asian or northern Chinese from the first half of the 14th century. Cuts and the remains of vertical pleating in a length of roughly 10 cm are visible on the larger fragment. This was apparently one of the trapezoidal segments of a cloak on which the upper edge was pleated around the shoulder. In addition to a decorative effect, the pleats reduced the edge to the required dimension for the neckline. Given the characteristics of the garment and the find context, the item can be attributed to Anna von Schweidnitz.

Analogies to fabric n7: A similar technique was used to make, for example, the lampas of a dalmatic from Stralsund interpreted as central Asian or northern Chinese from the first half of the 14th century (Kulturhistorisches Museum der Hansestadt Stralsund, Stralsund: Fircks 2008, 72-91, catalogue number 1/II). A very similar pattern is found on the lampas of a dalmatic; the composition is identical and differs only in the details of individual motifs. The fabric is interpreted as central Asian or northern Chinese from the first half of the 14th century (Kulturhistorisches Museum der Hansestadt Stralsund, Stralsund: Fircks 2008, 72-91, catalogue number 1/III).

Double weave with Chinese dragons and clouds (n8; table 1; fig. 8)

The fabric can apparently be identified as central Asian or northern Chinese from the late 13th to early 14th century, even if an analogy to the weaving technique has not yet been found. Four vertically placed stripes of fabric and several other smaller fragments were sewn into an unlined half-oval cloak with a train. Two trapezoidal segments and several smaller fragments are interpreted as part of a pair of long hose. An arched cut-out for the instep was preserved on one segment. The cloak had a maximum length of 200.8 cm and a maximum width of 342 cm. The reconstructed length of the hose (from the instep to the upper hem) is about 73 cm; the upper circumference is 61.6 cm. Based on the poor craftsmanship of both garment components removed from the coffin of Rudolf I of Habsburg, they were evidently made for his funeral.

Analogies to fabric 8: The double weave with completely separate layers is unique for the High Middle Ages. The closest analogy is a central Asian fabric with birds from the same grave inventory (table 1, n9). A Persian fabric with falconers in octagons comes from an earlier period (11th century) (Abegg-Stiftung, Riggisberg: Otavský & Salím 1995, 122-125, catalogue number 75). A small gold pattern on the background of a natural colour composed of diverse motifs is found on the central Asian fabrics of a dalmatic and cloak of Pope Benedict XI from the second half of the 13th century to the early 14th century (Basilica di San Domenico, Perugia: Ludovica Rosati 2016). The dragon motif appears on a central Asian fabric from the first half of the 14th century used for a dalmatic and tunicella (Kulturhistorisches Museum der Hansestadt Stralsund, Stralsund: Fircks 2008, 207-220, catalogue number 17, 17a/II), and a cloud motif is found, for example, on a central Asian fabric from the 13th century (Museum of Islamic Art, Qatar: Denney 2016, 130-131, fig. 5).

Double weave with birds (n9; table 1; fig. 8)

The fabric can apparently be identified as central Asian or northern Chinese from the late 13th to early 14th century. Compared to other fabrics identified in the same way, this fabric has a different weave structure, as was the case with fabric n8. The fabric was used for a garment with sleeves, and the identification of fragments of silk lining helped determine its shape. It could have been a surcoat with three-quarter sleeves, either completely or partially quilted and hanging freely from the shoulders, or it could have been a cotte with long sleeves. Approximate dimensions of the reconstructed garment are an assumed length of 130 cm; lower circumference 260 cm; width of the front and back segment 40 cm; circumference of the armhole 80 cm. The garment was removed from the coffin of Rudolf I of Habsburg. Given that it was lined and its overall tailoring was quite precise, the king could have worn the garment during his lifetime. It was supplemented for the burial with a cloak and hose from fabric with Chinese dragons and clouds (n8).

Analogies to fabric n9: The weaving technology is nearly identical to the fabric with Chinese dragons and clouds (n8).

Lampas with palmettes and small plant motif (n10; table 1; fig. 8)

The fabric can be identified as central Asian or northern Chinese from the late 13th century to the first half of the 14th century. A garment whose form corresponds to a tunicella was made from the fragments. The front part was cut from two trapezoidal segments and featured a deeper neckline. The back part was from three segments, the middle of which had a shallower neckline. There were trapezoidal segments on the sides reaching up to the shoulders; the sleeves were not preserved. The total reconstructed length of the garment was 148 cm. Given the characteristics of the garment and the find context, it is probable that this was part of a ceremonial royal garment from the coffin of Charles IV. Early written reports support this interpretation.

Analogies to fabric n10: A similar technique is found, for example, on two silk lampas fabrics deposited in the Church of St Servatius in Maastricht. Dated to the 13th to 14th century, the fabrics come from central Asia (Stauffer 1991, 180-181, catalogue number 106). Identically arranged palmettes with an undivided perimeter line and with small plant ornament between them are found on the lampas-woven textile used for a cloak and surcoat with sleeves forming part of the burial garments of Cangrande della Scala, the overlord of Verona (died 1329). The fabric was woven in central Asia at the beginning of the 14th century (Museo di Castelvecchio, Verona: Frattaroli 2004, 289-291, catalogue numbers 29 & 30). Similarly arranged palmettes, albeit without other plant motifs between them, are also found, for example, on a central Asian lampas from the 13th to 14th century (Cleveland Museum of Art, Cleveland: Watt & Wardwell 1997, 160-161, catalogue number 46).

Lampas with vertical stripes and a gold pattern (n11; table 1; fig. 4)

The fabric can be dated from the late 13th century to the first half of the 14th century; it was probably produced somewhere in central Asia or northern China, but because the appearance of the pattern remains unknown, a more detailed interpretation is not possible.

The composition of fabric with stripes and a gold pattern is created with the use of two colours in the main warp and the metal weft covers most of the fabric. The actual pattern cannot be reconstructed, since the metal weft was preserved only in fragments, with the only recognisable detail probably being a wing. Compared to the group of striped fabrics presented below, the thread count here is lower; there is greater distance between the lengthwise stripes and there are probably differences in the dimensions of individual

Fig. 4: Fabric n11: fragments on panel (Image: © Prague Castle Administration, Jan Gloc)

pattern motifs, so that an assignment to this group set in the eastern part of the Middle East is problematic.
One of the fragments of a rectangular shape was once a pillow. Other fragments still stitched together form a nearly entire leg of hose (one large fragment remained from the other leg). Both legs were made from two segments, with the larger piece folded on the bias to form the calf and the heel, the smaller piece the instep and sole. The original length of the hose was about 50 cm, with an upper circumference of 37 cm.
The hose and pillow are specifically mentioned in the contemporary description of the clothing of Charles IV on the funeral catafalque, which would support the interpretation that the pillow and hose come from the emperor's burial.
Analogies to fabric n11: A similar technique is found, for example, on a central Asian lampas with a plant motif dated from the end of the 13th to the middle of the 14th century (Metropolitan Museum of Art, New York: Watt & Wardwell 1997, 146-147, catalogue number 37). Fabrics with densely ordered stripes of different colours in which various small geometric patterns, animals and plant motifs appear are interpreted today as Middle Eastern (from Iran or Iraq) rather than central Asian (Wardwell 1988-1989, 97-102; Ritter 2016; Fircks 2016; Borkopp-Restle 2016; Dode 2005, 273-277). The fabrics are characterised by a high thread count and densely ordered vertical stripes filled with small ornaments.

Central Asia or Middle East

Lampas with palmettes, a plant motif and blossoms with small diamonds (n12; table 1; fig. 5 and fig. 8)
The fabric can be dated to the first half of the 14th century. Although it was apparently woven in central Asia, a Middle Eastern origin also cannot be ruled out, mainly due to the composition of the pattern. A large part of a woman's surcoat with three-quarter sleeves could be composed with the fabric fragments. The front and back segments were cut from one piece of fabric, and an armhole was simply cut into the curve on the side. The garment was widened from the waist to the bottom by the insertion of four gores - in front, in the back and on both sides. One of the other preserved fragments was a slender sleeve with a tip reaching to the elbow. The original length of the garment was not preserved; the width across the chest was about 93 cm. The garment evidently belonged to one of the first two wives of Charles IV - Blanche of Valois or Anne of Bavaria, a determination made possible by the dating of the fabric and a description of the character of the garment.
Analogies to fabric n12: A nearly identical technique is also found on the fabric of a maniple interpreted as central Asian from the first half of the 14th century (Kulturhistorisches Museum der Hansestadt Stralsund, Stralsund: Fircks 2008, 93-95, catalogue number 2). An analogy to this pattern is found on a lampas with lotus blossoms in wide and pointed ovals identified as Middle Eastern from the first half of the 14th century. The lotus blossoms are presented from a front view (Berlin, Kunstgewerbemuseum: Wilckens 1992, 53, catalogue number 86).

Lampas with palmettes and plant motif (n13; table 1; fig. 8)
The fabric can be dated to the first half of the 14th century. Although it was apparently woven in central Asia, a Middle Eastern origin also cannot be ruled out, mainly due to the composition of the pattern. Given the preserved traces of tailoring and the right-angled fabric cuts, it can be assumed that the article was a pillow, evidently from the grave inventory of Blanche of Valois or Anne of Bavaria.
Analogies to fabric n13: A similar technique is found on the fabric of a maniple interpreted as central Asian from the first half of the 14th century. (Kulturhistorisches Museum der Hansestadt Stralsund, Stralsund: Fircks 2008, 96-99, catalogue number 3). An analogy to this pattern is found on a lampas with lotus blossoms in wide and pointed ovals identified as Middle Eastern from the first half of the 14th century. The placement of the palmettes in the pointed ovals is the dominant element here (Berlin, Kunstgewerbemuseum: Wilckens 1992, 53, catalogue number 86).

Middle East

Lampas with obliquely inscribed eight-sided stars and rosettes (n14; table 2; fig. 8)
The fabric can be dated to the 13th to 14th century with an origin in the Near East, in Egypt or perhaps the Islamic part of Spain. Although the fabric has retained traces of tailoring (three fragments are sewn together), its original shape and function can no longer be determined. It could have been part of the original furnishings of the Chapel of St Wenceslaus, either as an older cloth placed over the tomb or a former vestment that was placed in the interior of the tomb during renovation of the saint's grave in the 14th century.
Analogies to fabric n14: A lampas with a cross-star motif from the Middle East or Spain from the 14th century was produced using a similar technique (Abegg-Stiftung, Riggisberg: Otavský & Salím 1995,

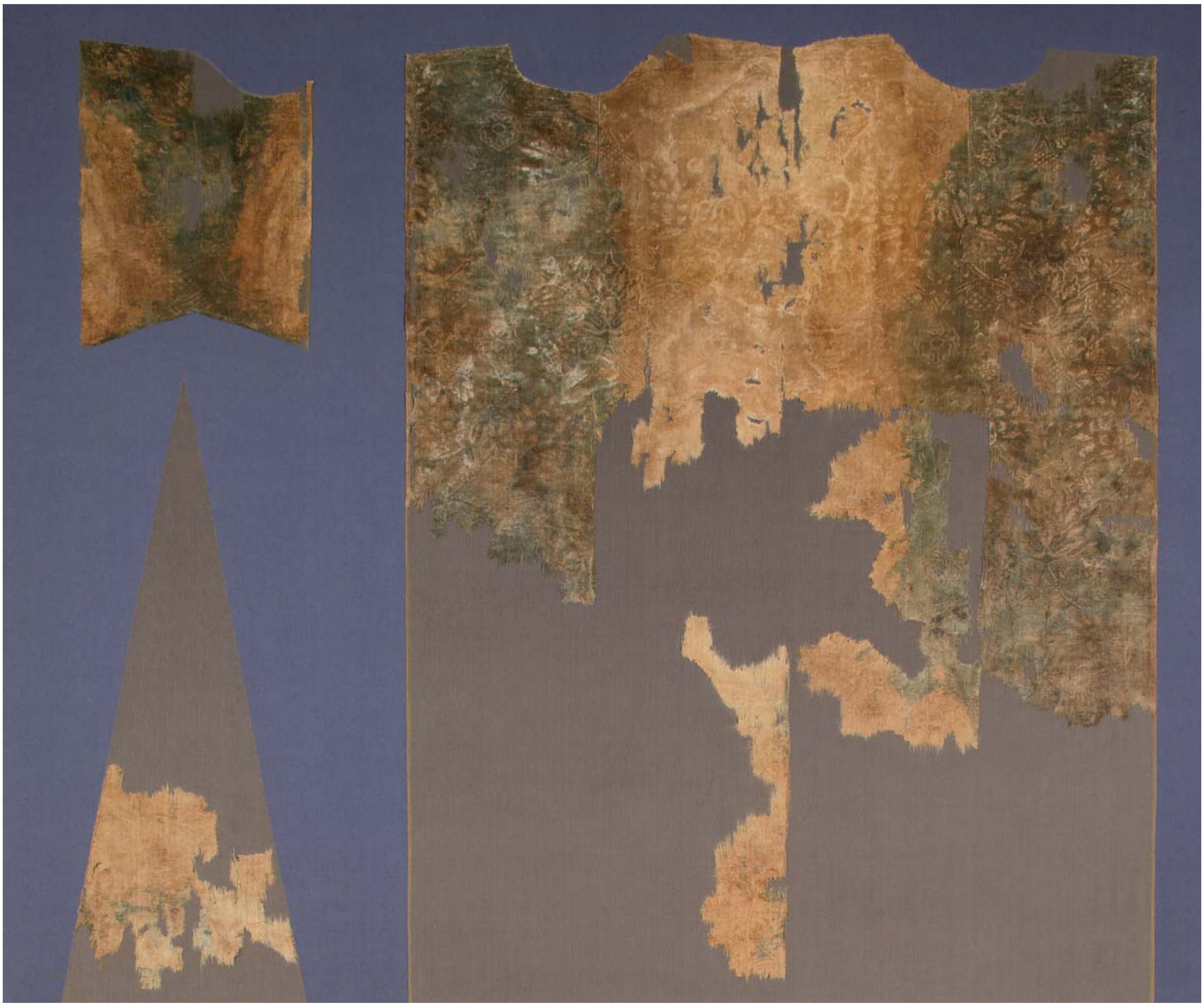

Fig. 5: Fabric n12: fragments on panel (Image: © Prague Castle Administration, Jan Gloc)

224-225, catalogue number 128). The eight-sided star motif is found, for example, on the silk lampas of a cap from the Middle East from the turn of the 12th century (Victoria and Albert Museum, London: Wilckens 1991, 66, fig. 66) and on the fabric of the "St Wenceslaus" casula and toga interpreted as a lampas from the second half of the 13th century to the first half of the 14th century produced in the Near East, in Egypt or the Islamic part of Spain (Metropolitan Chapter of St Vitus, Prague: Bravermanová 2012, catalogue number 7).

Lampas with ogival framework and an Arabic inscription (n15; table 2; fig. 8)

The fabric can be identified as Syrian or Egyptian from the 14th century, also due to the Arabic inscription "sultan" inside circles. Although the fabric has retained traces of tailoring (folds and needle marks with minute remnants of sewing thread), its original shape and function can no longer be determined. It could have been part of the original furnishings of the Chapel of St Wenceslaus, similar to n14.

Analogies to fabric n15: A lampas patterned in metal thread with a double-hare motif enclosed in an ogival framework from Egypt or Syria from the 14th century was made using a similar technique. The composition of the pattern on this fabric is also similar (Abegg-Stiftung, Riggisberg: Otavský & Salím 1995, 214-217, catalogue number 124). This composition and the identical Arabic inscription inside the oval are found on a fabric with pointed ovals and lotus blossoms from Egypt or Syria from the 14th century

(Kunstgewerbemuseum, Berlin: Wilckens 1992, 60, catalogue number 99).

Lampas with phoenixes, peacocks and tendrils (n16; table 1; fig. 6 and fig. 8)

The fabric can be identified as Middle Eastern from the 13th to early 14th century. A lined dalmatic was assembled from the preserved fragments. The foundation was formed by straight segments with shaped arm holes and neckline and triangular gores at the sides. The garment had sleeves to the elbows, and both shoulder seams were covered with a thin tablet-woven band. Dimensions of the garment: length 148 cm; lower circumference 240 cm; width of the front and back segment 60 cm; circumference of the armhole 78 cm, sleeve length 49 cm. Given the characteristics of the garment and the find context, it is probable that this was part of a ceremonial royal garment, probably a dalmatic originally from the coffin of Wenceslaus IV.

Analogies to fabric n16: The same technique and pattern are found on a Persian lampas from the 13th century to the beginning of the 14th century except that it is woven in a different colour combination of light blue and dark violet (Abegg-Stiftung, Riggisberg: Otavský & Wardwell 2011, 230-232, catalogue number 84).

Fig. 6: Fabric n16: three-dimensional display (Image: © Prague Castle Administration, Jan Gloc)

Fig. 7: Fabric n17: detail of interlacing of patterning wefts (Image: © Prague Castle Administration, Jan Gloc)

Lampas with an ogival framework including Arabic script (n17; table 1; fig. 7 & fig. 8)

The fabric can be identified as Middle Eastern from the second half of the 14th century, as suggested by the character of the metal patterning weft with a flax/cotton (?) core, a selvedge with ends of different colours and metal wefts extending to the edge. No traces of tailoring are preserved on the fabric and its original shape and function cannot be identified today. It is no longer possible to determine which coffin the fabric originally came from.

Analogies to fabric n17: An almost identical technique and pattern is found on a Middle Eastern lampas from the second half of the 14th century. The pattern differs only in the motifs enclosed in the ogees (Bayerisches Nationalmuseum, Munich: Durian-Ress 1986, 118-119, catalogue number 41; Wardwell 1988-1989, 106-108).

Lampas with palmettes, peacocks and gryphons (n18; table 1; fig. 8)

The fabric can be dated to the end of the 13th century or the first half of the 14th century and was made either in the Middle East (Syria) or in Italy. It belongs to a group of fabrics called *diasprum* in medieval inventories. The fragments were assembled into the lined upper part of a gown with small buttons made from loops of silk threads. The buttons ran down to the chest, and gores

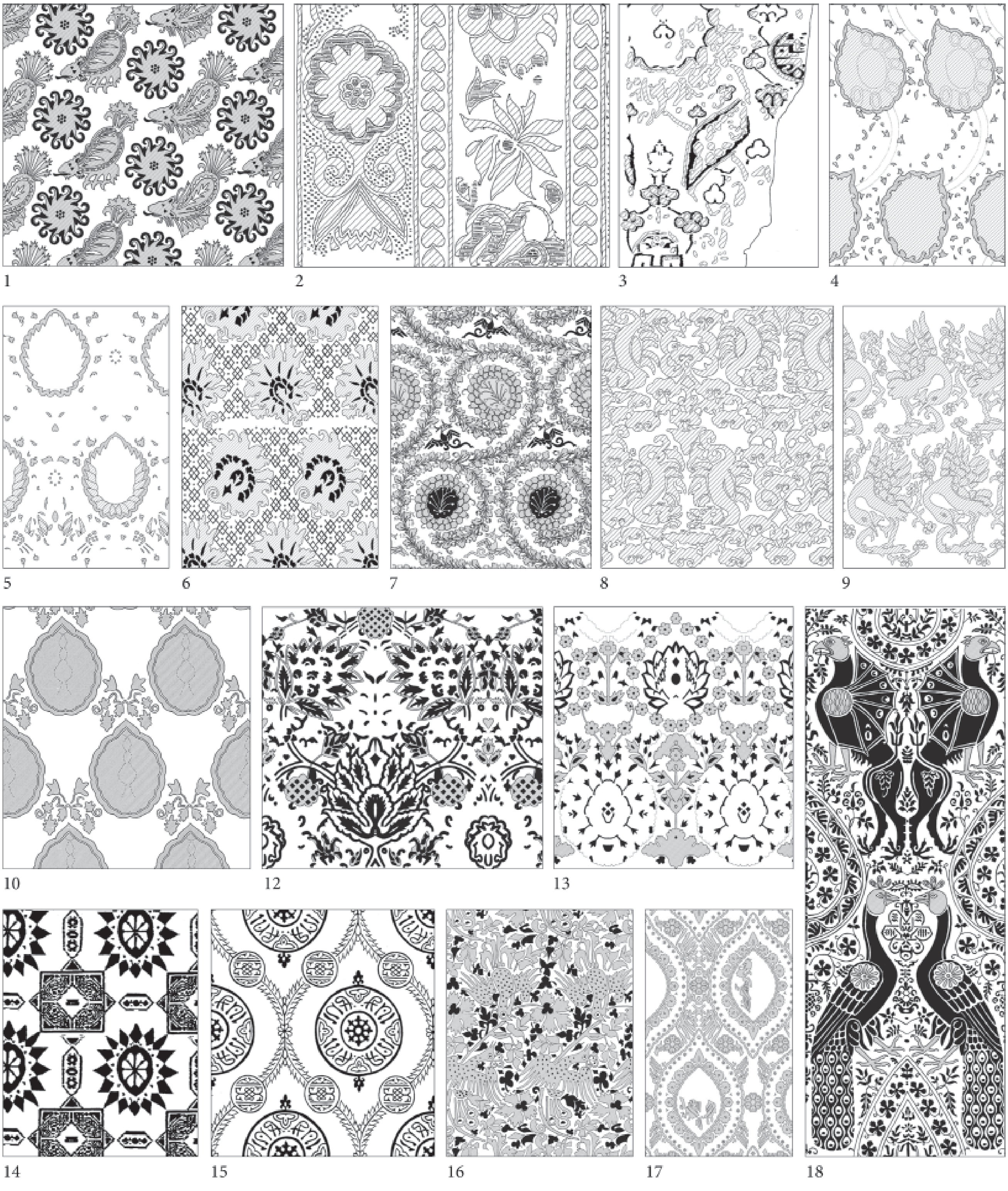

Fig. 8: Drawings of patterns (repeat h x w in cm): Fabric n1 (18 x 32); n2 (w 13.5); n3 (24.2 x 8.5); n4 (37 x 11); n5 (32 x 16); n6 (25 x 12.6); n7 (33 x 10.5); n8 (13.8 x 9); n9 (15.3 x 5.2); n10 (12 x 22); n12 (27 x 32); n13 (27 x 14); n14 (23 x 23); n15 (22.6 x 13.6); n16 (18.5 x 10); n17 (78 x 48); n18 (60 x 22). Note that the pattern for n11 cannot be reconstructed (Images: © reconstruction of pattern: Prague Castle Administration – Department of Art Collections; graphic editing: Kateřina Vytejčková)

widened the gown towards the waist. The original length is not known (the preserved length is about 36 cm). Given the characteristics of the garment and the find context, the item can be attributed to Anna von Schweidnitz, the wife of Charles IV.

Analogies to fabric n18: The same technique appears on a Syrian (?) lampas (*diasprum*) with palmettes, gazelles and (probably) birds from the 13th century (St Mariä Himmelfahrt, Hildesheim: Brandt & Schorta 2018, 43-44). A nearly identical pattern is on an Italian lampas (*diasprum*) from the first half of the 14th century (Deutsches Textilmuseum, Krefeld: Tietzel 1984, 202-205, catalogue number 45; Kunstgewerbemuseum, Berlin: Germanischen Nationalmuseum, Nürnberg: Wilckens 1992, 110, 112, catalogue number 226).

Interpretation

A total of 18 fabrics made in Asia and the Middle East in the High Middle Ages were preserved in two find contexts at Prague Castle. The first is an assemblage of four fabrics retrieved in 1911 from the tomb of St Wenceslaus, where they were likely deposited during the renovations of the saint's grave in the 14th century. The fabrics were a covering over the tomb or a vestment and were part of the original furnishings of the Chapel of St Wenceslaus (n2, n14, n15) or covered the gothic casket with relics placed inside the altar (n3).

The second assemblage is composed of 14 fabrics retrieved from the royal crypt in 1928. Despite the fact that traces of tailoring were preserved on the majority of these fabrics their fragmented condition, makes it no longer possible to determine the original shape and function of some of them (n1, n17). Men's garments were sewn from several of the fabrics, including a ceremonial robes (n6, n8, n10, n11, n16) and a garment of a secular nature (n9). Women's gowns could be reconstructed from other fabrics (n4, n5, n7, n12, n18), while pillows were apparently made from two fabrics (n11, n13).

Given the find contexts linked to the royal crypt, it was not always possible to attribute the garments to a specific individual. This process is simpler in the case of men's garments. A tunicella and dalmatics were evidently placed in the coffins of King Charles IV (n6, n10) and King Wenceslaus IV (n16), a surcoat and cloak (part of n8, n9) in the coffin of Rudolf I of Habsburg, and hose in the coffin of Rudolf I of Habsburg (n8) and Charles IV (n11). Attributing women's garments to individual Bohemian queens is far more complicated, mainly because their remains were deposited in a common coffin in 1612. The nature of the garment is helpful in making a more precise determination, not the dating of the fabrics, since the majority of them are approximately dated to the first half of the 14th century, and the deaths of the first three wives of Charles IV are not far apart.

All of the fabrics, with the exception of double weaves n8 and n9, are woven using the lampas technique in pure silk. Their background is composed of a simple, sometimes paired (n1, n6, n14, n15) main warp with a z-twist and a binding warp either with a z-twist or without a twist. The ratio of the main and binding warps is mainly four main warp ends to one binding warp end; three fabrics (n1, n14, n18) have three main warp ends to one binding warp end, while three others (n2, n7, n17) have five main warp ends to one binding warp end. One fabric has two systems of main warps in the background (n16). The basic weft is always without any twist.

In six cases, the patterns of the fabrics were woven with a basic *liseré* weft (n2, n4, n5, n7, 1n3, n17), in eight cases with a different coloured silk patterning *lancé* weft without a twist (n1, n3, n6, n7, n12, n14, n16, n18). With the exception of two fabrics (n14, n15), a metal pattern weft occurred on the other fabrics (nearly always *lancé*, only once *broché*). Minute remnants of this metal weft were preserved, sometimes only as dark imprints. In most cases, this was a gilded strip of an animal substrate; in two examples, the strip was gilded on one side and silver-plated on the other (n8, n9). In only two textiles was the gilded strip of an animal substrate wound around a core of either flax (n16) or flax/cotton (n17). No traces were preserved on the fragments on one fabric (n1), not even a black crust as remnants of an animal substrate. This could be explained by the use of a metal-plated strip of paper. In the environment of the royal crypt, the cellulose base of paper probably decomposed entirely, which would also have led to the degradation of the metal coating.

The background of the fabric employed a tabby weave (n16, n18), twill weave (n1, n3, n4, n5, n10, n11, n12, n13, n14) and satin weave (n2, n6, n7, n15, n17), in the pattern a tabby weave (n2, n3, n6, n7, n10, n12, n13, n14, n15, n16, n17, n18) or twill weave (n1, n4, n5, n11). One fabric has a double weave in the background (n1), as does fabric n16, on which two systems of the main warps and basic wefts create a specific type of binding. Two similar double weaves (n8, n9) are technically exceptional and thus far without known analogies. This may be a possible regionally specific characteristic accepted for central Asian fabrics (Wardwell 1988-1989, 97-102).

Selvedges were preserved on 11 fabrics. Their width is 0.4 cm to 0.6 cm (n5, n6, n8, n9, n10, n11, n12), in three cases 0.8 cm to 1.3 cm (n1, n3, n16, n17). Selvedge warp ends/threads are mostly of a different colour from the main warp. If the fabric is patterned with a metal weft, this weft is cut off before the selvedge or is turned back, though fabric n17 is an exception. A bundle of heavier warp ends is found on the outer side of the selvedge in six cases (n5, n6, n10, n11, n12); on one fabric this bundle is on the inner side of the selvedge (n1), in another example on both the inner and outer side of the selvedge (n16). Where the selvedge was preserved on both sides of the fabric, the width of the fabric could be established: 60 cm (n11, n16) or 90 cm to 93.5 cm (n8, n9, n10, n12).

Patterns are mostly plant motifs (n4, n5, n10, n12, n13), sometimes together with animals (n7, n16, n18) or geometric elements (n2, n6). An animal motif appears alone on a fabric in two cases (n1, n9), while geometric elements appear alone in one case (n14). Animals and clouds are found on one fabric (n8), Arabic inscriptions appear on two fabrics (n15, n17), while in one case a plant pattern is accompanied by a motif reminiscent of a stylised Chinese symbol of longevity (n3). Fabric n11 is decorated with vertical stripes in two different colours and was covered with a pattern or inscription that cannot be reconstructed.

The majority of the fabrics were made between the end of the 13th century and the first half of the 14th century. A broader date range applies to fabric n14, that is, in the 13th to 14th century, and fabric n15 (the entire 14th century). Three fabrics are somewhat older and can be dated at best to the beginning of the 14th century (n8, n9, n16). In contrast, one fabric is younger - from the second half of the 14th century (n17).

Only one fabric can be traced directly to northern China (n1). The majority of fabrics were woven in central Asia or northern China (n2, n3, n4, n5, n6, n7, n8, n9, n10, n11), two fabrics in central Asia or in the Middle East (n12, n13) and two in the Middle East (n16, n17). One fabric comes from the Near East, Egypt or the Islamic part of Spain (n14), one from Syria or Egypt (n15) and one from the Middle East or Italy (n18).

Conclusion

A detailed analysis and comparison with analogies in terms of weaving technique and pattern makes it possible to conclude that Prague Castle has a unique collection of 18 high medieval fabrics from Asia obtained through archaeological excavations. The fabrics mostly correspond to contemporary classifications of Asian textiles (Fircks 2008, 78-87; Fircks & Schorta 2016; Kuhn & Zhao Feng 2012; Wardwell 1988-1989, 95-173). Three similar and technically extraordinary fabrics feature Chinese dragons and clouds (n8), birds (n9) and tendrils, phoenixes and peacocks (n16).

Four fabrics from the tomb of St Wenceslaus mostly dated to the 14th century, which corresponds to the construction modifications of the tomb carried out at that time, during which the textiles were probably added to the remains. The fabrics from the royal crypt are mostly dated to the first half of the 14th century, although the first burials here began around the middle of the 14th century. Therefore, older fabrics were mostly used for funeral robes. The assemblage of textiles from the coffin of Charles IV, who died in 1378, is especially interesting in this regard (n6, n10, n11). In contrast, contemporary fabrics were used in the funerary apparel of Rudolf I of Habsburg (n8, n9), who died in 1306 but was not transferred to the royal crypt until the 20th century.

As silk textiles were not produced in the kingdom of Bohemia in the Middle Ages, they are all imports. They were bought mainly through specialised markets and some probably came from the dowries of Bohemian queens of foreign origin, or were gifts. The wealth of the Czech dominions since the second half of the 13th century derived mainly from silver mining in Jihlava, Havlíčkův Brod and, later, Kutná Hora. Initially, this silver was exported as a raw material, from about 1300 in the form of coins - Prague groschen. In return, goods flowed into Bohemia and Moravia that were not produced there, including silk textiles. In the last third of the 13th century, direct contacts were maintained with merchant houses in Florence, Venice and Genoa, and some Italian merchants remained in Prague; in addition, Prague merchants settled in Venice and bought goods directly in the city. In northern Italy, both locally produced and Asian textiles were available. In the Czech dominions, the main market for luxury textiles was in Prague; warehouses were established in the capital city and the goods were distributed to other towns and areas. Fees were paid on all transactions relating to sales. In the Luxembourg period (after 1310), this revenue gradually provided a significant source of income, as the wealth resulting from the ownership of natural resources slowly diminished (Jacoby 2016; Musílek 2012; Zaoral 2006). There was thus a surplus of funds at the Luxembourg court, which could also be invested in the purchase of a stock of luxury textiles, which were then used for ceremonial occasions.

The presence of fabrics of Asian provenance in the milieu of the Bohemian elite is also documented in other sources, for example, they are recorded in medieval inventories of the treasury of St Vitus Cathedral (for example, Bravermanová & Plátková 2016; Wetter 2016) and they are depicted in panel paintings by one of the most important Czech medieval painters, Master Theodoric (Bravermanová 2003).

In addition, imported Asian fabrics have been identified in the collection of archaeological textiles for the earlier period from the 10th to the 13th century: a samite with an eagle from the grave of Boleslaus II (Bravermanová 2001), a proto-lampas fabric from the reliquary grave of St Ludmila (Bravermanová & Otavská 2001), a samite with a braid, palmettes, a pearl roundel and animals from the grave of St Wenceslaus (Bravermanová, Březinová & Bureš Víchová 2020), and textiles from the graves of the Prague bishops (Bravermanová & Březinová 2013; Bravermanová, Foltýn & Sliwka 2010).
This assemblage of archaeological fabrics of Asian and Middle Eastern provenance related to Prague Castle, the seat of Bohemian monarchs and church dignitaries, is unique; such textiles are not found anywhere else in the Czech Republic, with the lone exception of several fragments of Chinese damask from the medieval waste dump in the centre of Prague (Březinová et al. 2016, 134-138).

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Sylvie Odstrčilová

Pious vanity:
Two pairs of 18th century abbesses' knitted gloves

Abstract
Two pairs of silk knitted gloves from the graves of abbesses of St George's convent in Prague Castle, Czech Republic, were compared. Both pairs are decorated with similar knitted-in patterns in metallic yarn, but they differ significantly in the knitting methods used and the skills of their creators. The gloves of Abbess Isidora Konstancie Roudnická (died 1731) were shaped by irregular increases and decreases using various methods and uneven yarn tension which resulted in a variety of loop sizes. In contrast, the gloves of Abbess Aloisie Theresie von Widmann (died 1735) were shaped only with right decreases and left raised increases placed in neat lines producing knitted fabric which is dense and even. The most interesting features of the gloves are the slits in the thumbs and the first two fingers of Abbess Isidora's gloves.

Keywords: knitting, religious, gloves, 18th century

Introduction
St George's convent in Prague Castle (founded in 973 or 976) was the first convent established in the territory of the present-day Czech Republic. It even predates the oldest monastery in the country by 20 years. Since its beginning, this convent of Benedictine nuns was closely connected to the oldest Czech ruling dynasty, the Přemyslids. Mlada, daughter of Prince Boleslav I, travelled to Rome to obtain permission to establish this convent from the pope, and she became its first abbess. During the next three and a half centuries, the convent was the place where the young Přemyslid daughters were educated (together with the daughters of other noble families) and two more princesses of the Přemyslid blood became its abbesses.
Even after the end of the Přemyslid dynasty, the convent maintained its prestige and importance. Documentary evidence confirms that at least from the 15th century, St George's abbesses were elevated to the rank of princess, and for official ceremonies wore crowns over their veils. According to the coronation rules written in the 14th century, the abbess of St George's convent accompanied the queen of Bohemia during the coronation ceremony. In later centuries, the abbesses assisted the archbishops during the queens' coronations and Abbess Isidora (whose gloves are discussed in this paper) put the crown on a queen's head herself (Pacovský 2016).
Until the convent's abolition by Emperor Joseph II in 1782, the nuns and abbesses were buried in St George's basilica and cloisters. More than 120 graves were discovered during the archaeological work between 1959 and 1963 (Borkovský 1975). Due to limited space, some graves were located one above another or their contents were moved to another location. For these reasons, most of the medieval graves were damaged and very little of their contents was preserved. Nevertheless, a varied collection of objects was recovered from the graves from the 16th to 18th centuries, especially from the graves of abbesses, which contained crowns and crosiers (wooden copies of the insignia of their office), rings, pectoral crosses,

Fig. 1: Abbess Isidora's gloves: a) overall view, palm; b) back of the left glove (Image: Sylvie Odstrčilová, © Prague Castle Administration)

rosaries and clothes in various states of preservation (Bravermanová 2005). Since excavation and basic treatment, many of these objects are still waiting for conservation and research.

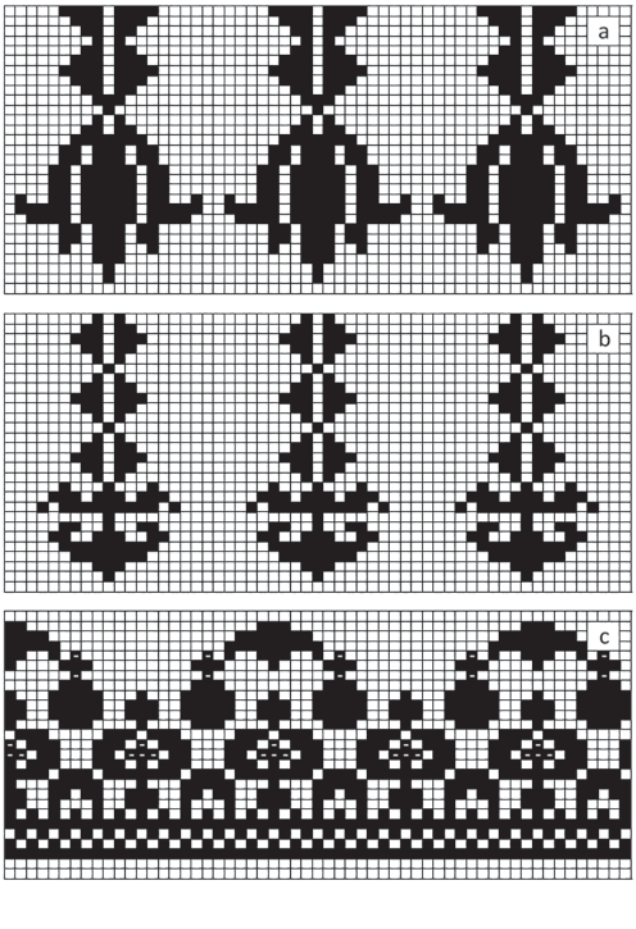
This paper deals with two previously unpublished pairs of knitted gloves found in the graves of Abbess Isidora Konstancie Roudnická z Březnice (1671?-1731, in office from 1722), and her successor Aloisie Theresie von Widmann (1677?-1735). Besides providing information about knitting in the 18th century, the gloves also offer a rare glimpse of life inside the convent walls.

Both pairs of gloves are kept in Prague Castle's collection. The gloves of Abbess Isidora (fig. 1) are on display in the permanent exhibition *The Story of Prague Castle* and were therefore available for examination only during a brief period when annual cleaning and control work required the display case to be opened. Most of the research on them was based on high resolution photographs taken during access to the gloves. Those of Abbess Aloisie (fig. 2) are not on display and were repeatedly studied by naked eye, under a USB-microscope, and in high resolution photographs. The research followed the protocol and terminology suggested by Malcolm-Davies et al. (2018).

Description of the gloves

The two pairs of gloves share some common features. The gloves are about 40 cm long (elbow-length). Their original colours are unknown; the current colour is "archaeological brown" (Ringgaard and Scharff 2010). Both pairs were knitted from silk in a very fine gauge (Abbess Isidora's gloves have 90 wales and 130 courses per 10 cm; Abbess Aloisie's gloves have 100 wales and 150 courses per 10 cm) and are decorated with knitted-in patterns in metallic thread. The patterns in both pairs comprise three floral ornaments on the

Fig. 2: Abbess Aloisie's gloves: a) overall view, palm; b) back of the left glove (Image: Sylvie Odstrčilová, © Prague Castle Administration)



backs of the hands (fig. 3a and fig. 3b) from which run two lines of small triangles (parallel in Aloisie's gloves and slightly diverging in Isidora's gloves) to the tips of the fingers, with similar ornamentation below the thumb from which run two diverging lines of triangles along the under-thumb gusset to the tip of the thumb. Another double line of triangles (reduced to a single line of lozenges by the omission of the space between both lines in Isidora's gloves) runs from the bottom edge of the gloves to the tip of the little finger. The metallic thread in these patterns consists of a strip of metal wound around a silk core of a slightly different colour than the silk in the main parts of the gloves. Two of these metallic threads were held together as they were knitted.

Gloves of Isidora Konstancie Roudnická z Březnice (inventory number PHA 39/10)
The main silk yarn consists of two parallel yarns, each of which is 2-ply with an S-twist. The spin direction of

Fig. 3: Knitted patterns: a) on the back of Abbess Isidora's gloves; b) on the back of Abbess Aloisie's gloves; c) along the bottom edge of Abbess Aloisie's gloves. (Image: Sylvie Odstrčilová)

Fig. 4: Openings in Abbess Isidora's gloves (Image: Sylvie Odstrčilová, © Prague Castle Administration)

the singles was not identifiable. Noticeable features of these gloves are the openings on the palm sides of the thumb and the first two fingers of both gloves (fig. 4). The bottom edge of the left glove has the spiral effect typical of a half-hitch cast on (Hiatt Hemmonds 2012, 44), whereas the bottom edge of the right glove is formed by the chain of loops usually associated with casting off. Next to the bottom edge, there are four bands of reverse loops. They are five to six courses in depth and are separated by two courses of face loops. The outermost reverse-loop courses of each band as well as the face-loop courses between them were knitted in the main silk yarn. The other reverse-loop courses were knitted in metallic yarn. Apart from these bands, the gloves are in simple knit.

The shaping of the gloves was achieved by irregularly placed decreases and increases (fig. 5). In contrast to the majority of recorded extant knitted objects from the Early Modern era, most of the decreases lean to the left. Right-leaning decreases occur only in some of the fingers. Three types of increases are observable, although in some cases, the type of increase could not

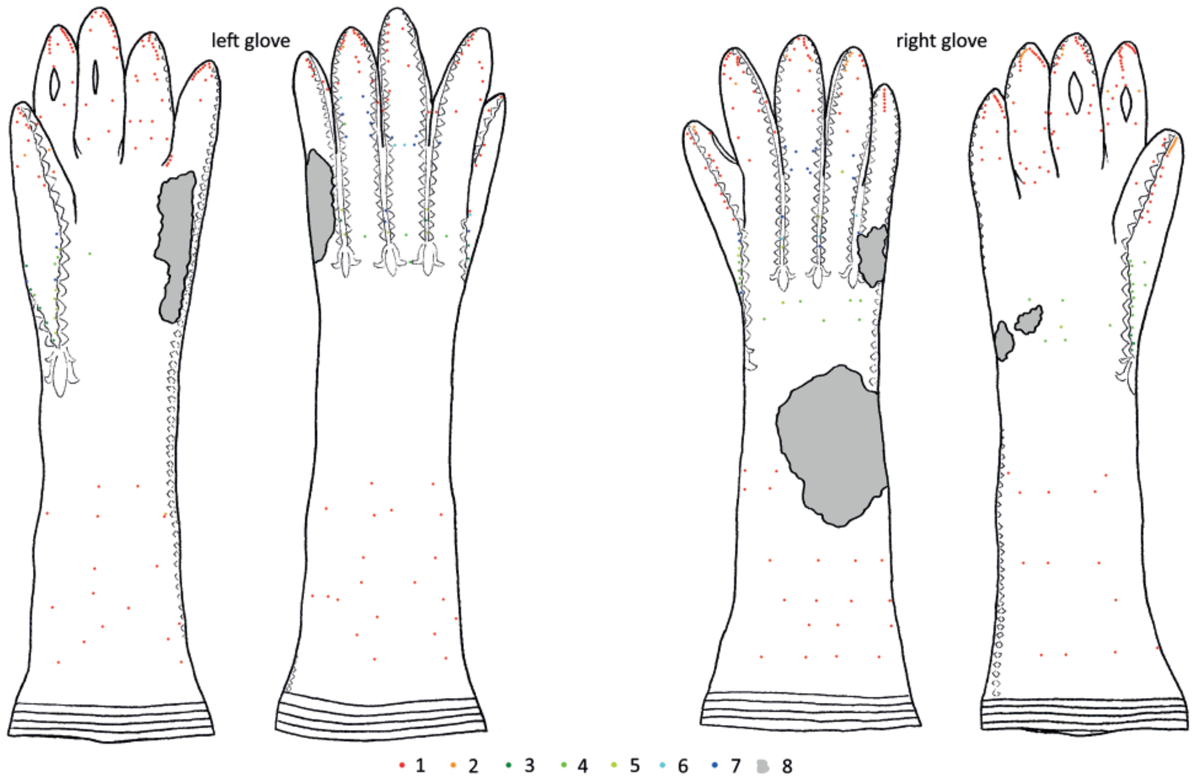


Fig. 5: Schema of shaping in Abbess Isidora's gloves: 1) left decrease; 2) right decrease; 3) raised increase; 4) running thread increase; 5) probably running thread increase (details unrecognisable); 6) split yarn increase; 7) increase in unrecognisable method; 8 = destroyed area (Image: Sylvie Odstrčilová)

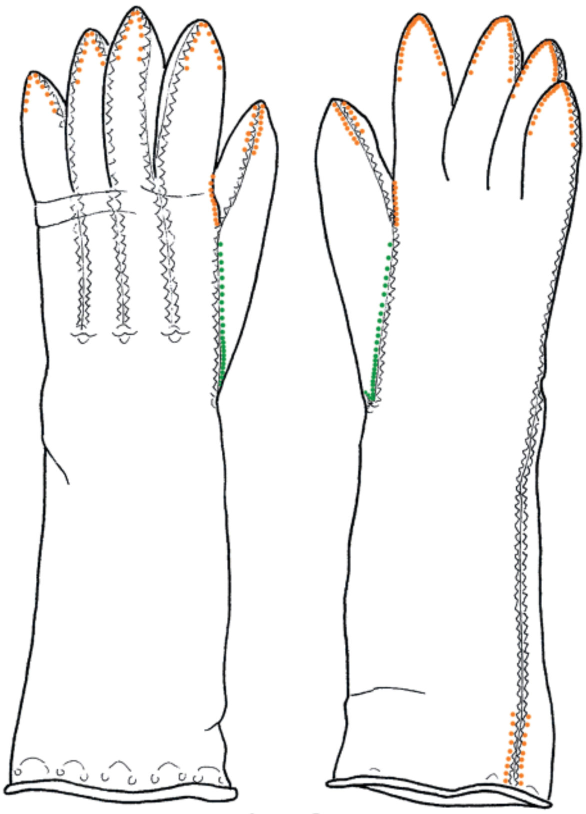


Fig. 6: Schema of shaping of Abbess Aloisie's gloves: 1) right decrease; 2) raised increase (Image: Sylvie Odstrčilová)

be determined. Left-twisted running thread increases (Hemmons Hiatt 2012, 211) are located most frequently in the middle of the simple knit silk fabric. To the left of each of the columnar metallic patterns, new loops were added between the existing loops, but it is not possible to distinguish whether they were achieved with running thread increases or another type of increase. On the right side of the columnar metallic patterns, left raised increases (Hemmons Hiatt 2012, 209) were used. Occasionally, a non-standard increase occurred, in which each of two yarns forming one loop was knitted separately, resulting in two loops in the next course. Distribution of these increases in relation to other types of increases shows that sometimes this was done deliberately and sometimes this may have happened by mistake, as suggested by a decrease in the course immediately above one of these split yarn increases.

Gloves of Aloisie Theresie von Widmann (inventory number PHA 52/01)

The main yarn consists of several parallel S-spun strands of silk (fig. 7c). In addition to the knitted-in patterns similar to those in Abbess Isidora's gloves, there is a knitted-in pattern along the bottom edge (fig. 3c and fig. 7d). Except for a few reverse loops incorporated into this pattern, the gloves are in simple knit.

They are shaped less obviously than Abbess Isidora's gloves, and mostly by decreases. Increases occur only in the thumb gussets. All increases and decreases form lines, usually along the borders of the metallic patterns (fig. 6 and fig. 8b). All the shaping was achieved by right decreases and left raised increases.

Fig. 7: Comparison of bottom edges: a) cast-on edge of Isidora's left glove; b) cast-off edge of Abbess Isidora's right glove; c & d) rolled edge and patterned band of Abbess Aloisie's gloves (Image: Sylvie Odstrčilová, © Prague Castle Administration)

Fig. 8: Comparison of increases in thumb gussets: a) various types of increases in irregular intervals in Abbess Isidora's gloves; b) neat row of raised increases in Abbess Aloisie's gloves (Image: Sylvie Odstrčilová, © Prague Castle Administration)

Interpretation

The absence of seams and the orientation of the loops in the patterns show that Abbess Aloisie's gloves were knitted round from the bottom edge to the fingers. The same can be said about most of Abbess Isidora's gloves, with the exception of the areas around the slits (fig. 4) and the bottom part of the right glove (fig. 7b). Slits in the fingers and thumbs were created by switching from knitting round to knitting back and forth, and then again to knitting round. The different heights of alternate courses suggest that the knitter probably had problems keeping the same tension of yarn when knitting and purling. Even though a chain of loops can also be created with a chained cast on (Hiatt Hemmonds 2012, 68), split yarns and other irregularities in the loops all around the circumference of the right glove just above the reverse-loop bands suggest that the raw loops were picked up here and the bands were knitted in the opposite direction to the main part of the glove. Abbess Isidora's gloves differ slightly in their length. Maybe they originally differed even more and removing the bottom part of the right glove and re-knitting the bands was an attempt to correct this difference or later damage of the right bottom band was repaired in this way.

Four wales of loose loops, regularly distributed along the circumference in the lower arm section of Abbess Isidora's gloves, provide evidence that five knitting needles were used (four needles to hold the knitwork and one for working), and that the loops were not slipped from one needle to the next to reduce the effect of inadequate yarn tension at the transition between needles, as observed in some knitted baby jackets from the same period, where these slack loops form spirals (Gilbert 2009).

Although the decreases in Abbess Isidora's gloves appear to be placed irregularly at first glance, more detailed scrutiny reveals some regularities. In the left glove, there are four decreases per round in the lower arm area, one per needle, and they are mostly placed in similar positions in relation to individual needles. In the right glove, there seems to have been an intention to place eight decreases in each decrease round (two per needle) but sometimes the decreases were omitted in the second half of the round. As mentioned above, most of the decreases in Abbess Isidora's gloves are left-leaning decreases. The right-leaning decreases, usually interpreted as "knitting two stitches (loops) together" occur only in two fingertips of Isidora's right glove, where they are symmetrically paired with the left-leaning decreases. Beside them, several right-leaning decreases occur on both sides of the slits. Given their exclusive position in the back-and-forth-knitted sections of the gloves, and the fact that there is usually more than one in the same course, with no left-leaning decrease in the same course, they were probably created by purling two loops together in the reverse course instead of knitting.

The dense and even fabric of Abbess Aloisie's gloves and the consistency in the increases and decreases suggest they were the work of an experienced and competent knitter. In comparison, irregularities in Abbess Isidora's gloves suggest the work of less competent knitters. The different distributions of decreases in the lower arm areas and of increases in the wrist areas, paired decreases in only one thumb and one finger, and sections of looser and tighter knitting suggest that these gloves could have been the collective work of several knitters. However, the consistent use of left-leaning increases suggests some similarities in the knitters' technique.

Discussion

Slits in the fingers are unusual but not unique. Three pairs of gloves from the Glove Collection Trust at the Fashion Museum in Bath have them too (inventory numbers 23400+A, 23401+A and 23419+A). Gloves 23419+A have vertical slits in their thumbs and index fingers. The other two pairs have slits (vertical in gloves 23400+A and horizontal in gloves 23401+A) in the first two fingers in both gloves and in one thumb. The other thumb was left open. It has been suggested that the slits were possibly for anointing with holy oil or water. However, this explanation is probable only for the gloves with missing thumb tips. In the gloves which have only slits below the tips, it would be quite difficult to wet the skin without staining the gloves. It is more likely that the openings provided better sensory interaction with the beads of a rosary. The rosaries found in the graves of St George's nuns and abbesses did not have beads for the *Ave Maria* and *Pater noster* prayers distinguished by spaces as in present-day rosaries; they were differentiated by shape. However, slits were not a necessity in the gloves of abbesses, as demonstrated by the example of Abbess Aloisie's gloves. In fact, as only two pairs of the gloves were available for the examination, it is not possible to say what was the norm in this convent.

One part of the pattern along the bottom edge of Abbess Aloisie's gloves resembles a royal orb and another part can be interpreted as stylised crown. This prompted an investigation into a possible connection between the gloves and coronation ceremonies. Aloisie did not crown a queen but as the prioress of the convent in 1723, she accompanied Abbess Isidora to the coronation of Queen Elizabeth Christina. However, no description of the coronation ceremony mentions gloves. On the contrary, it was recorded that Abbess Isidora took the crown in her bare hands (Pacovský 2016).

No other fragments of knitted fabric, such as gloves or stockings, were found in any graves of other abbesses and nuns. Unfortunately, other well-preserved graves belong only to abbesses who did not participate in coronations. The graves of abbesses or nuns who attended coronations (except abbesses Isidora and Aloisie) were not located or were severely damaged with almost no textile fragments found in them. For these reasons, the question of the gloves' use for coronations remains unresolved.

The portraits of St George's abbesses from the 17th and 18th centuries show women in the traditional black habits of Benedictine nuns with diadems on their veiled heads and crosiers in their hands. None of the abbesses wears gloves, which suggests they were not part of their official attire. In contrast, the portraits of Anna Gertrude Hofner, abbess at Münsterlingen (after 1750) and Eufemia Szaniawska, abbess at Nieśwież (circa 1768) show them wearing gloves. These were the only two portraits (in addition to one 20th century photograph) of abbesses in gloves currently available for study. Most of the convent abbesses (as opposed to abbesses of *Frauenestifts* in secular clothing) were depicted without them. The gloves in the above-mentioned portraits with their wide gauntlets and medallions on the backs of their hands resemble the pontifical gloves of male prelates, whereas the gloves of the two St George's abbesses resemble fashionable women's gloves of the period. Their length corresponds well with the fashion for elbow-length sleeves on women's gowns in the 18th century but they would be inconvenient to wear with long-sleeved nuns' habits. Although the black Benedictine habits had wide sleeves, the portraits of St George's abbesses show the narrow cuffs of the undergarments worn with them.

Most of the nuns in St George's convent were noblewomen by birth and the abbesses were further elevated to the rank of princess. Even though the black robes found in graves were of a simple loose cut following the rules of Benedictine order, many of them were not of wool but of silk. In the grave of Abbess Isidora, fragments of high-heeled shoes were found, and, in the grave of another abbess, there were pieces of cloth brocaded with gold threads. On entering the convent, the women should have left the vanity of the outer world behind them, yet these luxurious silk gloves and other archaeological finds from their graves paint a very different picture.

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The Gällared Shroud:
a clandestine early 19th century foetal burial

Abstract
A tiny wooden box was accidentally discovered directly underneath the wooden floorboards of the 19th-century rural parish church in Gällared, Sweden during restoration building works carried out in 2015. Upon closer examination, it was revealed that the simple wooden box was a coffin containing the naturally mummified skeletal remains of a first-trimester foetus wrapped in a cotton burial shroud. This paper describes the coffin and its contents, focusing on the well-preserved burial shroud that contributed significantly to the preservation of the foetal remains. The study of the shroud provides insight into the information such textile finds can contribute both to elucidating the history and evolution of the burial itself and to furthering the understanding of deliberate concealment of foetal remains within and around churches, and of infant death and grief.

Keywords: burial shroud, material culture, natural mummification, burial rituals, foetal death, dermestid beetles, Gällared, Sweden

Introduction
During the winter of 2015, restoration building works were carried out in the 19th century parish church in the rural village of Gällared located in the county of Halland in southwest Sweden. When the wooden floor in the southwest part of the nave was removed, the construction workers discovered a small wooden box underneath the floorboards (Tegnhed, 2016, 8-9). It was not known to them at the time that the box could be a clandestine burial. When recovered, the box was intact and sealed (fig. 1a). Assuming it was empty, the workers removed the lid, which proved easy because the nails had rusted through. Inside the box was a piece of folded cloth, which, upon closer examination later, revealed to be wrapped around and stuck to small pieces of what were suspected to be skeletal remains (fig. 1b). It became clear that the box was a coffin and the textile a burial shroud. This led to a systematic study of the box and its contents, and of the cultural practices relating to pre-term and unbaptised individuals that prevailed at the time of the interment. The excellent preservation enabled detailed observation of features and presented the opportunity to gain insight into the factors that contributed to this, especially the burial shroud. The aim of this article is to present this analysis, focusing on the burial shroud and place the find in a broader physical and social context. In this article, the medical definition of a foetus as an stillborn baby from the eighth week after fertilisation until birth is used. Foetal age (also known as fertilisation age, conceptional age and embryonic age) is used unless otherwise specified. This the actual age of the foetus calculated from the day of conception whereas gestational age is the common term and is determined from the first day of the last normal menstrual period.

The village of Gällared – population 393 in 2018 (Statistics Sweden) – is situated in an ancient cultural and cultivation landscape in rural southwest Sweden in the county of Halland. Its rural parish church is located on a gently sloping hill on the northern outskirts. There has been a parish church on the

Fig. 1: The Gällared wooden coffin (10.7 x 6.8 x 5.3 cm) containing the wrapped foetal remains. Fig. 1a. The lidded coffin. Fig. 1b. The open coffin with textile burial shroud (Images: Uno Andersson, Kulturmiljö Halland)

site of the current church since at least 1100 to 1350 (Nilsson 2002, 24; 2009, 358) although its exact dating is uncertain. It is constructed of white-plastered local graystone with a wooden shingle roof. Originally a rectangular longhouse, it underwent remodelling through the centuries, including the addition of a stand-alone wooden bell tower. The present building dates from its enlargement and the addition of an integrated bell tower at its west end in 1856 (fig. 2) (Karlsson 1982, 54). The church has no crypt, and there has been no custom of inhumations in the church (Uno Andersson, pers. com. 22 May 2020). The church has several medieval works of art of note, including a 13th century stone baptismal font of Gotland limestone, a 15th century polychrome wooden crucifix and Madonna in oak, and a late 15th century wooden figure of St Olaf.

By the end of the 1700s, Gällared's parish church had not only fallen into serious disrepair but was also considered insufficient for the village population (Karlsson 1982, 47 & 49). The wooden shingle roof was collapsing into the interior, lime plaster was delaminating from the interior stone walls and the mortar securing building stone was crumbling. A major building campaign was undertaken in 1831 to tear down, rebuild and extend the old church. The condition of the exterior walls was such that most of the church structure had to be demolished. The longhouse was extended in the east ending with the addition of a semi-circular sacristy. In the west end, thinner walls were erected atop broken down older, thicker, foundation walls. This was a period when Sweden was experiencing an economic downturn at the end of the 1820s and the beginning of the 1830s (Jonsson, 1994, 245-246). The population of the parish at that time was approximately 760 people (Larsson 1982, 85). The rebuilding began in May and except for three weeks of haymaking, the construction work proceeded into the autumn. The male parishioners were required to provide building materials (both quarried stone and wood) and to perform day labour, which is estimated to have been 3,000 days (Karlsson 1982, 51). The year 1831 was a hard year in the parish. The entire spring through autumn period was rainy. This delayed the spring sowing, damaged crops and caused a poor harvest. Additionally, a typhoid epidemic descended upon the parish. Together, these events delayed the rebuilding of the church, which was not completed until November (Karlsson 1982, 52). There is no doubt this building enterprise was a strain on both the economic and labour resources of the village.

Restoration building works within the church in 2015 were necessary to meet requirements for accessibility compliancy. During this work, it was discovered that the floor and floor beams in the western parts of the nave, especially on the north side, were rotten. In conjunction with replacing the floor, the contractor found it advisable to clear the crawl space under the floor and lower the ground level along the west walls of the church. It is these walls that were built atop the thicker medieval walls in the 1831 rebuilding. The well-ventilated crawl space was filled with building rubble (stone, masonry mortar and plaster) and fine

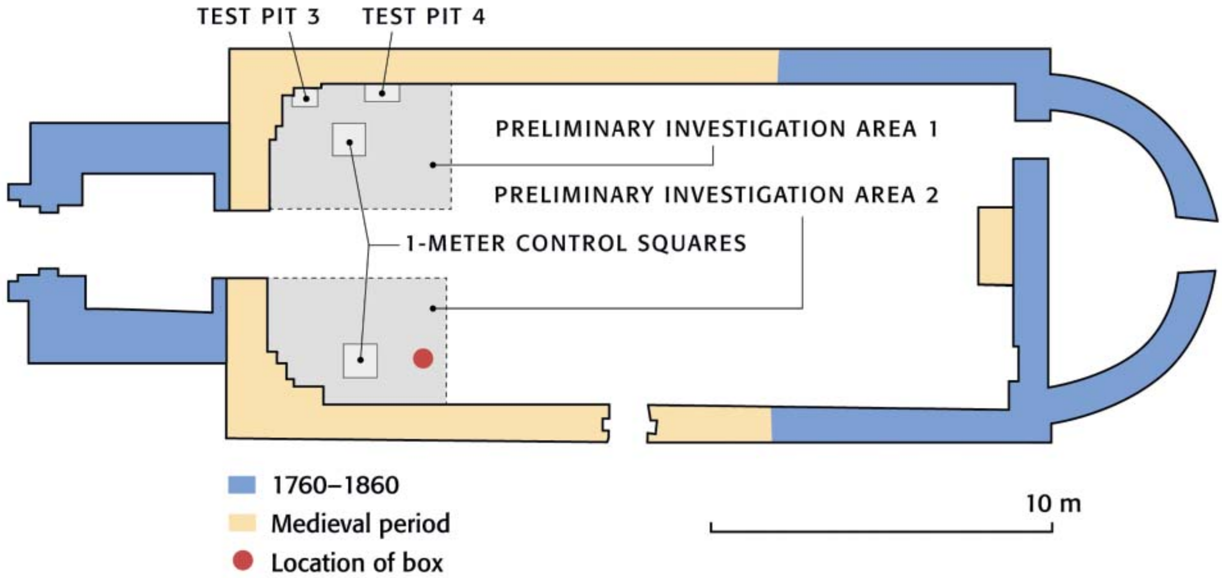

Fig. 2: Architectural plan of Gällared Parish Church, Sweden illustrating the remains of the medieval local graystone rectangular long-house, its rebuilding (1831) and bell tower addition (1856). The 2015 archaeological investigation and location of the coffin containing the foetus found underneath the floorboards are noted (Image: Uno Andersson, Kulturmiljö Halland)

sandy soil in addition to the thicker remaining stone walls of the medieval church. It was established that the older cultural layers and remaining construction elements of the medieval church preserved under the floor required an archaeological investigation to ensure that any structures or cultural layers relating to the medieval church were recorded. Several 1 m control squares and test pits were opened up and the area was investigated by Kulturmiljö Halland (fig. 2) (Tegnhed 2016). This was followed by a watching brief. It was during the removal of the floor that the builders discovered a small lidded wooden box sitting on building rubble directly underneath the floorboards. They reported that there were no gaps in the floor in the vicinity, and that the box was placed so far in under the floor that it most likely was concealed during the original laying of the floor in 1831 (Tegnhed 2016, 8-9).

The coffin and its contents

The simple wooden coffin is rectangular in shape. The coffin's exterior including lid measures 10.7 x 6.8 x 5.3 cm (l x h x w) and the interior is 8.2 x 4.5 x 3 cm. It is crudely constructed of six small dissimilar pieces of roughly sawn and planed pieces of pine (*Picea)* timber, with a mean thickness of 1.2 cm (fig. 1). The sides, corners and base are butt-joined together with wrought iron square-cut nails (Wells 1998), which have corroded, staining the surrounding areas rust brown. Additionally, the flat lid was fastened in place with nails. The use of adhesive to join the pieces of wood was not detected. No physical evidence of burial ritual was observed, such as exterior hardware or decoration (either painted or textile), or interior furnishings or burial goods. The edges of the individual pieces are neither precise nor square cut and vary from normal to rough and uneven. The lid and several side edges are roughly bevelled. Although the pieces are well-secured to one another, the overall shape of the coffin is skewed. The coffin is complete and was intact when discovered. It received no invasive interventive conservation treatment. The plank pieces are in good condition with no sign of past damp or insect activity either on interior or exterior faces. Exterior sides of the coffin are dusty and dark grey in colour. There is no evidence of water or soil staining on the coffin. The interior faces of the wood are a dusty, natural wood colour with no sign of staining.

Considering the coffin was constructed to house the Gällared foetus, its interior space was assessed to estimate the maximum size of foetus – in its natural crouched (sleep-like) position. The Gällared foetus prior to wrapping could not have exceeded a length of 6 to 7 cm. A foetus older than 10 to 11 foetal weeks – or late first trimester - would not have fit comfortably into the coffin (Napolitano et al. 2014, table 2).

The preserved skeletal remains were stuck to the inside face of the burial shroud in approximate anatomical arrangement adhering to the fabric with dried connective tissue. Their condition is indicative of natural mummification. They constitute 23 tiny bones, including ribs from both sides of the body (nine from the right and eight from the left), the left and right halves of the unfused mandible, the right humerus, an unidentified long bone and several pieces of paper-thin bone. These ossified skeletal parts exhibit an etched and fibrous surface morphology. The age at death of the foetus was estimated through assessment of times of appearance and fusion of major centres of ossification and the size, morphology and state of preservation of the skeletal elements in comparison with current data on embryonic and foetal development. It is estimated that the foetus died in foetal week nine.

The textile shroud is rectangular in shape (14.7 x 8.5 cm) with single-fold, turned-under edges on all sides and weighs 3 g (fig. 3a). The raw edges are straight and were scissor-cut prior to being turned under. The fabric is a regular diagonal 2/2 twill of medium quality in undyed cotton (*Gossypium*) with a thread count of 19 to 22 threads per cm in both the warp and weft directions. Its quality and use of the same yarn as both warp and weft points to it being handwoven and most likely the product of household textile production, which at that time produced the largest volume of cloth in Sweden, compared to the handicraft factories and mechanised factories (Schön 1980, 64-67; Nilsson & Schön 1978, 93-94). There are no selvedges on the textile. The Z-spun threads range in thickness from 0.25 to 0.9 mm with a light to medium twist. The single-fold, turned-under edges are 0.5 to 0.7 cm wide and were fastened with a whipstitch using linen thread (*L. usitatissimum*). These edges are no longer completely

Fig. 3: The Gällared burial shroud. Fig. 3a. The folded shroud. Fig. 3b. The unfolded shroud illustrating the stained area and embroidery on the inside face (Images: Anders Andersson, Kulturmiljö Halland)

fastened. They now have a scalloped contour from the stitching, and there are remnants of the thread in the stitch holes. There are two small circles coarsely embroidered next to one another on the fabric in the same sewing thread (fig. 4). Their nature could not be identified; however, it has been suggested that, considering the cloth was repurposed, these could be

Area of cloth	L*	a*	b*	Δ L*	Δ a*	Δ b*	Δ E*
Original (O)	79.50 ± 0.22	1.38 ± 0.12	12.13 ± 0.89				
Current (C)	73.65 ± 1.06	2.08 ± 0.22	15.23 ± 0.87	5.85 ↓ (O-C)	0.70 ↑ (O-C)	3.10 ↑ (O-C)	6.66
Staining (S)	67.24 ± 1.26	3.97 ± 0.30	18.56 ± 0.83	12.26 ↓ (O-S)	2.58 ↑ (O-S)	6.42 ↑ (O-S)	14.08

Table 1: Colour of burial shroud on the inside face. The colour of the inside face of the burial shroud in colour coordinates of the CIE L*a*b* colour coordinate system. The colour of the cloth was measured for pre-burial, original (under seams) = O, post-burial = C, and stained areas =S. Colour difference was calculated between original and post-burial (O-C) and original and stained areas (O-S). Symbols: L* = lightness-darkness scale; a* = red-green chromatic scale; b* = blue-yellow chromatic scale; Δ L* Δ a* and Δ b* = change in lightness and colour coordinates; and, Δ E* = total colour change. ↓ Δ L* darker; ↑ Δ a* increase in red; ↑ Δ b* increase in yellow. Following European Committee for Standardization CSN EN 15886 (2010).

laundry marks (Jane Malcolm-Davies, pers. com. 27 May 2020).

The interior face of the textile is stained along one half (fig. 3b). Colour measurement under a folded-over corner reveals the fabric was originally off-white (table 1). The current colour of the fabric is darker with a beige tone and with visual signs of light staining. The stained areas are darker with a brown-pinkish tone.

The textile is intact and in good condition. It is dry, soft and flexible, and can be handled without damage to the fabric. It received no invasive interventive conservation treatment. It has two non-creased folds edge-to-edge in the width direction. There are several weak areas where threads of the weave have been physically degraded but not broken through. There is no indication of active or recent biodeterioration by microorganisms or insects. However, there is some cotton-fibre frass under one of the folded-over long edges.

Fragmentary insect remains were found inside the coffin and scattered on the burial shroud. These were determined to be mostly parts of dermestid beetles at different life stages: a cast larval skin, a partial abdomen and a leg, plus the head of an ant (Rasmus Hovmöller, pers. com. 10 May 2016).

Fig. 4: Close-up of the embroidered area of the shroud (Image: Anders Andersson, Kulturmiljö Halland)

Discussion

The practice of burying foetuses within the church or walls of the consecrated graveyard surrounding the church was common in Scandinavia (Jonsson 2006, 84), and the custom dates to the Early Medieval period. Religion was a major structuring principle for beliefs and practices regarding burial during this period (Mytum 2004, 13). Medieval canon law dictated detailed directives for burial in consecrated church graveyards. Suicides, thieves, criminals, strangers, drowned bodies and unbaptised adults and children (including miscarriages, stillborns and newborns) were not entitled to burial in consecrated ground. With the denial of burial in consecrated soil, and the associated difficulties of the unbaptised children to find peace and come to the kingdom of heaven, alternative illicit burial customs developed for them (Jonsson 2006, 84; Hagberg 2015, 517-519). This included being secretly buried (with or without a coffin) in the bottom of a newly dug grave or placed together in the grave with the next adult burial (for example, Olsson 2003, 27); hidden in the coffin of an adult (for example, Ahlström et al. 2018, 16-17); or burial in a small container concealed within the church or graveyard wall. Burial directives that denied unbaptised children a Christian burial in consecrated ground led to fears surrounding the corpse and soul ranging from the unfortunate souls becoming restless spirits, such as so-called mylings in Scandinavia (for example, Hagberg 2015, 566-579; Kätterström Höök 2015, 15-16; Lindquist 1981, 7-12; Bø 1960), to abuse of their bodies by witches (Hausmair 2017, 2).

Gradually, from the late 16th century through to the late 18th century, a more tolerant attitude developed, and unbaptised newborns, followed by stillborns, were permitted burial in the church graveyard. The situation of small foetuses remained critical and, as a result, the custom of clandestine burial continued; although, it seems that this practice became limited to contained burial in small containers and cloth bundles and no longer earth-cut graveyard burial. Such burials constituted a transgression of official church regulations and were parents' attempt to achieve burial within consecrated ground and challenge their children's damnation.

The investigation of crypts is an expanding archaeological research area in Scandinavia (see, for example, Karsten and Manhag 2018; Ahlström Arcini 2016; Anthony 2016; Jonsson 2006). Meanwhile, archaeological investigations are often executed in association with restoration and construction work carried out in medieval churches and churches with medieval structures and cultural layers. The extent of these surveys usually varies with the scope of the construction activity. Traditionally, the mapping of the church building's architecture and construction details was the focus; however, there is increased emphasis on systematic collection and documentation of the many small finds that are recovered from such investigations, especially from underneath the floorboards. This includes small containers containing foetal burials.

Comparative material

Bø (1960, 99-152) undertook an extensive ethnographic study of the occurrence of clandestine historical foetal burials in Norway and Sweden. This practice ranged from the medieval period to the mid-20th century (Magnussen 2005, 58). In response to the 1953 survey Bø and Lid sent out to all parishes in Norway, one builder commented that he had found hundreds of small containers (Bø 1960, 134, 145). Bø recounts many churches in Norway and Sweden that provided accounts of such finds. Since the custom of burying foetuses in small boxes within the church or cemetery was well known, they were recognised as such when found and there was no reason to open and examine the contents. Consequently, there is scant comparative physical material. Another contributing factor to the scarcity is that archaeological investigation of crypts has been a limited research area in Scandinavia.

Only a few boxes and coffins have made their way into museum collections. There are three boxes in the collections of the Nordic Museum, Stockholm, Sweden (Kätterström Höök 2015, 16), inventory numbers NM.0285614+, NM.0285615+ and NM.0285616+. Furthermore, there is one in the collection of Jönköpings läns museum (Jönköping County Museum), Jönköping in Sweden (Londos 1995, 49-51); and eight in the collections of the University Museum of Bergen, Norway (Magnussen 2005, 54-57).

Many of the boxes in museum's collections do not contain skeletal remains. In those that do, the remains are wrapped in textile or newspaper. Only the skeletal remains in the coffin from Bringetofta Church in Jönköping Museum are reported as analysed (Londos 1995, 49). One of the wooden coffins in the Nordic Museum (inventory number NM.0285616+) and the coffin in Jönköping County Museum (Londos 1995, 48-49) are similar to the Gällared coffin in period (1700s to 1800s), size, shape, construction and lack of decoration with the exception that the wooden pieces are joined together with wooden plugs. The iron nails of the Gällared coffin place it in a later part of this period.

The burial containers range from small homemade boxes, to secondary use of various types of packaging such as cigar boxes, butter boxes, matchboxes, pieces of cloth and newspaper. The people of the community made use of the materials available. Containers are both undecorated and decorated, including some painted or carved with elaborate designs (Bø 1960, 150; Magnussen 2005, 55-57; Sellevold 2008, 7-9, 23). Most of the boxes are of such a nature that they could easily have been constructed by anybody; although, Bø (1960, 150) reported three centres in Norway for production of such boxes for sale. Whilst crudely constructed from scrap wood and undecorated, the Gällared coffin was specifically made for the foetus.

There is even less comparative textile material. Reports of box contents, when investigated, mention that the remains are packed or rolled in a piece of textile (Sellevold 2008, 18, 19, 23) or wrapped in a white cloth (Magnussen 2005, 55-57). The skeletal remains in the coffin recovered from Bringetofta Church were wrapped in a very worn and repaired linen children's shirt in tabby weave (Londos 1995, 50). Kätterström Höök (2015, 16) reports there are no skeletal remains in the coffins in the Nordic Museum but that one (NM.0285615+) contains flax and cotton fibres. One exception is a match-stick box in the Bergen University Museum collections that, in addition to containing a white cloth, was itself packed in a white cloth (Magnussen 2005, fig. 4; Østigård 2009, 19). Visual inspection of an image of the cloth (Østigård 2009, 19) suggests that the fabric is similar to the Gällared burial shroud in that it is a white, diagonal 2/2 twill of medium quality. The fibre could not be identified. Although a dearth of coffin textiles hampers further comparative technical study, the burial wrapping of the Bringetofta remains provides insight into the careful handling and attention to details the Gällared foetus was afforded. The Bringetofta wrapping was a repaired, fragmentary and very worn-out piece of child's clothing; whereas the white rectangular Gällared burial shroud was fashioned – probably by someone who was grieving the death of the child - with carefully hemmed, cut edges from a textile that was, judging from the embroidery, probably from re-purposed clothing or household linen but not worn-out, broken-down cloth. Comparative textile material has not come to light.

The environmental conditions surrounding the concealed Gällared coffin and its contents would have consisted of: low wintertime and cool summertime temperatures; low humidity; absence of weathering (for example, wind, rain, snow, ice, sunlight); exchange of air; and a dry, sandy soil ground with mixed building rubble, plaster and stones. The present configuration of the church sitting on a small rise would have contributed to favourable climate conditions in the crawl space. The surrounding environment over the almost 200-year history of the coffin's concealment was relatively stable and undisturbed as evidenced by the exterior and interior colour and condition of the coffin wood; the darkening and yellowing of the shroud fabric, which is in agreement with the natural oxidation (i.e., not resulting from burial) of cellulose-based plant fibres with age; and insect fauna that inhabit dry environments. The fresh pine wood, from which the coffin was constructed, produces turpenoids with significant antifungal and antimicrobial properties (Piombino-Mascali et al. 2014, 119) and this may have contributed to preservation in the initial burial phase as well.

During the early postmortem period of burial, the dry, aerated environment suggests that the Gällared foetus became naturally mummified by the principal mechanism of desiccation. This may not be apparent upon initial observation of the remains due to the absence of dried tissue. However, upon closer examination, the presence of minute fragments of dried tissue on and the adhesion of the skeletal parts to the burial shroud - as evidenced by the physically degraded areas in some threads of the weave are certainly indicative of mummification. Mummification of a deceased vertebrate can be seen as a competition between desiccation and decomposition (Micozzi 1986, 954). Decomposition in a cool, dry and well-aerated space would be expected to accelerate water loss by evaporation, both from the skin and the surrounding textile. Wrapping in a textile shroud will facilitate dissipation of any fluids leaking from the foetus (Aufderheide 2003, 303) and there were signs of liquid staining on the shroud.

Experimental forensic and bioanthropological studies carried out to investigate the effect of clothing and wrapping on the rate of human postmortem tissue desiccation concluded that the most important factor influencing the rate of postmortem body water loss is the environment at the skin surface and that clothing accelerates the desiccation rate (Aturaliya & Lukasewycz 1999, 893-896). Thus, the Gällared shroud in contact with the foetal skin surface, would have substantially enhanced the extent and rate of body water loss and soft tissue mummification in contrast to no wrapping. The shroud would have continually, effectively and rapidly removed water from the foetal skin surface hastening the desiccation of the soft tissue. The nine-week Gällared foetal corpse would have no gut flora to putrefy upon death (Burcham & Jordan 2017, 33-34). Its weight is estimated to have been approximately 20 to 25 g (extrapolated from Fazekas and Kósa's (1978) data set cited in Kósa 1989, table 2.1) of which 94% or 19 to 23 g (19 to 23 ml) would be water (Moulton 1923, table 1). The folds in the Gällared shroud bear evidence of double-folding, not tight winding, around the foetus. The staining is an indication that the textile was wrapped around something slightly damp, and that the foetal remains were not mummified when placed in the coffin. Remains in a saturated state would have discoloured the entire fabric and led to its biodegradation. It seems likely that the foetus was washed and dried prior to being wrapped. The specific area of staining along one side points to the foetus being in direct intimate contact with the shroud, and that the shroud was double-folded around the foetus with the short side parallel to the length of the body. The medium spin of the yarn and the medium weave of cloth created a porous textile. Together with the natural moisture-wicking properties of plant fibres, the burial shroud was well-suited to transport moisture, including body fluids, away from the foetal body. The loose wrapping will have facilitated the drying out of the soft tissue and brought about relatively widespread desiccation of the corpse (Bouquin et al. 2013, 14).

Furthermore, the wrapping of the foetus in the shroud restricted the scattering of the skeletal parts as the body decomposed, and thus led to those parts retaining the anatomically correct position of the foetal skeleton (Duday 2009, 45). This significantly aided the identification of the individual skeletal remains.

The foetal remains are predominantly skeletal; however, as previously noted, these were stuck to the fabric by dried-out connective tissue. That and the nature of the modified bone surface of the skeletal parts evidence a mummified state but one that has experienced insect attack. This is supported by the recovered insect fauna. Initially, the shroud would have protected the foetus from the access of insects once in the coffin. Once inside the shroud, however, the dermestid would have consumed the small amount of dried tissue of the mummy leaving the denser ossified skeletal parts.

The remains from dermestid beetles provide some clues about the environmental conditions experienced by the small coffin. In a forensic context, blow flies (*Ophyra sp.*) are among the first insects to visit a corpse and they prefer to feed on bodies before they become dried out. That there was no evidence of *Ophyra* in the tiny casket may indicate that they could not get access to the foetal remains or that it was interred during cold months (Turner-Walker & Scull 1997, 326). *Dermestidae* (skin beetles) feed on dead plant and animal remains, and in a forensic context are relatively late arrivals and feed on dried skin, tendons and bone. Electron microscope studies have demonstrated that the mouthparts of dermestids can modify the surfaces of bones causing grooves and a fibrous appearance (Fernández-Jalvo & Marín Monford 2008, fig. 3). They are typically small and would be able to infiltrate small cracks and crevices to gain access to the interior of the coffin. In the case of the Gällared foetus one might not expect a larger population of diverse insect species to be associated with such a small corpse.

Beyond exposing one specific event and in addition to the part they played in the postmortem preservation of the Gällared foetus, the simple coffin and burial shroud bear evidence of a complex material language heavily imbued with cultural meanings and values (Mui 2015, 154). The burial treatment of the foetus was not simply to accomplish the removal of its decaying remains. The foetus was handled with care and dignity after its death and was buried with attention to details. This was at a time not only when the village was beset with misfortune but also when miscarried individuals were not permitted similar burials to other members of society. Although crudely constructed from scrap wood, the lid and the edges of the small box used for the burial were finished. The piece of textile was fashioned into a burial shroud with carefully hemmed edges. It was carefully loosely wrapped around the foetus; it was not meaning-free and simply a piece of cloth wrapped around a corpse (Mui 2015, 150-151). Both were fashioned with care and specially made to house the foetal remains and witness an adherence to providing as decent and appropriate a burial as possible (Davidson 2016, 235; Douny & Harris 2014, 20). Neither was a haphazard solution whether improvised through resourcefulness or necessity.(Cannon & Cook 2015, 401). The formable textile wrapping protected the body and the stiff wooden coffin wrapping protected the wrapped body (Douny & Harris 2014, 15). The parents (mourners) made conscious decisions about the manner in which the deceased foetus was treated and arrangements for its emotionally motivated illicit internment in sacred ground under the newly laid floorboards of the parish church. This particular burial ritual represents an expression of strategy for coping with and managing loss, grief and transition.

Ethical considerations related to the raising, handling, study and exhibition of human remains from archaeological contexts have been and continue to be a much-debated issue (for example, World Archaeology Congress 1989; ICOM 2004; Jennbert 2004, 327-347; Tarlow 2006, 199-216; DeWitte 2015, 10-19). The dead should be treated with dignity and respect. This applies to the intimately associated textiles too (Peacock 2007, 12-16; Bakó 1998, 150-151; Janaway 1998, 17-18). The Gällared coffin was discovered by chance. The burial of early stage foetuses in boxes or other containers within churches or churchyard walls is no longer within living memory. Unknowingly, the Gällared box was opened up and the folded textile investigated before those on site realised that it contained human remains.

A less-structured part of the study of the Gällared find consisted of informal correspondence and conversations with practicing osteologists and several archaeologists representing universities, museums and forensic institutes in Scandinavia and the UK. Of the 19 respondents, many stated that they encountered graves with small children or foetuses in both cemeteries and inside churches. However, fewer than five were aware of the tradition of secretly burying small foetuses within churches or churchyard walls. This is of interest considering Bø's (1960, 99-152) survey in the mid-20th century found that this custom was well-known in rural areas at that time.

The remains of the Gällared foetus will be wrapped once again in their burial shroud and returned to their coffin, and then be reinterred in Gällared Parish Church under the floorboards where they were discovered (Uno Andersson, pers. com. 2019).

Conclusions

The Gällared coffin was a clandestine burial. There is no record or knowledge of a similar secret burial within Gällared Parish Church (Uno Andersson, pers. com. 20 April 2020). Based upon the find context, it is posited that the find dates to autumn 1831. The rebuilding of the church between the spring and autumn 1831 would have provided not only a convenient supply of fresh scrap wood for the coffin, but also a convenient place for concealment when the floor was laid inside the new church. This is in agreement with the few fragments of insects that point to burial during a cooler period. The Gällared coffin was constructed using iron nails, whereas recovered boxes of earlier date have wooden nails. The cotton fibre of the burial shroud also supports an early 19th century date. It was at the end of the 1700s that cotton began to make inroads into the Swedish market eventually overtaking linen as the primary textile industry (Schön 1979, 99-136).

Although there are many examples of almost full-term foetal or stillborn child burials recovered from archaeological contexts, early stage foetuses are so tiny and poorly ossified that the potential to recover them is low (Halcrow et al. 2018, 86). It is possible the first-trimester Gällared foetus is the youngest recovered from an archaeological context. The conditions conducive for preservation by natural mummification were exceptional: 1) an aerated 'crypt' instead of an earth-cut cemetery burial; 2) contained in a well-sealed wooden coffin placed in a stable cool environment; 3) the high water content and lack of gut bacteria of the foetal corpse; and, 4) wrapped in a highly absorbent textile burial shroud.

Beyond the textile material itself, archaeological textiles are diagnostic resources. They contain physical information not only in the form of technique, material and design, but also within patterns of wear and use, staining and alterations – evidence of creation, context and use (Lister 2002, 99-100; Brooks et al. 1996, 16-17; Cooke 1988, 28-29). In addition, there is the truly hidden evidence revealed by chemical analysis such as dyestuffs, age and protein preservation. The Gällared shroud was not only instrumental in but also bears witness to the preservation of a young early 19th century foetus in a church archaeology context.

Commonly, the importance of burial textile finds, in particular, lies in providing evidence of burial customs, funerary fashion and in understanding garments of the period (e.g., technique, fibre, dyes). Less attention is given to the fact that they preserve evidence of the history and evolution of burial itself (Duday 2009, 50-51) evidenced in staining, residue, folds, damage and loss (e.g., Glover 1990, 49-52). Similarly, excavated mortuary evidence has tended to be seen as a source for biological data with the cultural dimension often being overlooked (Mytum 2004, viii). Study of the Gällared skeletal remains, coffin and burial shroud taken together provide broader insight into understanding not only the deposition and postmortem history of this find but also its associated social and cultural life.

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Karina Grömer, Margarita Gleba, Mathieu Boudin & Hans Reschreiter

Linen twills from the Hallstatt salt mine re-dated

Introduction

As the field of textile research enters into a more mature stage, previously published textile finds require reassessment using updated scientific analytical methods. This is particularly important for the finds for which it is claimed they are 'the earliest' or 'unique' since their dating or identification determines how textile history is written. Several cases of such recent re-examination demonstrate that we cannot rely on old data and that 'first' or 'exceptional' finds must be revised.

As an example, the late 4th millennium BC find from a burial at Alişar Hüyük, Turkey, has previously been published as a twill but the latest investigation suggests it is a stretched tabby (Bender Jørgensen & Rast-Eicher 2016, 83-84). This is important, because this find has been used to claim early twill production in the Near East, although it is the only example of twill dating to the prehistoric period found in the region, which otherwise produced only balanced and weft-faced tabbies (Gleba 2017). The earliest twills are now those recovered from the Bronze Age salt mines of Hallstatt in Austria (Grömer et al. 2013) and in roughly contemporaneous burials excavated in the Tarim Basin of China (Barber 1999) – both areas where twills are well attested in the subsequent periods.

The textiles from Ditfurt, Latdorf and Unterteuschental, regarded as among the earliest wool finds in Germany, have recently been reassessed (Hertel & Grömer 2019). Scanning electron microscope (SEM) analysis of the textiles from Latdorf and Ditfurt demonstrated that they are made in plant fibres rather than wool and thus are no longer relevant for the prehistory of wool in Central Europe. Radiocarbon dating of textiles from Unterteuschental placed one fragment in the Middle Bronze Age while the 'iconic' blended weave, the fabric with wool in one thread system and flax in the other (Textile No HK:5882,1) turned out to be modern. The SEM analysis of fibres from North Cairn Farm in Scotland, originally published as a Bronze Age apron made of hair moss, demonstrated the fibres are silk, and therefore highly unlikely to be Bronze Age (Harris & Gleba 2015). All other old finds of presumed hair moss textiles across the British Isles should be reassessed considering this result.

Lise Bender Jørgensen (2013) has traced the origins of early prehistoric silks in Europe, demonstrating that none can be substantiated as silks: most of the identifications relied on impressions and wishful thinking rather than scientific evidence.

In all these cases, careful track of the find history, new scientific analyses, and deep knowledge of textile (pre)history have been of utmost importance in reassessing these old finds and correcting data in the archaeological literature.

Here, we present a re-assessment of two linen 2/1 twill fragments from the early excavations of Hallstatt in Austria, which were for a long time assumed to date to the Bronze Age.

HallTex 26 and 27: find context and research history

The salt mine at Hallstatt in Austria is an important source of prehistoric textiles in Central Europe. More than 750 individual textile fragments (belonging to about 350 larger textile complexes) have been found in the different parts of the salt mine, dated to the Bronze and Iron Ages, roughly the timespan from 1400-400 BC. Few textiles from Hallstatt are directly dated using Radiocarbon dting (see van Strydonck & Grömer 2013). Most are dated using the archaeological context – the find spot in the mine. One of the Bronze Age find spots is the so-called Grünerwerk site. Various artefacts from this site have been dated using ^{14}C (Stadler 1999) and these dates have also been applied to the other artefacts found there.

The Grünerwerk site was opened as a brine production plant from 1895 to 1902, and was in operation from 1903 to 1944 in a zone of the mountain that also contained remains of prehistoric mining. Thus, many archaeological finds were collected by modern miners and local researchers, including a number of textile fragments. From 1985 on, archaeological excavations took place at the Grünerwerk site (Barth 1986). Together with the Christian-von-Tuschwerk site and the Appoldwerk site, the Grünerwerk belongs to the lower end of a huge Bronze Age shaft system reaching to a depth of up to 200 m below ground (Reschreiter & Kowarik 2019).

Hans-Jürgen Hundt was the first to describe and publish the two textiles HallTex 26 and 27 in detail as deriving from the Grünerwerk site (Hundt 1960, 129-130). He published them as 2/2 twills, with HallTex 26 having a thread count of 6/12 threads per cm. Both textiles have recently been re-assessed by Karina Grömer and Helga Rösel-Mautendorfer, updating the identification of seams and hems, and also changing the identification of the weave type (Grömer et al. 2013, 61, 251-252). Both textile fragments are in fact

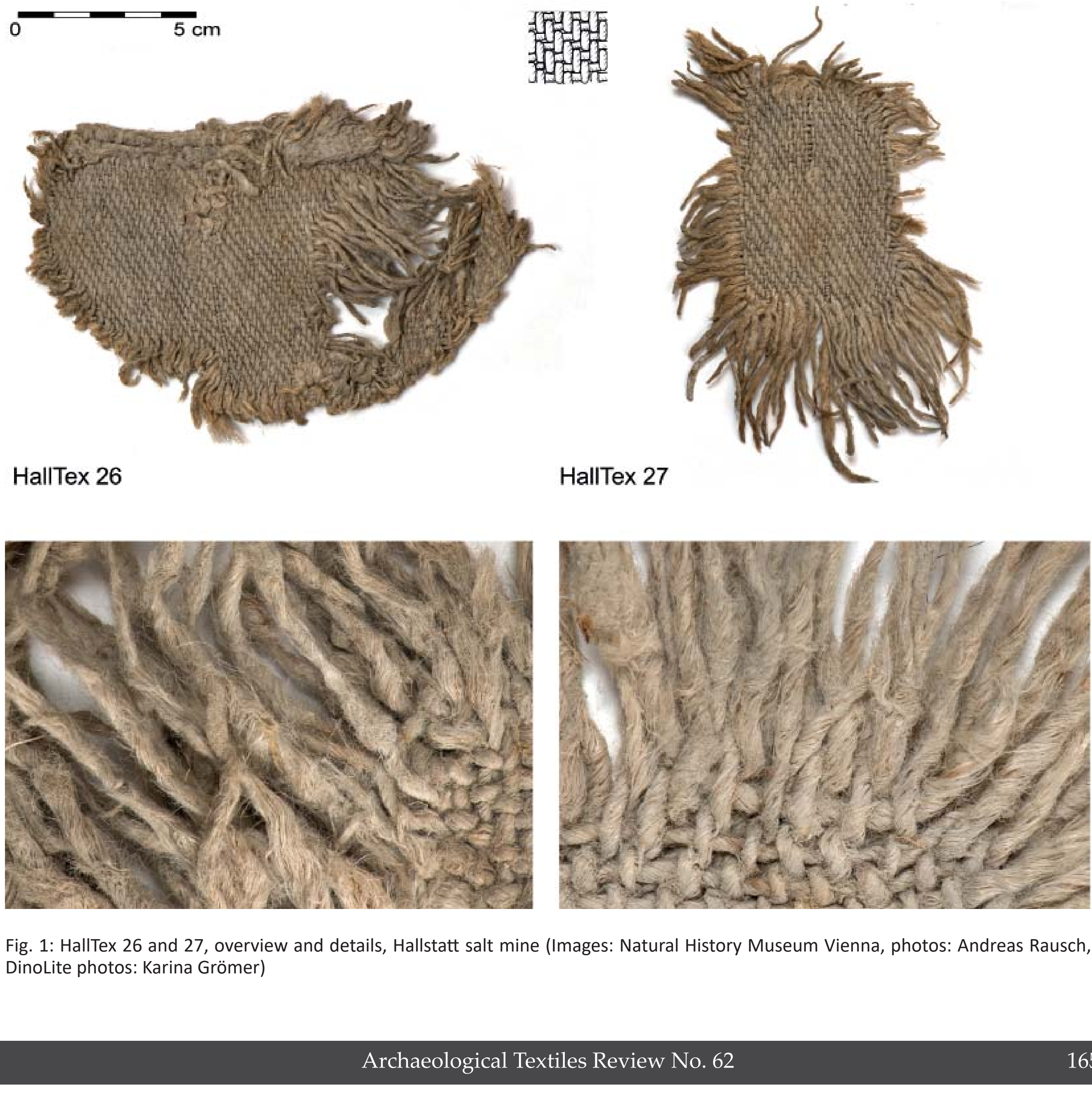

Fig. 1: HallTex 26 and 27, overview and details, Hallstatt salt mine (Images: Natural History Museum Vienna, photos: Andreas Rausch, DinoLite photos: Karina Grömer)

	HallTex 26		HallTex 27	
	system 1	system 2	system 1	system 2
single/plied	single	single	single	single
twist direction	z	z	z	z
twist angle	40-50°	40-50°	50-60°	30°
thread diam.	0.6-0.8	0.5-1	0.8-1	1.2
thread count	8	11	9	6-7
weave type	2/1 twill		2/1 twill	

Table 1: Technical characteristics of HallTex 26 and 27

made in dense 2/1 twill, using single z-spun yarn in both directions (fig. 1). The threads are medium-coarse with a diameter ranging between 0.5 and 1.2 mm. The thread counts vary between 6 and 11 threads per cm (Table 1). Both textiles are made of undyed flax (Linum usitatissimum), as noted already by early investigations in the 1960s (Hopf 1960). Since the two textiles are similar in their technical characteristics, they may have belonged to the same cloth.

Rast-Eicher et al. noted the well prepared and separated fibres of the textiles, arguing that this indicated a change in flax fibre processing as the material looks different in comparison to Late Neolithic and Early Bronze Age textiles in Central Europe (e.g. Leuzinger & Rast-Eicher 2011, 540 and fig. 3h; Bender Jørgensen and Rast-Eicher 2016, 71; Rast-Eicher & Dietrich 2015, 36).

Dating of textiles from Hallstatt

In the salt mine at Hallstatt, several hundreds of textile fragments have been found so far, most of them dated by context as is also done for archaeological textiles from other sites. The chronology and dating of the different parts of the salt mine at Hallstatt is based on a complex system of archaeological find spots, C^{14} (Stadler 1999) and dendrochronological dating. Some years ago, the first direct C^{14} dates were obtained for several textiles from the salt mine (van Strydonck & Grömer 2013). As it was not possible to date all of them (sometimes for reasons of preservation), two groups of textiles were selected for the dating: a) Bronze Age textiles with highly developed technical characteristics, and b) textiles from disturbed layers (*verlaugtes Heidengebirge*) of the Kilbwerk site, chosen to resolve problems of possible Baroque period intrusions in the mine. The research team was aware at the time that some textiles deriving from the Bronze Age contexts looked very advanced in terms of fibre type, dyeing and weave type (e.g. chevron twills in HallTex 211 and 275). Testing was therefore recommended since they appeared more appropriate to the Iron Age. Their C^{14} dating confirmed them to be Bronze Age. Doubts about the Bronze Age origins of the flax twills HallTex 26 and 27 arose later (Gleba & Harris 2018, 2340, 2343).

New questions arising

In 2016-2017, within the framework of the PROCON project (Gleba 2015), the discovery of numerous spliced bast (plant) fibre textiles from various sites across Mediterranean Europe dating to the early 1st millennium BC led to a review of the evidence for the use of splicing in prehistoric Europe (Gleba & Harris 2018). The survey demonstrated that practically all of the European Bronze Age textiles made of bast fibre were woven with plied and spliced thread. The only exceptions to this general trend are the two linen twills from Hallstatt, which are woven in single z-twisted thread, which is clearly spun. The well

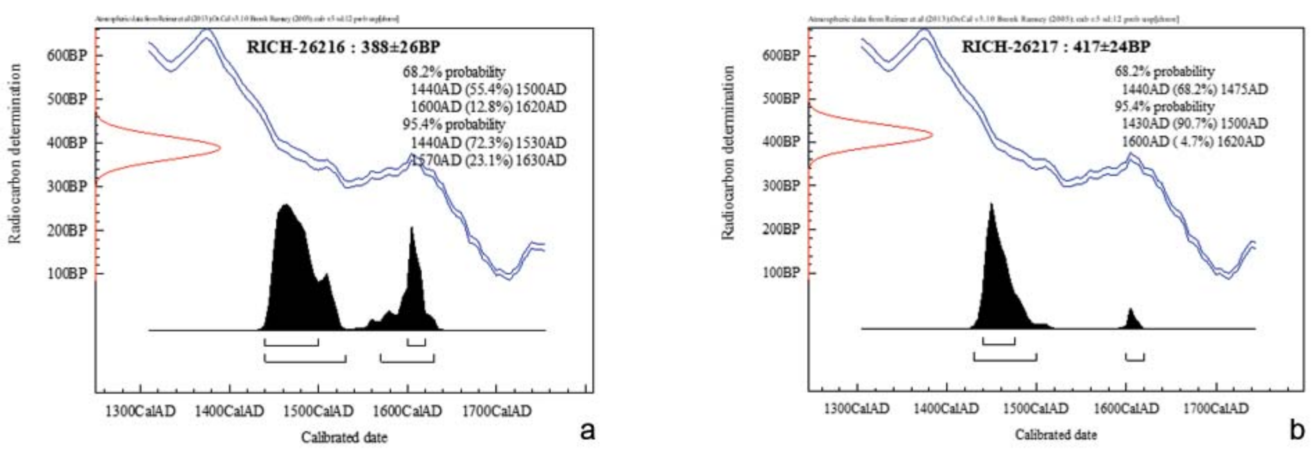

Fig. 2: Radiocarbon curves of a) HallTex 26 and b) HallTex 27 (Images: Mathieu Boudin)

Fig. 3: Linen twill from Lengberg Castle (FNr. 273.16), 15th century CE (Image: Beatrix Nutz)

separated fibres are atypical for the Bronze Age, with the vast majority of all other examples having spliced single yarns with intact fibre bundles and parallel nodes (Rast-Eicher & Dietrich 2015; Bender Jørgensen & Rast-Eicher 2016, 71; Gleba & Harris 2018).

The textiles are also unusual in terms of their structure for the Bronze Age, since all other known linen 2/1 twills in Europe date to the middle of the 1st millennium CE or later.

The exceptional features – for the Bronze Age – of the two linen twill textiles from Hallstatt and the fact that they did not come from the scientific excavations of the salt mine led to the decision to carry out C^{14} dating of both fragments.

HallTex 26 and 27: ^{14}C dating

Thread samples of about 1 cm were cut directly from the textiles. The two linen samples were pre-treated with the bleaching method to remove exogenous contaminants. Thereafter, the samples were transformed into graphite using the automatic graphitisation device AEG (Němec et al. 2010; Wacker et al. 2010). C^{14} concentrations were measured with accelerated mass spectrometry (AMS) at the Royal Institute for Cultural Heritage in Brussels, Belgium (Boudin et al. 2015). The results are presented in Figure 2. Both textiles date to either the 15th or the early 17th century CE and are therefore not Bronze Age but of Early Modern period.

Discussion

The two linen textiles on display at the local Hallstatt Museum. They are listed in the inventories as originating from the findspot Grünerwerk, found during modern salt mining activities and entering the museum in the 1930s.

The new C^{14} data presented here raise several questions about the origin of these textiles. The pieces are Early Modern, dating to about 1600 CE. As far as known, the Grünerwerk was not in operation before the early 20th century CE and therefore the textiles cannot derive from the construction or operation of this plant. The Grünerwerk is located in the Kaiser-Josef horizon of the salt mine Hallstatt, in which there are many archaeological and modern mining sites. However, since the Kaiser-Josef tunnel was not used until 1687, this area can be excluded as the origin of the textiles.

Nevertheless, it seems likely that the two Early Modern linen textiles were found somewhere in the Hallstatt salt mine and then ended up in the museum collection (albeit with wrong location of origin within the mine recorded). Where could textiles dating to the 15th or early 17th century have been found in the 1930s? At this time, mining work was still being carried out in a number of tunnels that had been used since the 1600s, e.g. Kaiser-Maximilian-Stollen site and Ferdinand-Stollen site. Do the two textile fragments come from these areas and were mistakenly thought to be prehistoric? Or did someone deliberately gave these pieces to Friedrich Morton, curator of Hallstatt Museum from 1925 to 1967 (Urstöger 2000, 677), with false information? These questions will probably never be resolved. Yet, it is all the more important that the new data is presented here.

Conclusion

Then new dating and reassessment of the possible find context of the two linen twills from Hallstatt has important implications for textile research as – up to now – these textiles have been counted among the oldest of their kind (e.g. Grömer 2012, 32; Grömer 2016, 135; Bender Jørgensen & Rast-Eicher 2016, 83). Although wool twills from the Christian-von-Tuschwerk site at Hallstatt indeed date to the Bronze Age and are the earliest in Europe, the linen twills must now be excluded from the list of prehistoric finds.

Instead, according to the C^{14} dates, they have to be placed in much later times. Such linen twill textiles are common from the end of the Medieval and beginning of the Early Modern period in Central Europe, as demonstrated by the artefacts from Austria, e.g. from Lengberg castle, 15th century CE (fig. 3; Nutz 2015, fig. 7; Nutz 2021) or Schloss Tirol, 17th century CE (Nutz & Tomedi 2015, 49-50). Comparable finds suggest both dates (15th or early 17th century CE) are possible as indicated by the peaks in fig. 2.

Although the results change our long-standing assumptions of early 2/1 linen twills made of spun (not spliced) flax in the Bronze Age, such corrections of our textile history are important.

Archaeological textiles are few and precious – it is our responsibility to give them their rightful place in human history using the best means available at any given time – and to correct the information when new data become available. As Lise Bender Jørgensen noted: "Documentation should be transparent and include exact provenance of samples and description of the methods applied, and results should be discussed and compared to those of other scholars, in a way that is understandable by the general archaeologist as well as relevant specialists" (Bender Jørgensen 2013, 587).

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Angharad Thomas & Lesley O'Connell Edwards

Holy hands: studies of knitted liturgical gloves

Introduction

The *Holy hands: studies of knitted liturgical gloves* project is funded by a Janet Arnold grant awarded by the Society of Antiquaries in early 2020. This report outlines the aims and objectives of the project, reports on the progress of the work and outlines plans for future action.

The project runs from April 2020 to March 2021. It is being undertaken by Angharad Thomas and Lesley O'Connell Edwards, independent scholars, both of whom have an active research interest in liturgical gloves. These gloves, sometimes referred to as ecclesiastical gloves, pontifical gloves, or bishop's gloves, were worn by high ranking clergy in the catholic church from the 10th century. They were initially constructed from woven fabric, leather or using looping techniques, but by the 12th century, they were often knitted. Initial research and information suggests that there is little material about these artefacts, and none that is organised in one location, despite the fact that they survive in a variety of collections and museums.

These cleverly crafted and often very beautiful symbols of high office were generally made in silk and frequently decorated with embroidery or lace in metallic thread. Online catalogues such as that of the Victoria & Albert Museum (V&A), London (UK) shows the sumptuous nature of some (V&A, inventory number 437&A-1892). As techniques developed, the patterns were worked into the knitted fabric (fig. 1). Examples of these gloves, such as William Warham's at New College, Oxford (UK), are preserved in collections, ecclesiastical treasuries and museums across Europe and in the United States. Extant gloves, paired, singly or in fragments, owe their continued existence to a variety of circumstance: some were found in burials with their owners, and many pairs were preserved in private collections from which they reached institutional holdings. Liturgical gloves are mentioned, in passing, in histories of knitting and clothing but a detailed and specific study of them in English does not exist, although they were clearly an important element of ecclesiastical dress and, as such, are worthy of attention.

The *Holy hands* project aims to build academic and practical foundations for a major study of knitted silk gloves worn by elite clergy in the Early Modern era from 1200 to 1700. There are four elements to the project as outlined in the grant application: a review of the literature on liturgical gloves in English and other European languages; the compilation of a database listing the known extant gloves and their principal features; the construction of a protocol for recording information when studying gloves; and the assembly of materials and tools for reconstructing elements of the gloves or a full glove (Davidson 2019). These elements were carefully planned with the objective of laying the foundation for a more extensive project in the future. This is a topic lacking in research and one which is worthy of in-depth study.

The methods of investigation proposed include desk research with some travel to libraries and institutions to read and see material not otherwise available. However, at the time of writing, the COVID-19 pandemic has limited this activity and it is hard to plan for future action as outlined in the project plan. However, there is much material online, both literature and artefacts, and progress is being made, as reported here.

The purpose of the literature review was to trace sources of information about liturgical gloves across a range of literature from academic journals and specialist costume publications to consumer or leisure magazines and books, both printed and online. These sources will be critically assessed and synthesised to make an informed summary of current knowledge and identify fields for further work. Initially, the project intended to use only English, French and German language sources of information, but initial research revealed recent literature on gloves which have only been written about in Dutch (de Kruijf 2009, 64, 71-72; Willemsen 2015), or in Spanish (see, for instance, Socorro 1995; Carbonell, 2007). The scope of the review will now be expanded to include other languages. Internet translation services such as Google Translate expand the availability of material to those researchers who do not speak the relevant language. References to liturgical gloves exist in academic works and mass market publications, occasionally included as curiosities, such as the illustrations in Nargi (2011, 19-20) but sometimes enabling researchers to discover gloves of which they were previously unaware, as was the case for two pairs in Portugal (Pomar 2020/2013, 13-14). Knitted liturgical gloves are only occasionally mentioned in material on liturgical vestments, and usually only as a passing reference.

There are two major published overviews of liturgical gloves: both were made well over 100 years ago in French and German: Barbier de Montault 1876-7 and Braun 1907. One or both of these are often mentioned by subsequent writers. Much of each concentrates on the whole history and rationale for all types of liturgical gloves, with knitted gloves occupying only a small number of pages (Barbier de Montault, 1876, 797-801, 1877, 8-15, 23-25; Braun 1907, 369-373). Two English language publications from the end of the 20th century provide general summaries of knitted liturgical gloves (Rutt 1987, 56-58; Turnau 1991, 16-18, 131-135), but these do not go into details of construction or use. The pictures in all these four publications are in black and white, and are of a poor quality. Further, Warr's (2019) article on gloves in liturgical ritual included a detailed study of the pair of gloves in the Whitworth Gallery in Manchester.

Fig. 1: Liturgical glove from the Glovers Company Collection , Fashion Museum, Bath (UK), accession number 2007.25 (Image: © Glove Collection Trust/Courtesy of The Worshipful Company of Glovers of London)

Individual studies of gloves are rare but they do exist. Some gloves have been the subject of several articles in varying depth, such as those of William Warham mentioned above (Coatsworth and Owen-Crocker 2018, 408-410). Odstrčilovǎ (2016) has studied the St Adalbert's glove in Prague (Czech Republic) in great detail, and Cardon (1993, 38-39) has examined those in Toulouse and Saint Bertrand de Comminges. Conservation reports or articles based on these can provide adequate details of the construction of a glove, such as those of Bishop Nikolaus Schiner and Archbishop Roderigo de Rada, conserved at the Abegg Foundation, Switzerland (Flury-Lemberg 1988, 66, 244-47, 468, 488). Other conservation reports may only exist as 'grey literature' within an institution. Any details of construction and the work carried out on a glove they record are not in the public domain.

The project has already noted that as knowledge about looped and knitted structures has improved since the mid-20th century so too has the understanding of liturgical gloves. Gloves previously thought to be knitted have now been identified as having been made using a different craft. An example of this is the gloves at St German-des-Pres (Barbier de Montault 1876, 797-800), which are now identified as a type of macramé (Beaulieu 1968, 148-149; Laget 1971). Some gloves which were previously reported have disappeared. This is the case with knitted stockings and gloves dated to the 14th century from a bishop's tomb in Fortrose (Scotland) (Stuart 1851). These were in private hands in the 1960s (Levey 1968-70, 186) but their current location is unknown.

The review also set out to consider the theological context for the gloves, and how this can assist an understanding of the construction of gloves. It has been suggested that gloves were always placed on bishops' hands by another person, and that might affect their shape (see, for instance, Warr 2019). However, very few medieval clerics wrote on liturgical gloves, and the comments of those who did, especially Durand in his *Rationale divinorum officiorum* (Thibodeau 2010), are occasionally quoted by modern writers.

Evidence as to why gloves have been dated to specific periods is minimal and rarely explained. Occasionally, there is a reasonable provenance, such as those of William Warham at New College (Ashton 1929, 39). The gloves in the Gertrudiskathedraal in Utrecht have been dated to the later 17th century through their embroidery (de Kruijf 2009, 64). As early as 1877, Barbier de Montault (1877, 12-15) suggested that a glove from a later period could be linked with a saint from an earlier period, as the former was used to embellish the latter. In such cases, the attribution to a specific saint did not mean that the glove was of the same era. The Greek Orthodox tradition continues this practice today - replacing an artefact of a saint as it is worn out by physical contact with believers (Carroll 2017, 194).

The bibliography below is not a complete list of all the sources that have been traced; there are other texts which are not included here. If anyone would like more information, please contact the authors for a more detailed list of sources. They also welcome information about other gloves and relevant publications.

An early observation made from the literature review is that little has been written about the construction of the gloves or about their ornamentation, and the project intends to identify these variations by examining the gloves, either in person or virtually. There are several versions of thumb construction, for example, ranging from a gusseted construction to a 'placeholder thumb' (Hemmons Hiatt 2012, 334), but no discussion as to why one style might be used in preference to another. The gauntlets of the gloves differ too – some are very wide, others much narrower, some are ornamented with embroidery or have a metal roundel on the back of the hand. There are others with knitted patterns in the gauntlets or the hands. It may be that a systematic classification of this patterning could identify groups of similar gloves, which in turn might help date them and also locate the place of production. Gloves are described as being of specific national workmanship but there is no literature explaining the rationale for this. The researchers are unaware of any literature on the knitters and merchants who produced and supplied these ornate gloves, although since it is suggested that many are Spanish or Italian, any papers on them may not be widely disseminated.

This lack of information on construction and patterning in the literature demonstrates the need for another aspect of this project: the study of these gloves as individual artefacts to expand our knowledge and develop our understanding of the anonymous knitters who constructed them and their methods of working.

Fig. 2: Reconstruction of patterning on the cuff of glove 2007.25 (see fig. 1) (Image: Courtesy of Lesley O'Connell Edwards)

The level of detail concerning the knitting varies from publication to publication, as does the quality of the photographs. Some photographs can be examined in detailed to identify modes of construction: for example, the exact patterns on a gauntlet cuff or the roundel on the back of a hand may be identified. Others are not of such good quality. When museums post pictures of their gloves on their websites, some can be expanded to make the patterning and construction very clear, whereas others start to blur once they are magnified.

The quality of available images is also of relevance to the second major component of the *Holy hands* project, which is a database. This aims to tabulate existing information about extant liturgical gloves in a systematic way. As was noted with respect to the literature survey, information about liturgical gloves does exist and they have been studied, but the material is spread between many published and online sources. The compilation of the database will bring together information about extant gloves, providing the opportunity to compare and contrast materials, construction and patterning across all of the known gloves.

Information for each glove, pair of gloves or fragment will be collated under a series of headings, of which there are currently 26, ranging from location, materials and colour, to notes about the existence of literature or images for each entry. This information should permit a classification of glove constructions and ornamentations and identify areas for further work. It is hoped that if common patterns are idenitifiable, possible sources for particular groups of gloves may be suggested. The database is being constructed using an Excel spreadsheet allowing further analysis of the entries. Links may be established between, for example, design features and country of origin by using pivot tables. The database and the recording protocol will conform to the standardised knitting vocabulary detailed in Malcolm-Davies et al. (2018).

Currently, the database has more than 60 entries, ranging from well documented gloves, such as those at the V&A Museum, to some referred to in old publications, the continued existence of which are uncertain. An important part of this documentation is the verification of the existence of a particular entry through a variety of direct and indirect contacts.

The third element of the *Holy hands* project, the protocol for standardising observations of gloves, has not yet begun (at the time of writing). However, it will include a list of features to be noted when examining gloves in collections and the order in which these are to be noted. Describing and recording a pair of gloves is complex and time consuming as there are several elements of their construction including cuff, thumb, fingers, shaping, and ornamentation. Pairs are not always matching, which creates a further complication. A template will be constructed to enable this recording to be done in a systematic way with the aid of diagrams on which measurements will be entered. This is currently being designed. When visits to collections are once more possible, both of the researchers will test the protocol with a sample in a collection accessible to them. After this, modifications will be made to it, as necessary.

The final part of the *Holy hands* project proposes the reconstruction of a glove or part of a glove to enable a deeper understanding of their making. Consideration will be given to the availability of yarns and tools in the period of their production and the tools and materials required for their production currently. Work on knitting articles similar to known examples is being undertaken by both the project's researchers (fig. 2). This aspect of the project aims to extend knowledge and understanding of liturgical gloves and their production, in particular, the change from non-woven fabric techniques, such as looping, to knitting. This is a development little studied or understood.

Although liturgical gloves are known to textile scholars and featured in books for hobby makers illustrated with examples preserved in many collections, little is known about their makers, their dates or provenance. Even less is known about the tools, construction methods and cultural context for their production, although the skill level required for this was high. No republished construction of a knitted liturgical glove is currently known to the authors. Such work could form the foundation for a larger project using citizen science methodology as adopted in both the Knitting in Early Modern Europe (KEME) project and the Textile Research Centre's Texel Stockings project (see internet sources below).

It is anticipated that the project will result in articles to be offered to both academic journals and non-specialist magazines with a wide readership, such as *Piecework*. It is hoped that the database will be published as an online resource, similar to that of the KEME project for knitted caps. It is also hoped that the project will form the basis for further work on these fascinating and understudied textiles.

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Heritage Gansey Knitting Network Project

A gansey is a fisherman's wool sweater, also known as a guernsey, or a knit-frock, which is traditionally handknitted in the round. Each knitter designed their own motifs, which were not always recorded at the time. These 19th and 20th century garments were made for fishermen who required hardwearing clothing that was resistant to sea-spray and the weather.

Sheringham Museum has had an active informal textile group with 35 members for five years who have been working on a long-term project charting gansey patterns using the museum's collection of 83 items. These include 30 examples of knitted ganseys, images of fishermen wearing ganseys, articles, books, press cuttings plus a representative collection of knitting tools, such as knitting needles and sheaths. They have been enthusiastically knitting swatches to chart the various gansey patterns, the results of which are available on the textile and gansey page on the museum's website: http://www.sheringhammuseum.co.uk/textile.html. The museum has now received funding from the Art Fund to establish the Heritage Gansey Knitting Network (HGKN), and work began in 2019 to develop a scoping project for gathering research material and developing expertise about this unique textile tradition.

The terms *knit-frock* and *jersey-frock*, as used in Cornwall, have fallen out of common parlance, as has *froak* in Shetland. Depending on the location in the British Isles, this style of knitted garment is still known as a guernsey or a gansey, although at one point, the term *jersey* became interchangeable with a variety of names such as jumper, pullover and sweater. As yet, no definite date has been identified for this.

Sheringham Museum's textile collection has recently expanded with the bequest of Michael Harvey's archive in 2019. He was a textile researcher who focused on ganseys as his contribution to the field of early 20th century knitting. His forensic approach has given the museum a wealth of valuable scientific material. Harvey was the 'go-to' expert in his field, contributing and working with the original gansey pattern collectors such as Gladys Thompson in the 1950s and 1960s, Rae Compton in the 1970s, and Michael Pearson in the 1980s, who all published their findings.

Harvey bequeathed his lifetime's research and object collection to Sheringham Museum, so that his archive remains in Norfolk. Interest in the ganseys significantly heightened thanks to the success of two previous highly acclaimed exhibitions at the museum; *Shoal of Ganseys* during 2014 and *Traditional Dutch Ganseys* in 2017. Having already established a good working relationship with Harvey through his loans to the exhibitions, the museum was well placed to accommodate the collection and was delighted when his family agreed to donate it.

The museum accepted 80 folders of research material and more than 100 objects, including six early, very fine hand-knitted ganseys, 43 knitting sheaths and 50 examples of knitwear dating from the 1930s to 2000 comprising a lifetime's research. Harvey's archive contains his original photographic, postcard and slide images, manuscripts and publications on knitting, crochet and textiles, film footage, articles as well as correspondence he wrote and replies he received. Harvey had catalogued all of this material according to location and type for ease of reference.

The museum textile team and the curator's enthusiasm for mapping other relevant collections has inspired a plan for a scientific approach to the material. It has begun by recording and charting knitted ganseys, including photographic records of the wearers and makers throughout England and Wales, starting with those nearest to Sheringham and building on connections made through the previous gansey exhibitions held at the museum.

The knitted workwear of fishing communities was made between the mid-1850s and the mid-1970s, after which clothing technology changed, and the skills needed for making these sweaters began to disappear. Everyday apparel such as workwear is simply not valued or kept making the physical evidence rare and difficult to recognise. The recent resurgence of interest and appreciation in handcrafted textiles, combined with the loss of generations of knitters has added urgency to the current project. Very few expert gansey knitters are still alive, and others are known only through unrecorded recollection.

Previous projects were aware of the need to record this vanishing textile knowledge: for example, The Moray Firth Gansey Project, which ran from 2007 to 2010 with funding from UK Heritage Lottery Fund, the Scottish Government and the European Community Rural Aberdeenshire, Highland and Moray LEADER Programmes (http://www.gansey-mf.co.uk/index.html). This project has been revitalised in Scotland; more funding was announced in May 2020. HGKN has offered to share its recording template and methodology with Anstruther Museum (Scotland) and its knitting project.

The HGKN has begun to work with other groups to highlight gansey recording and aims to become the one-stop centre for sharing information by formalising existing loose networks and groups, such as the Lowestoft Gansey Project, Ravelry Gansey group, the North Norfolk Branch of the Knitting and Crochet Guild, Propagansey (in Robin Hood's Bay) as well as working alongside The Moray Firth-Anstruther 2020-21 project.

Other museums hold ganseys in their collections and a principal objective is to scope the extent of the gansey collections through direct contact and personal visits to develop a specialist network. The aim is to record and chart all the relevant information in a standardised template for future reference to be shared by all. HGKN has already contacted networks across the country, sharing work on charting patterns and knitting examples found in the Sheringham collection and that of Norfolk Museum Service. This has produced reference swatches and charts which have helped demystify incorrect charting of the past which was copied repeatedly (for example, Thompson 1955).

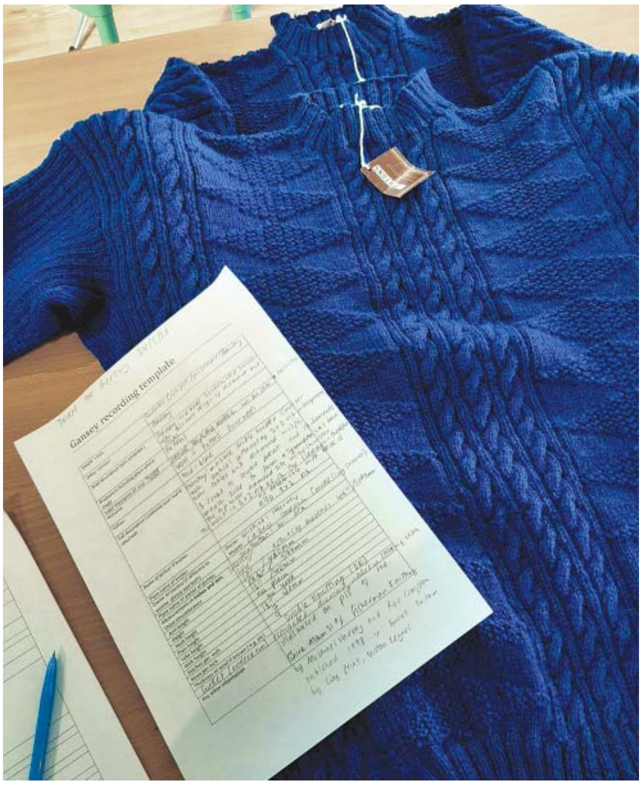

Fig. 1: Trialling an early version of the Gansey Recording Template on a gansey already in the Sheringham Museum collection (Image: Sheringham Museum)

Mapping the knitted ganseys requires an appropriate framework or template to ensure all the relevant details are recorded. A basic template was trialled using two ganseys from the Harvey bequest. These were found to be lacking in rigour and consistency, and so a second version was developed and tested (fig. 1). This was found to have significant improvements in the way the material was recorded. However, it became obvious that this template assumes the recorder has a basic knowledge of knitting and textile analysis, and that they can identify a gansey among a collection of garments. Therefore, a toolkit for using the recording template is needed which will include a glossary of terms. This toolkit and template will also include a diagnostic flow chart, allowing a non-knitter, non-expert and/or volunteer working on a collection to identify what is and is not a gansey, and then assist them to record it. Much more work needs to be completed before a workable toolkit can be presented but it will include the basic method and template for recording and a glossary for reference.

First, it is necessary to ascertain that the participant recorder is aware that there are knitted ganseys in a collection. It is possible they have been overlooked and their value is unrecognised. A navy blue sweater is, after all, just a sweater. The skill with which a gansey was made does not automatically imbue it with value, nor does apparent knitting skill make the knitted garment a gansey.

Knitting suffers, as does all craft, by being considered of a lesser value and therefore lesser importance than the 'higher' art forms, such as painting. This value is measured in monetary terms as well as in significance and importance. This may be partly because of the association that knitted garments and workwear have with the everyday and the working class. There is also the challenge of helping others recognise the value of the ganseys which have repairs or areas which were re-knitted. A 'museum-quality' gansey need not be a pristine example: those of lesser quality or with damage are just as worthy of consideration for their value in providing a socially historical narrative which can be read in the wear, tear and repair.

To complicate matters further, not all ganseys were blue (although most of them were). Some ganseys were machine knitted and may or may not have been hand finished. There are many variables to be considered, which the recording toolkit and template will need to evolve to accommodate. It is also necessary for the nomenclature to be defined, which necessitates a study of the origins of the name *gansey.*

The fishermen's Guernsey began life in the Channel Islands before becoming popular across all English ports. The general assumption is the *gansey* was derived from the *Guernsey or Jersey,* Dutch ganseys are referred to as *ganser,* yet another derivation of the word. The plainer knitted versions from Guernsey were traded as far afield as Newfoundland in Canada. All are variations of names ostensibly applied to a sweater made without seams of a finer wool and was usual based on patterns in squares and rectangles. Regional differences aside, these all refer to everyday practical workwear, which goes some way to explaining the popularity of the gansey.

There are fewer variables in recording a gansey than in recording knitted fragments. As wearable garments, they have all that is needed to cover a body: a front, back and two sleeves. This allows us to assume the completeness of the garment and by doing so focus only on the variables within the range of the gansey: the fineness of the wool and thereby the loop, the depth of the yoke, the length of the sleeve, the complexity of the patterning. These are a few of the fields included in the current recording template. More fields will be added as the database increases with the number of ganseys

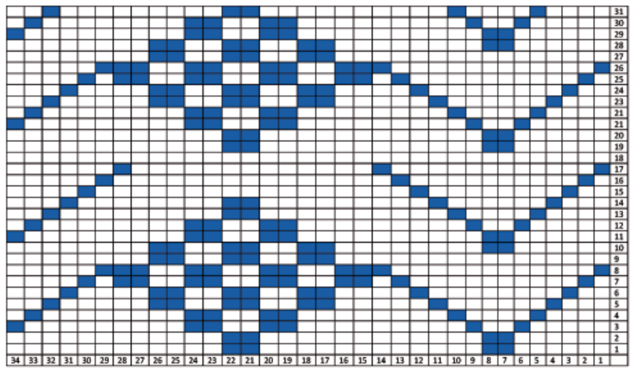

Fig. 2: A chart of Mrs Bishop's knitting for Robert 'Tarr' Bishop's gansey now in the Michael Harvey collection (inventory number SHMMT: 2019.1.2) (Image: Sheringham Museum)

recorded: for example, Dutch ganseys have drawstring closures at the neck, sometimes with pompom ends, and others have button fastenings at the neckline. As the project progresses, there will be a need to record all the neck fastenings, including the pompom measurements. The basic shape is reminiscent of shapes and constructions of early knitted and linen undergarments such as shirts and shifts, even down to the inclusion of an underarm diamond-shaped gusset. Although some ganseys are knitted without the inclusion of the gusset, this scoping project will reveal the extent of the use of underarm gussets and perhaps define their shapes: square, diamond or none.

Patterning was used in different areas of the gansey. A glossary with images of patterns and suggestions for charting (fig. 2) the motifs is an essential element for the template, which will facilitate the systematic recording of new variations and the many names of stitch combinations (for example, the 'hailstones' pattern type is sometimes called double moss stitch or seed stitch. Gansey knitters did not use written or published patterns. Instead, they used those worn and made by others as inspiration for their own work. Anecdotally, a Sheringham grandmother of the Chesney family was said to take a trip to Great Yarmouth to 'look at the knitting the fisher-lasses were making because they would make lovely ganseys'. She decided what the pattern would be later, after she had been inspired. Another Sheringham gansey knitter recalled that she would measure people and say 'I think I will cast on five score and five'; the neck was so tight that the grandfather for whom it was made had a job to get it over his ears (Childs and Sampson 2004, 15). To learn about the knitters is an interesting aspect of the work. Theirs were the unseen hands tirelessly

GANSEY RECORDING TEMPLATE	
Accession number or organisational identifier	SHMMT : 2019.1.2
SHIC classification	4.151.721
Organisation name	Sheringham Museum at the Mo
Organisation address	Sheringham Museum Lifeboat Plain, Sheringham NR26 8BD
Website/email address **Telephone number**	www.sheringhammuseum.co.uk 01263 824482
Simple name of object **e.g:** Sweater, Jumper, Pullover	Sweater, Jumper, Pullover Fishermen's jumper
Other names (e.g. alternative names or local nomenclature)	Gansey
Brief Description (one sentence overview)	Gansey; fisherman's sweater hand-knitted in navy blue worsted wool.
Date of manufacture and when worn	C. 1900
Production including place made	Hand knitted, Sheringham, Norfolk
Label inscription (if any)	None
Colour: dyed before or after knitting	Navy blue
Material: Yarn	Wool
: Fibre	Worsted spun
Ply (if known)	Fine, 4 ply
Ply twist: Z, S (if known)	Z
Name of knitter (if known)	Mrs Bishop
Full Description (continue on extra sheet if needed	Gansey: fisherman's hand knitted sweater made on 5 needles (in the round) by Mrs Bishop of Sheringham. Navy blue fine wool with 12 repeats of pattern on the yoke above welts, same pattern repeat used on sleeves. Rib welts on body, cuff and neck are worked in 2&2 rib, 3 rows of 2/2 rigs to front (recto) and back (verso) of garment, this trio of rigs are repeated twice on each sleeve. The shoulder band is worked in 2/2 rigs. See photographs attached and image of knitter and wearer at end of report.
Place name of knitter (if different to place of production)	Sheringham, Norfolk
Owner of Gansey	Mr Robert 'Tarr' Bishop
Wearer of Gansey	Mr Robert 'Tarr' Bishop
Knitted 'in the round' or on 2 needles	In the round on 5 needles
Cast on edge details (if known)	

Table 1: First page of the completed five-page template (devised by Heritage Gansey Knitting Network) recording the Bishop gansey

Fig. 3: Recto of the Bishop gansey (inventory number SHMMT: 2019.1.2) (Image: Sheringham Museum)

working away rarely recorded or remembered. The stories and reminiscences are evocative and provide insights into the sharing of patterns and designs.

The toolkit and recording template will be comprehensively tested before being used for mapping other collections of ganseys. This template will be available for others to use and record their collections, and, where possible, the project team will assist the participants in identifying and recording their own collections. A representative sample of collections with which to work has already been identified and their data are being collected. When all have been recorded as fully as possible, there will be a further evaluation of the template and recording procedure before rolling it out across a wider pool of contributors.

The template used the recording fields listed in on Modes, the museum documentation and collections management software, with the aim of ensuring that the recording was as standardised as possible. As the template was tested, extra fields were added. Later versions have benefited from those used in the tables *Summary of proposed key terms for basic description of knitwork* and *Protocol for recording early knitwork* (Malcolm-Davies et al, 2018, 12-15).

One gansey from the Michael Harvey bequest was selected to trial the most complex template so far, which was the fifth version of it (table 1). This gansey was knitted by Mrs Bishop of Sheringham about 1900 for her husband Robert 'Tarr' Bishop (fig. 3). It had been previously recorded with some technical details and its social context. The knitter and wearer were identified and a chart for the gansey was already published (Compton 1985, 41) and family recollections

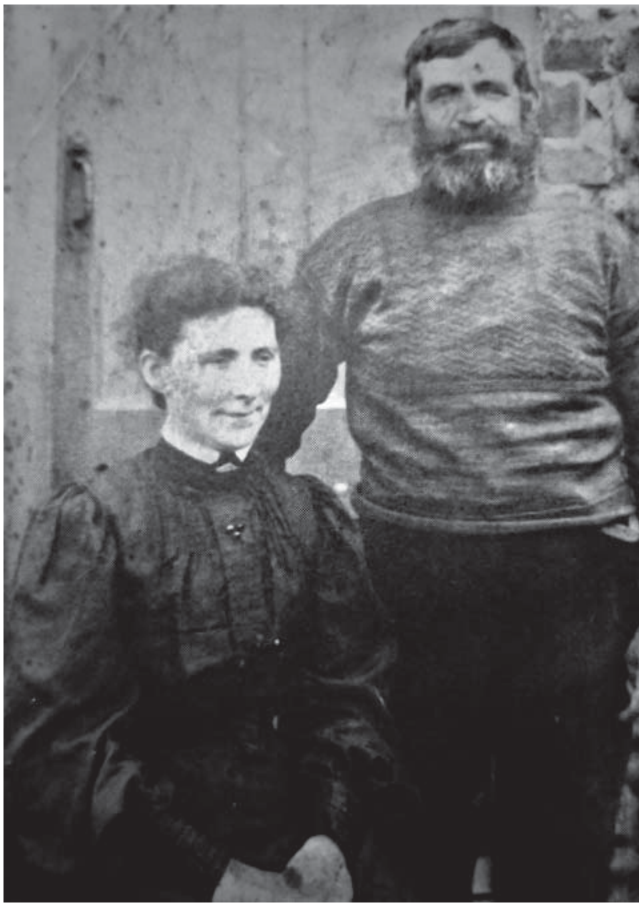

Fig. 4: Mr and Mrs Robert 'Tarr' Bishop. Mrs Bishop knitted the gansey worn by her husband pictured here in 1906 (Image: Sheringham Museum)

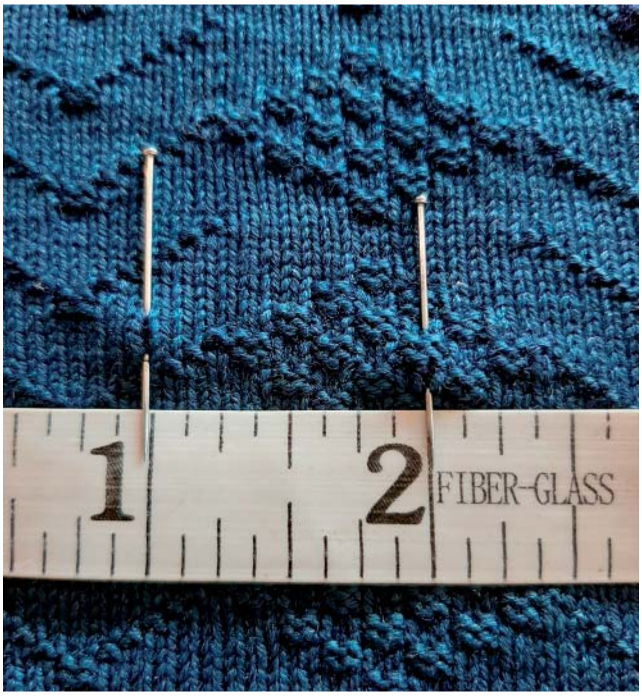

Fig. 5: Measuring loops per inch (2.5 cm) in the pattern of the gansey (Image: Sheringham Museum)

had been collected (Thompson 1969): 'She [Mrs Bishop] had always insisted on a tight fit, and when ganseys knitted for the children were pulled over their heads, they sometimes made the lobes of their ears bleed! She gave them family fittings, the first just before the pattern to adjust for correct width, the next for gussets, and then the arms. The gansey could be re-knitted when worn thin, from practically any part, and made as new. She used five needles. It is wonderfully even in tension and has worn to a lovely grey-blue through the action of the sun, sea water, and time, and is really a museum piece of fine knitting' (Thompson 1969, 84). The published chart and pattern description contained errors which were repeated in subsequent gansey knitting publications. As a result, documenting Mrs Bishop's gansey thoroughly, correctly and logically was a necessary step. It was also the start of in-depth research into the collection using Harvey's research and local knowledge to piece the relevant information together. With his collection, the portrait (fig. 4) and information on 'Tarr' Bishop, the gansey's owner and wearer, and more importantly, on Mrs Bishop, the gansey's knitter, can now be placed accurately alongside its measurements (fig. 5) and recorded details within the gansey scoping project and on the Modes database.

The main aims of the project are to become a fully developed gansey study network and to identify the whereabouts of ganseys held in public and private collections around the coast and inland waterways of the United Kingdom. Further aims are to give advice, share resources, including the toolkit and template, for recording ganseys. In doing so, HGKN will continue by establishing this outward-facing project to clearly define the relevant professional communities. The collections with which HGKN collaborates will benefit by producing improved records of the ganseys in their own collections.

The network members will help each other through reciprocal learning and research.

Eventually, the aim is to publish the findings online making the information accessible to all. The project will do this by compiling a searchable database. Any research leads from sharing the scoping project results will be used by the network to inform the future direction of gansey research and propose a model for it to be rolled out across the United Kingdom and Europe. When there is a significant data set, it is hoped that the information may be extrapolated to identify regional differences and techniques.

Often overlooked, commonplace items are hugely significant records of social history. Harvey's pioneering work elevated the gansey's status to a garment worthy of scientific study. The HGKN project aims to build on his legacy and address this issue further by analysing the 'lowly' sweater and recording its sophisticated complexities via the framework of the toolkit and template.

After the first phase of the project as described here, all templates are now live on the museum website, see: https://www.sheringhammuseum.co.uk/textile.html

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Ulrikka Mokdad, Morten Grymer-Hansen & Eva Andersson Strand

Margrethe Hald:
the life and work of a textile pioneer

A new research project was launched at the Centre for Textile Research (CTR), University of Copenhagen on 1 September 2020 with the generous support from Stiftelsen Agnes Geijers Fond för Nordisk Textilforskning.

The project deals with the life and work of the famous Danish textile researcher Margrethe Hald. Her pioneering research represented a rare virtuosity by combining various academic fields such as archaeology, ethnology, art history and cultural history with textile craftsmanship - a combination that continues to inspire textile researchers today. This project continues CTR's 2019 work on the Margrethe Hald Archive, when it was digitised and made accessible to the public, and a research group was formed at the beginning of 2020. During the process of digitising the archive, it became clear that a large amount of hitherto unresearched and unpublished material was archived at the National Museum of Denmark and in the National Archives in Copenhagen.

The research group will work for one year preparing a study of Margrethe Hald's work. The project will revisit Hald's considerable output, her immense private and professional correspondence in the Danish National Archive and the National Museum of Denmark, travel logs and photographs in order to revitalise and create new understandings of her groundbreaking research.

Margrethe Hald understood that textile research could not be limited to just one particular scientific approach. Her study travels to other geographical areas, especially south and Mesoamerica and the Middle East, were of vital importance for the development of her academic knowledge. The digitisation of the approximately 600 slides from the archive spotlighted the fact that most of the slides lack information on either place or date. However, using the newly discovered material from the Danish National Archive, CTR will attempt to pair letters, passport stamps etc to individual slides to make it possible to publish these appropriately in connection with the other records. In doing so, it will be possible to understand exactly what

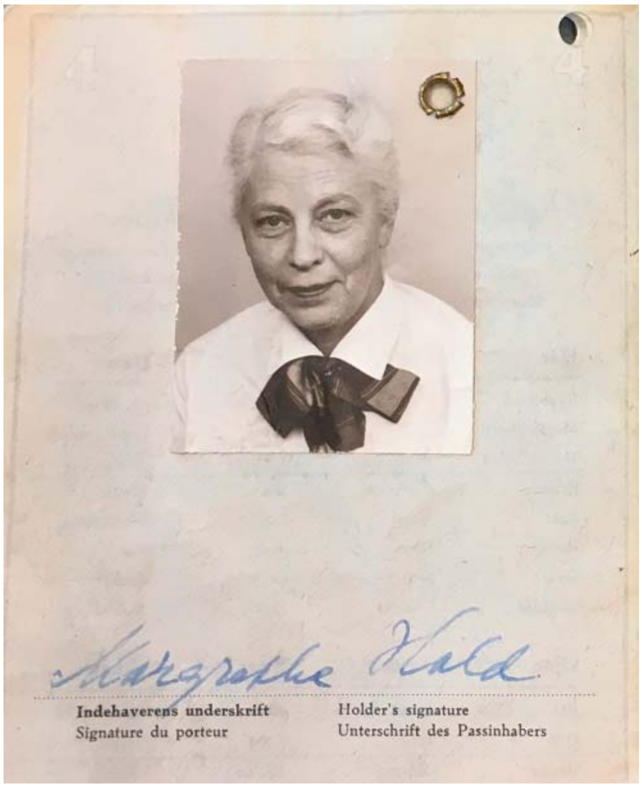

Fig. 1: Margarete Hald, passport issued 16th September 1958 in Copenhagen (Image: Hald Archive CTR)

Margrethe Hald learned during her travels and how this influenced the results of her research.

So far, the archival studies show that Margrethe Hald had an unusual talent for cultural historical dissemination to both academics and the public. Her work included both technical analyses of archaeological textiles and reconstructions of ancient dress and costume. Her retirement from her position at the National Museum of Denmark in 1967 was marked with the major exhibition *Ancient looms*, which was also shown at the Moesgaard Museum in Aarhus. In many ways, this exhibition was innovative in the field of dissemination in Danish museums. As a part of the project, CTR will highlight Margrethe Hald's hitherto unrecognised impact on dissemination through museums.

The overall goal of the project is to update Margrethe Hald as one of the pioneers of textile research, whose work represented a virtuoso interdisciplinarity that continues to define textile research today, and to present her groundbreaking research to a new generation of textile researchers.

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Fig. 2: Margarete Hald, Cultural Identity Card of the Council of Europe, executed before 1955,when it became renewed to 1957 (Image: Hald Archive CTR)

Marie Louise Nosch, Agata Ulanowska & Elsa Yvanez

EuroWeb: a new European network and COST Action 2020-24

COST EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

EuroWeb is a new pan-European network of scholars and stakeholders from academia, museums, conservation, and the cultural and creative industries. Participants from multiple disciplines join forces to bridge current cultural, political and geographical gaps and facilitate interdisciplinary research leading to inspirational material for experts in the allied and applied disciplines of fashion, art and design. The overall aims are:

- To formulate a new vision of European history based on textiles;
- To uncover the underlying structures connected to textiles in languages, technologies and identities;
- To bridge different theoretical and methodological approaches grounded in European scholarship, and to test and disseminate new analytical and multi-disciplinary methods;
- To dissolve the traditional and often obsolete and obstructive dichotomies of practice and theory through a more integrated approach of disciplines and cultural institutions; and
- To forge new notions of inclusive European identity based on a shared heritage and experience of textiles - as identity, a sense of belonging and social cohesion.

This new European network has received funding from the EU for 2020 to 2024 and, so far, 30 countries have signed up with near to 260 participants comprising dress scholars, textile experts, craftspeople and designers. The network is funded by the COST Action as CA 19131, *EuroWeb. Europe Through Textiles: Network for an Integrated and Interdisciplinary Humanities.*

The project was originally conceived at the Centre for Textile Research in Copenhagen (CTR) but at the first management committee meeting 13 to 14 October 2020, it was transferred to the Faculty of Archaeology, University of Warsaw in order to enhance the participation of early career academics and Polish scholars. Agata Ulanowska (PL) was elected chair of the COST Action and Karina Grömer (AT) vice-chair.

The scholarly vision of EuroWeb is to rewrite European history based on its massive production, trade, consumption and reuse of textiles and dress. This will be undertaken in scholarly ventures such as conferences, workshops, papers. It will also produce a final EuroWeb anthology and the textile history of Europe will also be presented diachronically as a "digital atlas".

In the longerterm, the goal is to identify expertise in sustainable textile practices across time that can be used in European textile and fashion businesses.

Participants

The COST Action particularly targets the interaction of new scholars such as Early Career Investigators (ECI) who are up to eight years past the award of their doctorates. Special funds are allocated for their travel, research stays, and conference participation.

The COST Action also promotes the integration of eastern European countries as well as other European states that have so far not benefited much from EU research funding. These are termed Inclusiveness Target Countries (ITC). In EuroWeb's collaborators come from 16 ITC nations: Albania, Bosnia and Herzegovina, Croatia, Czech Republic, Estonia, Hungary, Republic of North Macedonia, Latvia, Lithuania, Malta, Poland, Portugal, Romania, Serbia, Slovakia and Turkey. In addition, 13 other nations have joined the action: Austria, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Norway, Spain, Sweden, Switzerland and the UK.

COST Actions are based on member states but all textile and dress scholars are welcome in the project's activities. If you wish to join the EuroWeb COST Action, please make contact by using the email below.

EuroWeb activities

EuroWeb offers theoretical and practical training schools, mentoring, targeted career development masterclasses for early career scholars and hosts international textile and dress conferences, especially in eastern Europe to highlight their collections, capacities and scholarships.

The scholarly work is organised into four working groups (WGs), and each WG is headed by a WG leader and two WG vice leaders. The goal for the project's leadership is diversity in skills and training. All the working groups welcome scholars who wish to be affiliated to the group and who aim to work towards delivering on the goals set for each.

WG 1: Textile technologies. Leader: Christina Margariti (GR)

Objectives: to explore the origins and long-term development of textile technologies by examining tools and textiles and testing techniques using experimental

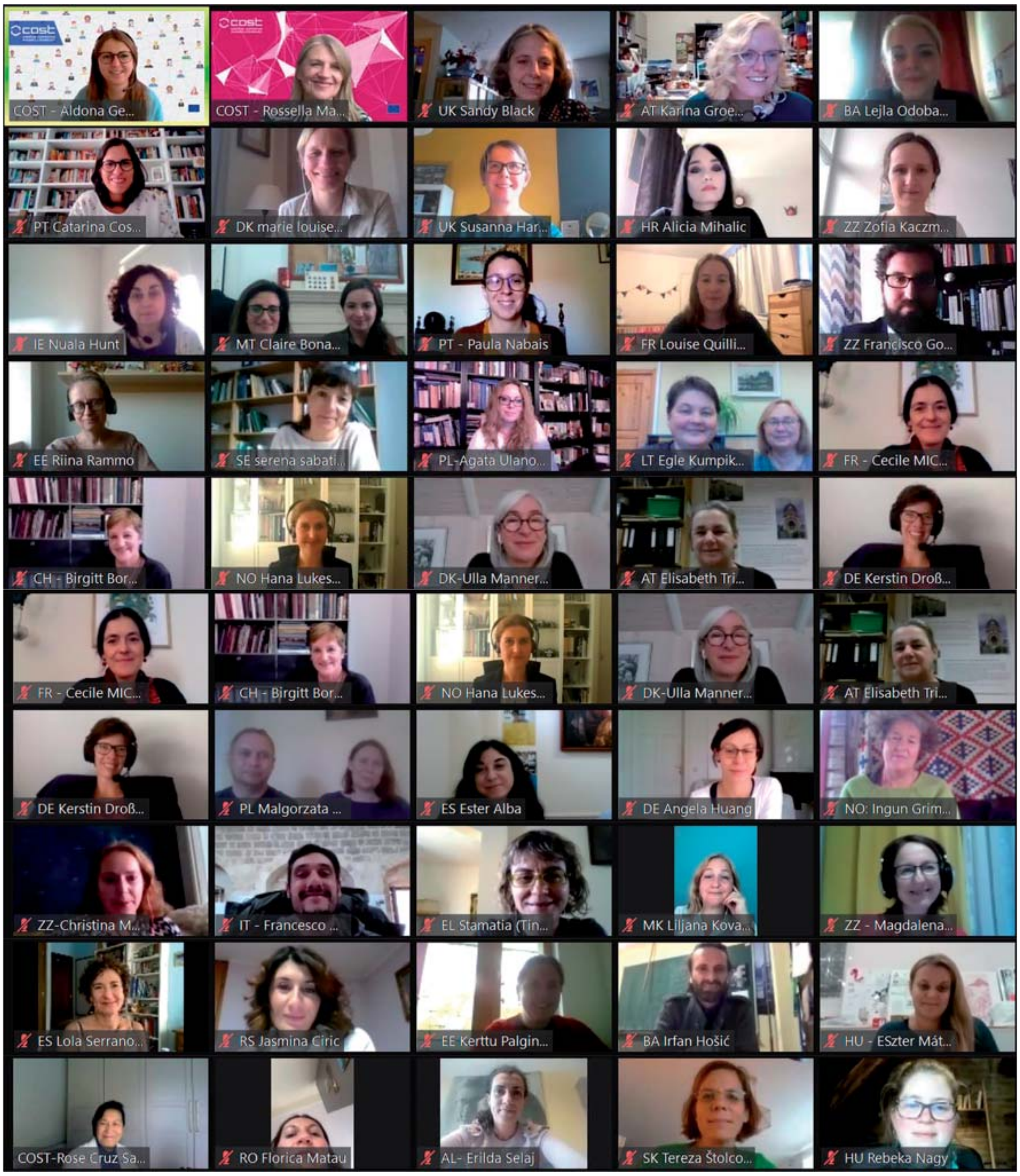

Fig. 1: EuroWeb Management Committee members at the 1st online meeting on 13th October 2020 (Image: Agata Ulanowska)

archaeology, and learning from craftspeople and textile engineers; to investigate how textile techniques influenced and were influenced by other fields of knowledge and cross-craft phenomena; to highlight the roles of skill and creativity, and the mechanisms for the diffusion of techniques, innovations, patterns and fashions, and how it has influenced other technologies and inventions.

Methodologies: textile analysis, textile tool analyses, experimental archaeology, conventional and new analytical methods stemming from the natural sciences. Digital motion capture will track bodily movements when weaving, spinning, knitting etc.

Research questions Q1: How to identify technological traditions and innovations? Q2: How is textile knowledge/skill transmitted? Q3: How can the production of textiles inform us of the relationship between gender, age, status, labour, economy and family income? Q3: What is the cross-craft interaction with other technologies of the past?

Deliverables: A course on textile archaeology; training in experimental textile archaeology; films of textile techniques; scholarly papers on textile techniques; presentations at conferences; digital corpus of motion capture of bodily movements when making textiles; training in archaeological fieldwork; and new textile analyses.

WG 2: Clothing identities - gender, age and status. Leader: Magdalena Woźniak (PL)

Objectives: to explore the meaning of clothing through the ages, areas and cultures; to use clothing as a key to explain values in society; to use clothing as a key to understand individuals, self-representation and groups.

Methodologies: Clothing identity and status are explored in visual analyses of statues and images, as well as in archaeological textiles and museum collections of dress, by creating typologies of dress and employing the methodology of wardrobe studies. Clothing as a gender marker is explored in texts and images, using gender theory. This is compared with the terminological analyses in WG3 to identify garment types and link them to, for example, professional and gender identities. Chemical analysis (HPLC) reveals dyes and potential colour symbolism. Motion capture enables the testing and tracking of bodily movements when wearing certain garments. Legal and religious documents detail prohibitions of clothing, drawing on law, anthropology, and social psychology.

Research questions Q1: How do gender and age specific clothing express one's place in the economic, social, and productive spheres in society? Q2: How far did sumptuary laws and prohibition shape European clothing? Q3: How can we rethink and remake dress exhibitions in a more inclusive way, and discuss their colonial, ethnic, nationalistic and religious markers and symbolism? Q4: How can museum dress collections contribute to the rewriting of European history?

Deliverables: Editing and publication of the EuroWeb anthology; scholarly papers; and presentations at conferences.

WG 3: Textile and clothing terminologies. Leader: Louise Quillien (FR)

Objectives: to explore specialised language and garment terms in European languages, and Semitic loan words; to trace and map textile and garment loanwords between languages; to determine how textile terminologies influence other fields of knowledge, such as the sciences and expressions for the body; and clothing as metaphor and literary device in literature.

Methodologies: comparative, synchronic and diachronic analyses of textile lexemes and terminology. Methods from philology and linguistics, as well as literary analyses of textile and garment metaphors. Outlining the delimitation of semantic fields through comprehensive bodies of data. Comparative studies include Semitic and Indo-European textile and garment terms, and in medieval texts the relationship between Slavo-Balto and Germanic textile and garment terms. In Early Modern trade and commercial and legal texts, the new textile and garment terms generated through trade and contacts outside Europe will be explored. Data from art history and evidence from texts in/on textiles will also be used.

Research questions Q1: How to understand toponyms in textile terminology? Q2: How can loan words in textile terminology inform us about the economic and technical contexts? Q3: How does a textile or clothing term (text) refer and relate to the object (textile)?

Deliverables: Papers in high-ranking journals; presentations at international conferences on terminologies and language; workshop on textiles and toponyms; co-create and compile a corpus of textiles with in-woven or embroidered texts; comparative study of textile and garment terms in European languages 1000 CE to 1500 CE; and workshop on in-woven/embroidered texts.

WG 4: The fabric of society. Leader: Francesco Meo (IT)

Objectives: To explore the economic and agricultural impact of textile production and use. To explore the economic and agricultural basis for textile crops and textile trade by tracing textile trade patterns and paths through Europe and through time. To map textile resource areas (water, dyestuffs, cultivation, pasture, cheap but skilled labour) and how they have shifted through time, as well as emerging textile technology regions, which branded their products and created specialised and standardised textile products.

Research questions Q1: What is the interaction between agriculture, herding and textile production in different periods and places? Q2: How can textile consumption of a population be quantified and qualified, and how can textile production and trade in past economies be quantified and qualified? Q3: How was (Early) Modern Europe shaped by textile production? Q4: How did Europe affect the rest of the world through textile trade and colonies, and vice versa?

Methodologies: reading historical texts (legal documents, private account books, city registries and probate accounts), which are mapped geographically and tagged chronologically to establish textile trade patterns across Europe and through time using historical archaeology, historical geography, toponymy and geographic information systems (GIS) to map textile resource areas (water access, ponds, dye plants, flax cultivation and pastures) and how they have shifted through time. A comparative approach to technology and context can be used between eastern and western Europe, northern and southern Europe, and between Europe and the Near East. However, a less schematic comparative approach must be elaborated, with a view on European peripheries.

Deliverables: Scholarly papers; lectures at international conferences; co-creation of the EuroWeb Digital Atlas visualising trade routes, areas of resources, path of innovations, terminological exchanges, fashion trends, across time.

Opportunities

EuroWeb first and foremost offers an open network for all scholars and practitioners working with textiles, dress and fashion. It is a place to search for collaborations, offer online resources, and to share findings and papers. Collaborative workshops, seminars, and research articles are encouraged to develop the themes proposed in the working groups.

EuroWeb is also a platform for research training, and in 2020-2021 this will mainly take place online. Later training schools and courses in the host countries are planned.

For the special target groups, ECIs and ITCs, EuroWeb offers mentorship, funding for conference participation, and funding for research stays abroad.

Conferences, workshops with training and meetings scheduled for the first grant period (November 2020 – April 2021) are planned as online or hybrid events. These are:

- 10 November 2020, Copenhagen/on-line: **Training in recording and editing podcasts about your favourite piece of clothing**. Organisers: Marie-Louise Nosch and Gülzar Demir.
- 21-22 November 2020, Copenhagen/on-line: **EuroWeb Digital Atlas Training Initiative (including a career development training)**. Organisers: Angela Huang, Mikkel Nørtoft, Eva Andersson Strand and Piotr Kasprzyk.
- January 2021, Thessaloniki, **International Workshop on Interdisciplinary Textile Studies: Byzantine, Post-Byzantine and Related Productions**. Organisers: Paschalis Androudis and Elena Papastavrou.
- 22-23 March 2021, Warsaw: **Textiles and Seals. Relationships between textile production and seals and sealing practices in the Bronze to Iron Age Mediterranean and the Near East**, workshop. Organiser: Agata Ulanowska.
- 23 March 2021, Warsaw: **Second Management Committee Meeting**. Organiser: Agata Ulanowska and Faculty of Archaeology, University of Warsaw**.**
- March/April (2 days) 2021, Warsaw: **Funerary Textiles. Towards a better method for *in situ* study, retrieval and conservation**, conference workshop. Organisers: Elsa Yvanez and Magdalena Woźniak.

Results

There are two major deliverables: the EuroWeb anthology to draft a new vision of European history based on textiles and dress, and the EuroWeb digital atlas mapping textile and dress production, circulation and consumption. If you wish to contribute to the Atlas, please contact the atlas manager: Angela Huang (DE).

Communication

Read more about EuroWeb here: https://www.cost.eu/actions/CA19131/#tabs|Name:overview

Follow us on Twitter @EuroWeb4 to discover the project's participants and get news on ongoing activities and events.

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Texel Stocking Project conference

2-3 November 2019, Leiden, Netherlands

The conference was organised by the Textile Research Centre (TRC) in Leiden and the Knitting History Forum, an international research network. The keynote lecture of the programme was about the reconstruction of the 17th century Texel stocking finds by a citizen science community under Chrystel Brandenburgh's direction. The stocking came from shipwreck number BZN17, an armed Dutch merchant ship which sank between 1645 and 1660. The two goals for the project were: to involve people who are not normally part of archaeological research but have the expertise needed for a reproduction; and to be able to repeat the experiment. In this case, the participants were experienced knitters.

The aim was for 20 participants to make ten reconstructions and to produce a publication at the end of the two-year project. More than 100 people responded to the invitation to participate, possibly because the finds were featured in local newspapers. It would be interesting to repeat the experiment with a less well-known stocking from a museum collection.

The stocking to be reconstructed was examined with a Dino-Lite microscope without turning or otherwise disturbing it. It was made from reeled silk, not spun silk, and knitted in the round. This examination provided all the information used in the project.

The citizen science project involved knitting test swatches with different types of silk (some already degummed, some still containing the sericin) and different sized needles, to find the right material and gauge for the reconstruction (fig. 1). After the test swatch stage, about 40 people continued with the experiment by knitting a complete stocking, and as of the date of the conference, 27 stockings were finished (fig. 2).

Knitting with the silk that still contained the sericin proved easiest and quickest, and blocking the stocking after removing the gum also produced the most uniform result. Evidence for using a wooden former to shape the stockings after washing and degumming came from contemporary records mentioning this equipment and an extant example from the period in Denmark. Uneven knitting and a certain amount of difference in gauge did not matter after removing the sericin and blocking the stocking.

The experiment also investigated stocking colours (fig. 3). Gold examples were knitted from silk degummed before knitting whereas white ones were knitted first and degummed after finishing. Two stockings were dyed black using natural dyes of the era.

The project did not provide evidence for how long it would take to knit a stocking in the 17th century. The participants who knitted more than one stocking reported that the time it took to knit the second one was almost half that of the first, showing how much familiarity with the material and the way to knit sped up the process. Other papers explored different perspectives on the Texel Stocking project. The first session was

Fig. 1: The citizen science knitters' test swatches in different types of silk (Image: Christine Carnie)

Fig. 2: A selection of the 27 not yet blocked stockings on display at the Textile Research Centre in Leiden (Image: Christine Carnie)

about stocking production in Europe, showcasing current research in knitting history. Lesley O'Connell Edwards' paper *A hidden workforce: hand knitters in 17th century England* focused on evidence of who was knitting and what was being produced in Norfolk and Suffolk, in particular. There is less information available on knitters themselves for the 17th century than for the 16th century, and civic records are so far the best sources.

Items produced by knitters included caps, gloves, petticoats (short jackets), stockings or hose, and waistcoats. There were no knitters' guilds in England but knitting was taught in schools, and not necessarily learned in the family. Although men were listed as teachers, very few men were listed as being taught. Silk hand knitters are mentioned in 1619 but there is not much more information about this aspect of knitting.

Sylvie Odstrčilová's paper *Early modern stockings from the Czech Republic and neighbouring countries: the story continues* offered a fascinating glimpse into the variety of extant stockings in this area, and built on her research previously published by the Northern European Symposium of Archaeological textiles (NESAT) and the *Archaeological Textiles Review*. Her discovery of the similarity between the stockings of Imrich Thurzo in Orava Castle to the Texel stocking opened questions regarding manufacture and importation of silk stockings throughout Europe. Hanna Bäckström's paper *The earliest printed knitting patterns* compared what the printed patterns looked like and for whom they were made to a handwritten 17th century notebook, possibly from a knitter's workshop. I thought this was one of the highlights of the conference. It raised many interesting questions as to how the charts, diagrams and sketches contained in this book were used, especially in contrast to the later printed books which seem to have been designed for a different audience.

The first afternoon section was dedicated to work inspired by the Texel Stocking project. Art Ness Proano Gaibor's *Dye experiments on the Texel Stocking* was an interesting paper on how period dye recipes can have an impact on our modern lives, and how diverse the period recipes for dyeing black were - some doing more harm to the fabric than others. Geeske Kruseman's report *Wearing 17th century knitted silk stockings* had some results that were really surprising. Two people wore two pairs of the stockings produced by the citizen science project with period reproduction shoes and recorded their subjective and objective observations. Although the experiment was cut short, they still collected some data. The stockings showed no signs of wear after an accumulated 139 hours. They kept their shape after washing and were comfortable in hot and cold weather. It would be interesting to repeat this experiment with a wider range of participants. Everyone with the appropriate foot size (European 38) had a chance to try the stockings afterwards, and I loved the experience!

Sally Pointer reported on making a reconstruction based on the Texel stocking for the reenactment market using a 19th century knitting machine. She started with a wool version to test the design, and subsequently made a version with spun silk. She had to alter key features to work with the much smaller stitch count possible with the knitting machine, reducing the patterns in purl stitches by about one third, and producing a clearly different stocking. This led to her key question: “Though we can do it, should we? How much can we learn from something that is clearly removed from the original?” The stocking she produced is beautiful and was much quicker to make than a handknitted one, but it still took a considerable time. This begs the question how it would compare to a non-patterned, machine-knit silk stocking and the replica handknitted ones.

The last section offered papers based on citizen science projects. In her paper entitled *How not to knit: Sourcing silk, research and reconstructions reviewed*, Susan North shared her insights into the problems encountered and mistakes made when making reconstruction silk stockings for the Original Practice at The Globe theatre, and how difficult it was to find any information on tools, materials, and methods. Hers was a one-woman project, so there was no repeat of the experiment for comparative purposes. Jane Malcolm-Davies' paper *Modern slavery and the early modern work ethic: lessons learned from volunteer participation in Knitting in Early Modern Europe (KEME)* gave insights into the experiences of her volunteers. She discussed how using volunteers in knitting (a notoriously underpaid work activity) raises the question to what extent citizen science is exploitative, and how much can be learned from the knitwork produced and the process of knitting it. The focus has to be on what the benefits for the volunteers are as well as for the researcher/scientist. It was interesting that the KEME volunteers had previously listed a similar range of benefits as the Texel stocking project participants. There was also discussion of the term citizen science, and what difficulties and highlights such projects provide. The panel discussion with Roeland Paardekoper of EXARC and Katrin Kania of the European Textile Forum which followed was along similar lines. I loved the new-to-me emphasis on the social aspect of taking part in a citizen science project, and the notion of being mindful of the nature of these experiments versus lab experiments – in terms of mutual benefits for the researcher and the volunteer. Volunteering walks a narrow path between fulfilling participation and exploitation, not only in citizen science projects, and I was happy to see how that was at the forefront of the papers. The conference has hopefully also raised awareness on how knitting, and other textile arts, are equal in importance to analysing woven fabrics, and that textiles in general are equal in importance to other materials.

My biggest thank you for a wonderful conference has to go to everyone who took part in the citizen science project - for making their experiences and work available to a wider community. I am taking the shortcut by reading about their experiments and experiences, and by having a finished pattern to follow, and using all the information now available to make my own interpretation. Thank you also to all the people who helped make the conference a reality, and all the speakers who so generously shared their experiences and knowledge. It would be great to

Fig. 3: Left – a gold stocking in silk thread dyed with modern dye (left); right – a black stocking dyed with natural period dye (Image: Christine Carnie)

have a chance to hear more of the experiences of the knitters themselves, of their troubles and successes, and how they saw their level of participation. In general, I am glad to see that knitting is fashionable again - is that why there were so many volunteers? One sentence made me think: “Knitters are not archaeologists”, which in most cases is true, but what struck me was what might have been behind this sentence. They are experts in their realm of knitting, and can be shown and taught the necessary steps to make their input count. Is learning the methods and recording techniques necessary to make the data useable for research more difficult than learning and mastering the skills needed for the knowledge of a craft, honed by years of practice? Craft is still a neglected step-child of science, possibly because it is difficult to measure, and I am glad to see that craft and science are being brought together more often to learn from archaeological finds.

My stay in Leiden extended to Sunday, and I had the chance to visit the exhibition about the stockings in the Textile Research Centre, showcasing all the finished stockings, the former used for shaping them, all the samples, and the ingenious thread holders some of the knitters had created to keep the cone of silk from unravelling while being able to knit from it easily. We also were given a short tour of the facilities, making me want to come back to study some of the beautiful knitted and crocheted items in the collection. In the afternoon, we visited the Weaver’s House - Het Leids Wevershuis - and the Laakenhal museum, both places I am looking forward to visiting again.

By Christine Carnie

The colour BLUE in ancient Egypt and Sudan

3-4 March 2020, University of Copenhagen, Denmark

A few days before the world shut down because of Covid-19 at the beginning of March, I had the pleasure of participating in the conference *The colour BLUE in ancient Egypt and Sudan* hosted by the Centre for Textile Research (CTR) at the University of Copenhagen. The organisers Elsa Yvanez, Marie Skłodowska-Curie fellow at CTR and Cecilie Brøns, polychromy expert and senior researcher at the Ny Carlsberg Glyptotek introduced the conference together and gave a short presentation of their work, explaining the range of questions and fields of expertise involved in the study of the colour blue in the ancient Nile Valley.

The first day of the conference introduced the colour blue from very different perspectives. The research papers included the humanities and the natural sciences, mixing Egyptology, archaeology, art history, art, craft, textile studies, museum conservation, and natural sciences.

Magdalena Biesaga (Faculty of Chemistry, University of Warsaw, Poland) presented *Discover colours: what can the archaeologist learn from chromatography?* She explained how she has used modern analytical methods such as chromatography coupled with tandem mass spectrometry to identify dyes in archaeological textiles.

Chemist Joanne Dyer (Department of Scientific Research, British Museum, UK), presented the paper: *Mineral or Vegetable? Blue pigments and technical choices in Graeco-Roman funerary portraits from Egypt.* She compared images taken with different filters and identified the colours using the multispectral imaging techniques (MSI): infrared-reflected imaging (IRR), multiband-reflected imaging (MBR), infrared reflected false colour (IRRFC), induced visible luminescence (UVL) and visible-reflected (VIS). By using these methods, Dyer was able to record more than the eye can see through a visual examination.

Clara Granzotto (of the Art Institute of Chicago, Illinois, US) gave a particularly interesting paper on *Palaeoproteomic and saccharide mass fingerprint analysis of paint binders in ancient Egyptian artefacts*. She explained how to detect whether paint binders are from animals or plants and which protein sources were preferred for this purpose. These identifications were achieved using tandem mass spectrometry-based protein sequencing and matrix-assisted laser desorption/ionization (MALDI-MS). By comparing these findings to results from more established techniques such as gas chromatography-mass spectrometry (GC-MS), new insights into the protein sources were possible, including the preference for animal rather than plant proteins. However, a well-known technique for silk

Fig. 4: Blue Amun figures on Kumma temple (Boston Museum of Fine Arts, inventory number 25.1510A-B) and on a textile from Qasr Ibrim, British Museum, inventory number EA 71854 (Image: Elsa Yvanez)

screen printing, woodblock printing and painting is the use gum arabic, a thickener derived from plants such as *Acacia senegal* and *seyal*. These new insights into ancient paint binders made me curious about what types were preferred for specific objects and pigments? Granzotto investigated paint layers from ancient Egyptian coffins, cartonnages and mural paintings. This revealed what kinds of binders were used on fabrics for these purposes and where other techniques besides weaving were employed in making and decorating fabrics in ancient Egypt and Sudan. Woven textiles made up the majority which is in keeping with the fact that spindle whorls and loom weights are common finds in Sudan and Nubia (Yvanez 2018). *Acacia senegal* was identified in several cases. Even though the presentation was of a scientific area unfamiliar to some of the audience, Granzotto explained the method and results very clearly using a visual presentation of the workflow.

Kaori Takahashi (Tokyo University of the Arts, Japan) presented the paper *The colour of Monkey and background: blue in Old Kingdom wall paintings*. The tomb of Ini Sneferu Ishetef was the focus of a case comparison between Egypt and Japan. To identify Egyptian blue, Takahashi used visible-induced infrared luminescence images, X-ray fluorescence analysis and microscopic observations. She also focused on the "false blue" used as a background colour.

Aleksandra Hallmann (Polish Academy of Science, Warsaw) presented *Blue colour in the decorative programme of the Kushite chapel of Osiris Neb-ankh/Pa-wesheb-iad in Karnak*. The research was based on fieldwork at Karnak temple and the paper put the findings into historical and archaeological context. The fact that only fragments survived required a reconstruction of the colour palette based on mere traces of surviving pigments.

Anthropologist Sandrine Vuilleumier (Université de Lausanne, France) presented *Ornamental and scriptural blue: usage in the Ptolemaic temple of Deir el-Medina and in the local funerary material.* The paper considered two topics: the colour blue in the decorative programme of the temple and its use in writing practices. Vuilleumier also discussed her methodology - "coloured palaeography" - and a comparison between temple practices and burial customs, including the use of colours other than blue.

In the afternoon, the first speaker was Lucy Anne Skinner (British Museum & Northampton University, UK) who presented her work in progress on *Green is the new blue: on leather in ancient Egypt*. Leatherwork is a well-known craft of ancient Egypt and it was often brightly coloured and decorated. The leather items found include sandals, balls, chariot-covers, quivers and bow-cases decorated in shades of green, red/pink and occasionally yellow. Egyptian blue pigment has been used in manuscripts made from animal skin. But blue leather was rare and green was a more typical leather colour.

Rachael Dann (Department of Crosscultural and Regional Studies, University of Copenhagen, Denmark) presented *Eternity under a cyan sky.* The use of Egyptian blue pigment was widespread in the tombs of Queen Qalhata and her son King Tanwetamani (a UNESCO World Heritage Site). The paper demonstrated an experimental archaeological reconstruction of a wall painting with a focus on the material and body.

Shadia Abdu Rhabo (Sudan National Museum) presented *Faience in Kush: meaning and significance.* She explained that in Sudan, people expressed their spiritual beliefs through faience. The paper focused on their cognition of faience material and its religious and spiritual significance which can help us understand philosophical and ideological aspects of the Kushite culture.

Anne Kwaspen (Centre for Textile Research, University of Copenhagen, Denmark) presented *The use of (blue) colour in Egyptian garments of the First Millennium CE.* She explained that the tunic was the basic garment during this period and that it could be woven in linen or wool. The focus of the presentation was on the ornamentation and use of colour on them but the shape of the tunics was also discussed.

Giovanni Tata (Brigham Young University, Utah, US) presented *The colour blue in textiles from Fag el-Gamous.* Since 1981, *Fag el-Gamous* has been systematically excavated by Brigham Young University resulting in a huge number of textile finds. A total of 335 graves were found with textiles in 58% of them (196). The majority of the textiles are in plain linen because colours were expensive. However, hundreds were patterned, with the colour blue found on 70 of them compared to 254 which were red.

Magdalena Wozniak (Polish Centre for Mediterranean Archaeology, University of Warsaw) presented *Blue in iconography and textiles in the medieval kingdom of Makuria (Sudan): a state of art.* She explained that the colour blue is often used in combination with red (see also Dobrochna Zielinska's paper below). The garments found were often multi-coloured with patterns in thin stripes. Her dye analyses of 50 samples showed both the use of woad and indigo.

Fig. 5: Delegates at *The colour BLUE* conference, March 2020 (Image: Pernille Olsen)

Dobrochna Zielinska (University of Warsaw, Poland) presented *A royal shade of blue? immaterial meaning of the material value of the blue colour in Nubian wall painting*. She gave an analysis of the materials in works of arts from minerals to pigments, from Lapis Lazuli stone, to Lapis Lazuli pure Ultramarine to Ultramarine Ash. She also explained the phenomenon of optical blue known as false blue.

Karel Innemée (Department of Ancient History, University of Amsterdam, Netherlands) presented *Blue as an apotropaic colour* including its use in Mesopotamia, Egypt, ancient Israel, in the Christian folk tradition and in other religions. Apotropaic means something which has the the power to protect. A specific example is blue in protecting eye amulets. In the Jewish tradition, blue is used for the star in the flag and in the tallit (prayer shawl) and its tassels.

On the morning of the second day, CTR researchers and guests from the conference were invited to an indigo dyeing workshop led by natural dyer Fria Gemynthe from Lejre Land of Legends (Denmark). The other participants followed the recommendation to visit the National Museum of Denmark, the Ny Calsberg

Glyptotek and/or the David Collection, to explore displays of ancient Egyptian objects, sculptures, and a unique collection of Islamic art, artefacts and textiles.
In the afternoon, three different contemporary artists presented their work with indigo: Helle Vibeke Jensen (a Danish designer and illustrator) showed her sketchbooks documenting her inspiration from Japan; Aboubakar Fofana (a master dyer from Mali) wore one of his indigo creations; Gail Rothschild (artist and painter from Brooklyn, US) showed her work *Portraits of Ancient Linen* and *Singing Those (Nile) Delta Blue*s, and also wore her own blue digital prints on silk. Ulrikka Mokdad (a Danish weaver) also presented the book *Tekstilkunst i Danmark 2008-2018*. Everyone then joined an "artistic corner" where the work of the three artists could be explored in more detail. There were also lively discussions between the participants about the techniques and the presentation of the previous day's papers.
The conference presented CTR's first art exhibition and event bringing archaeologists, scientists, and contemporary artists together and was hopefully not the last. This diversity of such interdisciplinary research was very valuable and inspiring. It was a great opportunity to make contact with others working in the areas of textile research, art and handicraft. We learned how powerful the colour blue is through different media such as architectural decor in tombs and temples, painted statuary, funerary equipment, clothing made of leather and textiles, blue pigments and dyes. The organisers achieved their goal "to explore the relations between different media".
Eva Andersson Strand (director of CTR), Marie-Louise Nosch (former director of CTR) said a few words to mark the end of Elsa Yvanez's TexMeroe project (MSCA grant number 743420, European Union Horizon 2020 Research and Innovation Programme).
The conference was a very well organised mix of theory and practice, following the life cycle of textiles from raw material through manufacturing processes, to their everyday use and finally the garments and fabrics used for funerals and found in graves. The organisers succeeded in planning and presenting an enjoyable voyage of discovery along a very blue Nile Valley. Technical problems prevented the streaming of the presentations online, but the research papers and artists' presentations are to be published.
The event was made possible thanks to support from the Carlsberg Foundation, the Aage and Louise Hansens Fund, and the University of Copenhagen, and was supported by the TexMeroe project and the Textile Archaeology in Egypt and Sudan network.

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By Susanne Klose

EAA: Annual meeting of the European Association of Archaeologists

24-30 August 2020

The 26th Annual Meeting of the European Association of Archaeologists (EAA) was planned to take place in Budapest, Hungary, from 26 to 30 August 2020 but due to the Covid-19 pandemic, EAA made a fantastic effort to transform the conference into a virtual format, which allowed many of the original sessions to take place online. Using the Hopin platform, the conference featured a stage for the opening ceremony and keynote lectures, a session area for ongoing sessions, a networking forum and the European Archaeology Fair. Four sessions within the wide scientific programme were focused on cloth materials and technologies: *In textile layers* (session 194-195), *Skin, leather, and hide* (session 421), *Weaving*

Fig. 6: The organisers of session 194-195 In textile layers (from left: Elsa Yvanez, Matilde Borla and Luise Ørsted Brandt) inspecting the conservation of a mummy during their visit to the conservation centre La Venaria Reale with Tiziana Cavaleri, Chiara Tricerri and Paola Buscaglia.(Image: The organisers)

mobility (session 441), and *Multidisciplinary approaches to identify and preserve fibres and textile products in the archaeological field* (session 445). The following report summarises these sessions, their programmes and outcomes. All the presentations will be available on the EAA website (for members) after the appropriate rights have been obtained.

In Textile Layers: Wrapped human remains, animals and artefacts in the Nile Valley from Prehistory to the Early Medieval period
(session 194-195 on 26 & 27 August 2020)

This session was organised by Luise Ørsted Brandt (The GLOBE Institute, University of Copenhagen, Denmark), Elsa Yvanez (Centre for Textile Research, University of Copenhagen, Denmark), and Matilde Borla (Soprintendenza Archeologia, Belle Arti e Paesaggio per la Città Metropolitana di Torino, Italy). It focused on the large quantity of preserved textile wrappings from the Nile Valley dating from prehistory to the Early Medieval period.

Throughout the long history of the Nile Valley, wrappings were used on an industrial scale for ritual purposes. Due to the favourable preservation conditions of the Nile Valley, these perishable textile wrappings have survived in large numbers, demonstrating their frequent use and original importance. However, the materials, textile wrappings, wrapped bodies and objects have very frequently been separated when unwrapped, and have then been stored, exhibited and studied in isolation. The potential for studying the wrapping process, wrappings and the wrapped remains together has not been realised. This only became the focus of specific scholarly attention with the publication of *Unwrapping Ancient Egypt* by Christina Riggs in 2014. This landmark study raised many questions from the different scholarly perspectives of the session organisers (textiles in museums, in the field, and in the laboratory). These inspired the session which aimed at exploring textile wrappings with an interdisciplinary approach. It bridged the gap between scholars from the diverse disciplines of Egyptology, archaeology, conservation and the natural sciences. The objective was to illustrate the network of interconnected crafts and processes required for the manufacture of textile wrappings which made them powerful artefacts economically, ritually and epistemologically. The organisers received papers from a wide range of fields from universities and museums, and, despite the change of format, the session gathered 18 presentations given over two days and was attended by up to 46 people.

After the cancellation of the physical conference in Budapest, Luisa Papotti, Superintendant of the Soprintendenza Archeologia, Belle Arti e Paesaggio per la Città Metropolitana di Torino, and panel member Matilde Borla, from the same institution, offered to host the session from Palazzo Chiablese in Turin, the institutional headquarters. This venue provided a prestigious architectural frame for the session and helped the panel pull the session together. The panel members were also able to meet with several session speakers affiliated with institutions in Turin and to visit the conservation centre La Venaria Reale (fig. 6) and the collections at Museo Egizio after the session. This provided the opportunity to establish new connections and discuss research questions and possible future research projects.

The session featured case studies spread widely over time and many sites in the Nile Valley and the oasis, and even included parallels from the Levant (Janet Levy) and central Europe (Maria Kohle), which demonstrated that ritual wrapping was a widespread phenomenon in time and space. Anne Kwaspen and Kristin South presented evidence of the use and reuse of worn-out textiles as wrappings at from Fag El-Gamous, Egypt. Fleur Letellier-Willemin introduced the textiles from human and animal mummies of El Deir, Egypt, with a focus on comparing them and studying their development over time as well as their function in religious practices. Luise Ørsted Brandt (and colleagues Chiara Villa and Anne Haslund Hansen) also presented wrappings on animal mummies focusing on their ritual and economic role based on calculations of the quantities of textiles used for animal cults. Two studies highlighted Nubian traditions from both Egypt and Sudan: Alistair F. Dickey described the textiles found in the C-Group cemetery of Hierakonpolis, Sudan, and Elsa Yvanez presented an overview of wrapping practices in Meroitic funerals. The diverse textile material from the embalming cache next to the tomb of Ipi, Egypt, was explained by Antonio J. Morales and Jónatan Ortiz García, who highlighted their potential for scientific analysis of the wrapping and mummification process. Presentations by Paola Buscaglia (and colleagues Matilde Borla, Roberta Genta, Anna Piccirillo and Valentina Turina), Camilla Bruscagin (and colleagues Roberta Genta, Matilde Borla, Anna Piccirillo), Chiara Tricerri (and colleagues Michela Cardinali, Roberta Genta, Matilde Borla, Valentina Turina), Elisa Fiore Marochetti (and colleagues Cinzia Oliva, Rosa Boano), and Cinzia Oliva and Daniela Picchi showed how the conservation treatment of textile wrappings, garments, and associated bodies is key to understanding the original wrapping technology and the role of the textiles in the artefact. The presentation by Charlotte Hunkeler outlined the 22nd to 25th dynasty use of cartonnage for mummification and showed that its use of textile layers was a more complex funerary tradition than known hitherto.

Two papers outlined the importance of radiocarbon dating. Marie Ferrant and colleagues Ludovic Bellot-Gurlet and Anita Quiles showed how the development of pretreatments for radiocarbon dating textiles is important in accounting for organic substances which may distort the results and how will this will help to develop a better chronology of Egyptian textiles. Margarita Gleba and colleagues (Ruth Whitehouse, Mathieu Boudin, Thibaut Deviese, Igor Uranić) used a case study on the Zagreb mummy wrappings to demonstrated how an interdisciplinary approach combining several different radiocarbon dates and detailed textile analyses is necessary to clarify the long and complex history of use and reuse of textiles as wrappings and to reconstruct the wrapping process (fig. 2). Eva Panagiotakopulus' paper pointed out how insect remains can suggest the mummification process and, by combining these results with radiocarbon dating, they reveal later unwrapping and rewrapping processes. Susanna Faas-Bush provided another interesting approach: the 3D modelling of Greco-Roman mummy shrouds re-contextualising now flattened painted funerary shrouds, to reconstruct their original appearance and shed light on their visual impact and ritual powers.

Overall, the session demonstrated how the study of wrapping materials requires a broad range of specialists and interdisciplinary collaborations,

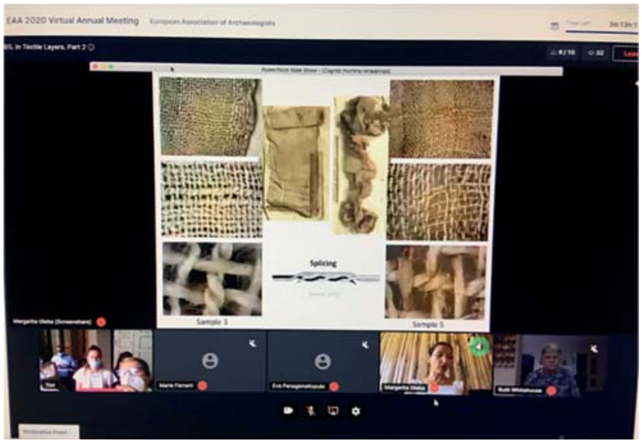

Fig. 7: Session 194-195 In Textile Layers included Margarita Gleba demonstrating differing textile bandages during her presentation on the many layers in Zagreb mummy wrappings (Image: The organisers)

from careful conservation and contextual analysis to specialised analytical techniques, in order to uncover the tiny clues that will provide new knowledge about practices and their ritual role.

Despite the organisation of several timeslots with incisive questions and discussion points and an evening forum on 27 August, the panel would have enjoyed meeting informally and having further conversations about specialist areas in smaller groups during breaks. As co-organisers, we hope to bring all the speakers together in the forthcoming publication of the conference proceedings, and to be able to meet and continue the exchanges about this fascinating topic over the coming years.

The panel would like to thank all the speakers and listeners for choosing to participate in online presentations and providing such interesting content and who, together, offered such a fruitful session. Our gratitude goes to the Soprintendenza Archeologia, Belle Arti e Paesaggio per la Città Metropolitana di Torino, for generously hosting the session in Turin.

The panel is already working on publishing the papers in a book in the first volume of the new British Archaeological Reports (BAR) short series *Textile Archaeology in Egypt and Sudan.*

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By Luise Ørsted Brandt, Elsa Yvanez and Matilde Borla

Skin, Leather, and Hide: Scientific Methods and Novel Approaches to the Study of Archaeological Leather
(Session 421 - 30 August 2020)

This session was organised by Varvara Busova of the Institute for the History of Material Culture, Russia, and Samantha Brown of the Max Planck Institute for the Science of Human History, Germany. It brought together archaeologists, anthropologists, museum specialists, and scientists for a broad discussion on the scientific study of archaeological leather. The papers covered a wide geographical area from Egypt to Mongolia and material which dated from the Bronze Age to the present day.

The study of archaeological leather has the potential to provide important insights into the ways in which ancient communities lived and how their traditions developed in connection with their physicality, community and the surrounding environment. Archaeological skin products are rare finds and their preservation usually depends on very particular and often unpredictable factors. In addition, methods for the scientific research of archaeological skin are dependent on the archaeological context in which these objects were found. This session aimed to bring together specialists focusing on the study of leather objects who are using an array of techniques including proteomic analysis, optical light microscopy, spectral imaging technologies, X-ray techniques, and genetic analysis. The organisers aimed to facilitate a broader discussion about which research methods are most applicable in a given situation, what data can be expected, and how to build effective analysis based on the data obtained by traditional and/or scientific methods.

The session opened with the paper 'Optical microscopy in analyses of late-medieval leather artefacts' by Karolina Blusiewicz. She discussed the use of optical microscopy for the identification of species and topographic origin of skin objects, evaluation of the quality of tanning processes, and determining the specialisation of workshops based on late medieval collections of leather goods and offcuts from small towns in Gdańsk, Pomerania (Poland). Lucy-Anne Skinner shared her paper 'Reverse engineering ancient Egyptian skin-processing methods – from the artefact to the animal source material' in which leather artefacts from arid sites with high levels of preservation were investigated using a variety of techniques, including proteomics, multi-spectral imaging, microscopy, experimental tanning, and leather colouring. Luise Ørsted Brandt examined the differences between the grain pattern analysis and zooarchaeology by mass spectrometry (ZooMS) identifications in her paper 'Leather shoes in Early Danish cities: choices of animal resources and specialisation of crafts in Viking and Medieval Denmark'. In the paper 'Archaeological leather degradation: an experimental approach using ATR-FTIR, Micro DSC, solid state and unilateral NMR', Elena Badea presented different methods that her laboratory uses to analyse the condition of historical and archaeological leather samples in connection with tanning methods. Maria-Cristina Micu, in her paper, 'Characterisation of archaeological leather. A multi-technique approach for a case study involving medieval artefacts from Romania and Ukraine', focused on results they obtained using microscopy (optical and scanning electron microscopy (SEM)), attenuated total reflection coupled with Fourier transform infrared (ATR-FTIR) and X-ray fluorescence (XRF) spectroscopy, thermal microscopy, microDSC (micro differential scanning calorimetry) and PH acidity through the study of 15 archaeological leather samples from Romanian and Ukrainian archaeological sites. Varvara Busova discussed her paper 'Experience of Studying Archaeological Leather from Barrows of the Sayano-Altai Region (Russia) by Scientific Methods. Preliminary Results', and shared her result using ZooMS for an extensive collection of Scythian leather and fur artefacts from barrows from the eighth to the second centuries BCE (fig. 3). The final speaker Kristen Pearson presented her paper 'Skin garments beyond species: integrating ethnoarchaeological and scientific approaches in the analysis of archaeological leather'. She discussed the life history of leather and fur garments in the closets of the modern nomadic pastoralists in Mongolia and how this can inform the understanding of similar garments in the archaeological record. The session concluded with a discussion surrounding the common themes throughout much of the work presented and future opportunities to collaborate and test new scientific

Fig. 8: Session 421 Skin, Leather, and Hide featured a bronze knife in a leather sheath from barrow 2 burial ground Beloe Ozero 4 from the 2013 excavations at Tuva (central Asia) (Image: Courtesy of the Institute for the History of Material Culture of the Russian Academy of Sciences)

methods. The organisers hope that this session can be held again in the future, for new and inspiring projects to be discussed, and for the scientific analysis of leather to be furthered.

By Varvara Busova and Samantha Brown

Weaving mobility: Movement of people, tools, and techniques in the textile archaeology of the ancient Mediterranean
(session 441 - 27 August 2020)
This session was co-organised by Bela Dimova (British School at Athens, Greece), Francesco Meo (University of Salento, Italy) and Alessandro Quercia (Soprintendenza archeologia belle arti e paesaggio per la città metropolitana di Torino, Italy). It focused on how the study of tools, raw materials, and techniques for textile production can reveal the movement of people, the circulation of goods, and the exchange of technologies, and ideas in the Mediterranean area. Textiles are excellent exchange goods, being durable, portable, and highly valuable (both as utilitarian and luxury objects). Textile makers also moved across the ancient Mediterranean. Written sources from the Bronze Age onwards document both free and forced mobility of textile workers. Mobility took different forms, such as individuals marrying into another community, families or larger groups moving together to settle somewhere new willingly or as slaves, captives, or refugees fleeing war, environmental crisis or economic hardship. In the absence of written sources, it is not certain how people moved but archaeological data enable the analysis of the direction, scale, timing, and consequences of mobility. Tools for weaving and spinning are especially suitable for tracing and analysing networks of movement on a regional scale.
Seven papers were offered during the session, with particular attention to the Aegean and east Mediterranean in pre-classical times. The keynote speaker Lin Foxhall (University of Liverpool) introduced the session with a broad research perspective that emphasised the high potential of the study of textile tools, fabric technologies and fabrics for a better knowledge and comprehension of human mobility and technological transfer. Janet Levy (Ben Gurion University, Israel) analysed the emergence of textile activities, with particular focus on the production of linen garments, in mid-fifth millennium BCE, as a hypothetical consequence of mobility of people and technology from Anatolia and Iran, as attested by genetic evidence. Kalliope Sarri's paper (Centre for Textile Research, University of Copenhagen) addressed the role that textile decoration and iconography has in determining the origin and the movement of fabrics and in detecting the locality and mobility of people and ideas during the Aegean Neolithic and Bronze Age periods. Mobility of spinners in the Prehistoric Aegean, a phenomenon also attested by the textual evidence, was the theme of Sophia Vakirtzi's contribution (Archaeological Resources Fund, Hellenic Ministry of Culture) that analysed the morphological variations and clay fabrics of spindle whorls, which in the case of Akrotiri reveal different patterns of provenance than the loom weights. In the case of the Prehistoric settlement of Koukonisi (Lemnos), the later introduction of the warp-weighted loom was related by Tita Boloti's talk (Academy of Athens, Greece) to the mobility of foreign people (from a Cretan textile tradition) or to the diffusion of 'foreign' technologies. By analysing the remarkable collection of casts in the Corpus of the Minoan and Mycenaean Seals in Heidelberg, Agata Ulanowska (University of Warsaw, Poland) examined the textile imprints that provide information on production techniques of threads, cords and ropes, as well as on the uses of textile products in sealing practices. The session's final paper delivered by Gabriella Longhitano (University of Catania, Italy) offered the opportunity for a discussion on networks of people (and craftspeople) and transfer of textile technologies in ancient Sicily from the Final Bronze Age to the Archaic period, through the study of morphological, dimensional and clay variations of loom weights from a series of sites.

By Bela Dimova, Francesco Meo and Alessandro Quercia

Multidisciplinary approaches to identify and preserve fibres and textile products in the archaeological field
(session 445 - 28 August 2020)
This session was organised by Francesca Coletti and Vanessa Forte (Sapienza University of Rome) together with Christina Margariti (Directorate of Conservation of the Hellenic Ministry of Culture) and Stella Spantidaki (Hellenic Centre for Research and Conservation of Archaeological Textiles, Athens - ARTEX). The organisers aimed to bring together colleagues who use different approaches for the identification and preservation of ancient textiles and fibres to provide an opportunity to learn about new advances in traditional techniques, the application of innovative techniques, and to communicate any questions, challenges and solutions on this topic.
The session consisted of seven talks and two posters, with the latter having five-minute slots towards the end. Despite the expected minor technical issues, the

Fig. 9: A snapshot of virtual session 445 *Multidisciplinary approaches* at the EAA 2020 conference (Image: Stella Spantidaki)

session was ran smoothly and all the presentations were communicated successfully (fig. 4). The introduction by Christina Margariti underlined the significance of instrumental scientific analysis to the study of archaeological textiles, which are very often particularly challenging finds to investigate, as they are generally made of organic material, sensitive to several post depositional processes.

The session was divided in two thematic areas. The first focused on the state of preservation of archaeological textiles through a variety of case studies: the discovery and study of a rare early Mycenaean cloth from tomb 10 at ancient Eleon in Boeotia (Bela Dimova and Brendan Burke), the promising study of the exceptionally well preserved silk garments from a second century CE tomb in Mongolia (Isaline Saunier, Vincent Bernard, Dominique Joly, Bayarkhuu Noost, Turbat Tsagaan, Antoine Zasso and Sebastien Lepetz), the effects of carbonisation on the morphology of archaeological textile fibres from Pompeii (F. Francesca Coletti, Christina Margariti and Stella Spantidaki), and the potential of scanning electron microscopy (SEM) to the study of mineralised textiles from Roman Venetia (Maria Stella Busana and Margarita Gleba).

The second part focused on instrumental and experimental scientific analysis. It started with a presentation explaining the potential of the protein mass spectrometry technique applied to the identification of silk fibres and the wealth of information one can obtain from it (Boyoung Lee, Elisabete Pires, Caroline Solazzo, Mark Pollard and James McCullagh). The study and identification of perished fibres and cordage was attempted by the examination of seals in direct contact to object from Bronze Age Greece (Agata Ullanowska). Finally, the relationship between Roman fibres and textile tools in in north-eastern Italy was explained, in the context of the TEXPA (Textile EXPerimental Archaeology) experimental project (Maria Stella Busana, Denis Francisi and Agnese Lena).

The session concluded with two poster presentations. The first discussed the results of an experimental study combining use wear and residue analysis applied to textile tools (Vanessa Forte, Francesca Coletti, Allesandra Celant, Carlo Virili, Allesandro Jaja, Cristina Lemorini), and the second focused on the characterisation of the condition of ancient textiles to ensure their preservation (Ilaria Serafini, Francesca Coletti, Allesandro Ciccola, Flamina Vincenti, Armandodoriano Bianco, Camilla Montesano, Paolo Postorino, Marco Galli, Roberta Curini).

The EAA offers anyone interested the chance to watch the presentations online. Contributions that receive the authors' consent will be uploaded on the EAA YouTube channel in the coming months.

By Francesca Coletti, Vanessa Forte, Christina Margariti and Stella Spantidaki

Recent publications

Burial textiles: Textile bits and pieces in Central Sweden, AD 500-800 **(2020) by Anita Malmius. Theses and papers in archaeology B. Stockholm: Department of Archaeology and Classical Studies, Stockholm University Press**

This thesis concerns the role and use of archaeological textiles (AT) deposited in inhumation and cremation burials in Sweden dating from 500–800 AD. The AT are studied in their burial context, including all other grave goods, emphasizing that they were as important as a source for understanding society in prehistory as they are today. Textiles take a long time to produce, from the collection and gathering of raw materials such as wool, flax, silk, seaweed, birch bark, bast, bulrush, down and feathers and dyestuffs, to spinning, fulling, dyeing, weaving and skin and fur preparation, and finally to garment production. Furthermore, weaving and other types of handicraft demand logical thinking and creativity, in order to transform an idea into reality.

Despite the fact that textile reconstructions are so time-consuming and require both knowledge and know-how, reconstructions of prehistoric clothing in publications or in museums are often based on very few facts, and these are mostly obtained from the small fragments of prehistoric burial textiles that have been preserved.

A total of 108 Swedish graves containing AT are discussed in this thesis, dating from the Bronze Age up to the beginning of the Viking Age. During the period in question there was a gradual change in the material culture and burial customs, although two major changes in AT can be observed, around 550 and 800 AD. Around 550 AD a new elite boat-burial tradition started in the Mälaren Valley in Uppland in which the textiles included new non-figurative patterned fabrics such as soumak, honeycomb and warp or weft float. These fabrics occurred most frequently in the Early and Middle Merovingian Periods, and many of them probably came from the Continent as gifts, exchange goods, status articles, etc. It is also possible that skilled, imaginative weavers in Sweden invented some of the textile techniques.

ISSN 1102-1195

Free download: http://su.diva-portal.org/smash/record.jsf?pid=diva2%3A1375949&dswid=-1538

Clothing the Past: Surviving Garments from Early Medieval to Early Modern Western Europe **(2018) by Elizabeth Coatsworth and Gale Owen-Crocker**

An astonishing number of medieval garments survive, more-or-less complete. Here the authors present 100 items, ranging from homely to princely. The book's wide-ranging introduction discusses the circumstances in which garments have survived to the present; sets and collections; constructional and decorative techniques; iconography; inscriptions on garments; style and fashion. Detailed descriptions and discussions explain technique and ornament, investigate alleged associations with famous people (many of them spurious) and demonstrate, even when there are no known associations, how a garment may reveal its own biography: a story that can include repair, remaking, recycling; burial, resurrection and veneration; accidental loss or deliberate deposition.

ISBN-13: 978-90-04-35216-2

Price: EUR 215

https://brill.com/view/title/27148

Dress Matters: Clothes and social order in Tallinn 1600-1700 **(2020) by Astrid Pajur. Studia Historica Upsaliensia 269, Uppsala: Acta Universitatis Upsaliensis. Uppsala University Press**

This dissertation explores the relationship of clothes and social order in early modern Europe. The period has often been characterised as inert and immobile, with especially middling and poorer people living in a sartorially drab world, but a number of historians have demonstrated that it was also a period of profound material change, with consumer demand, democratisation of fashion and global trade engendering cosmopolitan sensibilities earlier than thought. Based on an examination of seventeenth-century Tallinn, I analyse how social order influenced sartorial expression and how clothes shaped order through affirmation, negotiation and subversion.

The interaction between clothes and social order was complex, with both elements acting as moving parts within the ideal. While on the normative level, clothes were thought to have the primary function of visualising order, on the everyday level clothes could often obscure order and complicate the desired visualisation. Through the circulation of clothing as fungible items and as mediators of intricate emotions and social relations, much of clothes' complexity in the seventeenth century stemmed from their resistance to being anchored to a single function, whether manifesting status, demonstrating appreciation or helping poor people survive. The results arrived at have two key implications. Firstly, Tallinn, while undeniably an unequal and hierarchical society, was hardly static. The inherent dynamism suggests that social order, rather than being considered as an independent structure, should be viewed as negotiable and requiring the participation of people, space and materiality. Secondly, the study problematises the chronology that has a modern consumer society gradually replacing the ancien régime of fashion. Rather than an uncomplicated narrative of progress, I argue that aspects of both systems co-existed in parallel within a society that did not necessarily demonstrate any of the other tendencies assumed by proponents of 'consumer revolution'.
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ISBN-13: 978-91-513-0942-2
Free download: http://www.diva-portal.org/smash/record.jsf?pid=diva2%3A1423099&dswid=-4230

***Egypt as a textile hub. Textile interrelationships in the 1st millennium AD, Proceedings of the 10th conference of the research group 'Textiles from the Nile Valley'* (2019) edited by Antoine de Moor, Cäcilia Fluck, Petra Linscheid. Tielt, Lannoo publishers**

This book is the 7th volume presenting the results of the 'Textiles from the Nile Valley' conferences, taking place every two years at the HeadquARTers of the Katoen Natie Company at Antwerp, Belgium.

Most essays in the present book are concerned with textile finds from current or little known excavations in Dynastic, Roman, Late Antique and Early Islamic Egypt and neighbouring countries (Badari, Tarkan, El Deir, Antaeopolis, Deir el Banat, Ghirza) and their interrelationships. Other contributions introduce unknown textiles in the large collections of the Musée du Louvre, Paris and the State Hermitage, St. Petersburg. Further articles present hitherto unknown collections, namely in the museums of Ljubljana, Cracow, Chemnitz and Heidelberg. The volume is completed by investigations on special items of costume: sleeveless tunics, large woollen tunics, sprang hairnets and soldier´s cloaks.

The special attraction of the book are the the full-coloured and large size illustrations.
ISBN-13: 978-94-014-6469-7
Euro: 50,-
https://danae.vermeulen@katoennatie.com

***Begravd på Birka - tre århundraden, fyra vikingaliv* (2020) by Linda Wåhlander (ed.)**

Exhibition catalogue for the exhibition at the Birka Museum on Bjørkö in Sweden 2020-2022 (2020). 195 pages, text in Swedish.
ISBN-13: 978-91-519-4482-1
Price: SEK 300
http://myhoney.se/shop/index.php?main_page=product_info&cPath=136_140&products_id=1165

***Khirbet Qumrân and Aïn Feshkha IVA: Qumrân Cave 11Q Archaeology and New Scroll Fragments. Novum Testamentum Et Orbis Antiquus* (2019) edited by Marcello Fidanzio, Jean-Baptiste Humbert and Emanuel Tov. Series Archaeologica (Book 8). Vandenhoeck & Ruprecht.**

Qumran Cave 11Q was discovered by Bedouin in 1956. In the cave, remains of around 30 Dead Sea Scrolls were found, a few of them in very good state of preservation (the Temple Scroll, the Psalm Scroll, the Paleo Leviticus Scroll, and the Targum Job Scroll). The cave was excavated by Roland de Vaux (Ecole Biblique et Archeologique Francaise, Jerusalem) and Gerald L. Harding (Department of Antiquities of Jordan) in 1956; later by Joseph Patrich (University of Haifa) in 1988, and by Marcello Fidanzio and Dan Bahat (ISCAB FTL and Universita della Svizzera Italiana) in 2017. Due to Roland de Vaux's premature death, the archaeology of Cave 11Q has never been published. This volume presents the final report on the 1956, 1988 and 2017 excavations at Cave 11Q. Next to discussing the physical characteristics and stratigraphy of the cave and offering a full analysis of non-textual finds, the volume for the first time presents many tiny manuscript fragments found in storerooms during recent work. These fragments, most of which were collected during 1956 excavation, have not been known until now. The volume, therefore, offers the final report of Cave 11Q excavations as well as the editio princeps of the new fragments, followed by a reevaluation of the entire set of texts found in this famous cave.
ISBN-10: 3525564694
ISBN-13: 978-3525564691
343,11 $

https://www.amazon.com/Khirbet-Qumran-Ain-Feshkha-Archaeologica/dp/3525564694

***Lauchheim I. Beitrage zur Computertomographie als Dokumentationsmethode, zur Textilarchäologie und zur Bestattungspraxis in der frühen Merowingerzeit* (2020) by Krausse Dirk, Brather – Sebastian – Scheschkewitz, Jonathan – Ebinger, Nicole – Stork, Ingo (Hrsg.). Wiesbaden: Reichert.**

German publication

In Lauchheim (Ostalbkreis) wurde zwischen 1986 und 1996 der mit rund 1300 Gräbern des späten 5. bis späten 7. Jahrhundert bislang größte bekannte merowingerzeitliche Bestattungsplatz Südwestdeutschlands vollständig ausgegraben. Seit 2009 sind die Bestattungen aus Lauchheim Gegenstand eines multidisziplinären Forschungsprojekts, das sich durch die Anwendung innovativer Dokumentationsmethoden mit dem Anspruch einer möglichst vollständigen Datenerfassung auszeichnet. Die Beiträge dieses Sammelbands widmen sich zwei Grundpfeilern des Projekts: der methodisch wegweisenden, zerstörungsfreien Dokumentation von über 330 Blockbergungen und mehr als 100 Einzelobjekten mittels Mikro-Computertomographie sowie dem multidisziplinären, die Gesamtheit des Grabbefundes betrachtenden Auswertungsansatz. Im Rahmen des Projektes bot sich außerdem die Gelegenheit, erstmals sämtliche erhaltenen organischen Artefakte eines großen frühmittelalterlichen Friedhofes zu erfassen und so die Ergebnisse älterer textilarchäologischer Untersuchungen an auszugsweise erfassten Quellenbeständen maßgeblich zu ergänzen. Wegen der hohen Anzahl organischer Funde mussten gängige Untersuchungs- und Dokumentationsmethoden maßgeblich modifiziert werden.

Den Auftakt des Bandes bildet die Dissertation von Jörg Stelzner, in der die Computertomographie als Untersuchungs- und Dokumentationsmethode für eine große Anzahl von Blockbergungen und einzeln geborgenen Funden überprüft wurde.

Zwei Beiträge (B. Höke, J. Banck-Burgess et al.) widmen sich der Baumsargbestattung Grab 974, die zusammen mit einigen weiteren Gräbern des späten 5. Jahrhunderts am Anfang der Belegung des großen Bestattungsplatzes „Wasserfurche" steht. Die Ausstattung des Frauengrabes, zu der auch verschiedene bemerkenswerte Textilien gehörten, spiegelt eine gehobene Lebensweise und wirft Schlaglichter auf eine weit vernetzte materielle Kultur der frühen Merowingerzeit. Trotz einer stark vergangenen Organik mit Schichtabfolgen, die häufig nur wenige Millimetern stark waren, ließen sich die wesentliche Textilfunde und -befunde in der Baumsargbestattung 974 über Mikro-Schichtabfolgen nachweisen. Dazu zählen gesonderte Textilbeigaben; eine gepolsterte Decke, die die Bestattung abdeckte; der Nachweis von Seidentaft im gesamten Körperbereich; gepolsterte Bundschuhe oder Befundbeobachtungen zur Präsentation der Toten im Grab.

Den Abschluss bildet eine Betrachtung von Ch. Peek zu den Möglichkeiten und Grenzen textilarchäologischer Untersuchungen an organischen Artefakten aus dem Gräberfeld von Lauchheim.

ISBN-13: 978-395490-359-7

45,00 €

https://reichert-verlag.de/schlagworte/lauchheim_schlagwort/9783954903597_lauchheim_i-detail

***Llangorse Crannog: The Excavation of an Early Medieval Royal Site in the Kingdom of Brycheiniog* (2020) edited by Alan Lane and Mark Redknap. Oxford: Oxbow Books.**

The crannog on Llangorse Lake near Brecon in mid Wales was discovered in 1867 and first excavated in 1869 by two local antiquaries, Edgar and Henry Dumbleton, who published their findings over the next four years. In 1988 dendrochronological dates from submerged palisade planks established its construction in the ninth century, and a combined off- and on-shore investigation of the site was started as a joint project between Cardiff University and Amgueddfa Cymru - National Museum Wales. The subsequent surveys and excavation (1989-1994, 2004) resulted in the recovery of a remarkable time capsule of life in the late ninth and tenth century, on the only crannog yet identified in Wales. This publication re-examines the early investigations, describes in detail the anatomy of the crannog mound and its construction, and the material culture found. The crannog's treasures include early medieval secular and religious metalwork, evidence for manufacture, the largest depository of early medieval carpentry in Wales and a remarkable richly embroidered silk and linen textile which is fully analysed and placed in context. The crannog's place in Welsh history is explored, as a royal llys ('court') within the kingdom of Brycheiniog, as well as its subsequent significance of the crannog in local traditions and its post-medieval occupation during a riotous dispute in the reign Elizabeth I. The cultural affinities of the crannog and its material culture is assessed, as are their relationship

to origin myths for the kingdom, and to probable links with early medieval Ireland. The folk tales associated with the lake are explored, in a book that brings together archaeology, history, myths and legends, underwater and terrestrial archaeology.
ISBN-10: 1789253063
ISBN-13: 978-1789253061
£33.29
https://www.oxbowbooks.com/oxbow/llangorse-crannog.html

***Textilfunde aus der Seeufersiedlung See am Mondsee* (2020) by Veronika Holzer. In: K. Grömer und A. Kern (Hrsg.) Prähistorische Forschungen Online 10, Wien: Verlag des Naturhistorischen Museums Wien**
German publication
The discovery of the pile dwellings in See am Mondsee (Upper Austria by Matthäus Much on March 19, 1872 constitutes an important event in the research on pile dwellings in Austria. This settlement, the eponymous site of the Mondsee group and therefore an important archaeological site in the Neolithic period, has been in research focus for almost 150 years. Since 2011 the archeological site has been a part of the international UNESCO World Heritage of Prehistoric Pile Dwellings around the Alps, which is only one reason for this particular focus. Its substantial extension, prominent position at the outflow of Lake Mondsee, its continued use over a long period of time and the rich inventory of archeological artefacts make the importance of See am Mondsee in research history evident.
It is ever more delightful that after quite some time the publication of "Textilfunde aus der Seeufersiedlung See am Mondsee" (Textile finds from the lakeside settlement See am Mondsee) adds another piece to the scientific mosaic about the history of pile dwellings in the Salzkammergut.
ISSN: 2708-5708
Free download: http://verlag.nhm-wien.ac.at/PFon/PFon_10.pdf

***Textile Conservation: Advances in Practice* (2020) by Frances Lennard and Patricia Ewer. Routledge**
Textile Conservation: Advances in Practice demonstrates the development in the role and practice of the textile conservator and captures the current diversity of textile conservators' work.
The book focuses on four major factors which have influenced development in textile conservation practice since the 1980s: the changing context, an evolution in the way conservators think about objects, the greater involvement of stakeholders, and technical developments. These are all integral to effective conservation decision-making.
The publication includes case studies from the UK, USA and mainland Europe and Asia. It asesses the conservation of objects in some of the world's major cultural institutions. The book is highly illustrated in full colour to show the effect of conservation in practice Textile Conservation is a reference manual for textile conservators, textile conservation students and museum and heritage professionals.
ISBN-10: 0367606240
ISBN-13: 978-0367606244
$38.95

***Textiles and Gender in Antiquity from the Orient to the Mediterranean* (2020) edited by Mary Harlow, C. Michel and L. Quillien. London: Bloomsbury.**
This volume looks at how the issues of textiles and gender intertwine across three millennia in antiquity and examines continuities and differences across time and space – with surprising resonances for the modern world. The interplay of gender, identity, textile production and use is notable on many levels, from the question of who was involved in the transformation of raw materials into fabric at one end, to the wearing of garments and the construction of identity at the other. Textile production has often been considered to follow a linear trajectory from a domestic (female) activity to a more 'commercial' or 'industrial' (male-centred) mode of production. In reality, many modes of production co-existed and the making of textiles is not so easily grafted onto the labour of one sex or the other. Similarly, textiles once transformed into garments are often of 'unisex' shape but worn to express the gender of the wearer.
As shown by the detailed textual source material and the rich illustrations in this volume, dress and gender are intimately linked in the visual and written records of antiquity. The contributors show how it is common practice in both art and literature not only to use particular garments to characterize one sex or the other, but also to undermine characterizations by suggesting that they display features usually associated with the opposite gender.
ISBN-13: 978-1350141490
£84.00
https://www.bloomsbury.com/uk/textiles-and-gender-in-antiquity-9781350141490/

***Textile Workers. Skills, Labour and Status of Textile Craftspeople Between the Prehistoric Aegean and the Ancient Near East* (2020) edited by Luise Quillen and**

Kalliope Sarri. Proceedings of the Workshop held at 10th ICAANE in Vienna, April 2016. OREA - Oriental and European Archaeology 13. Vienna: Verlag der Österreichischen Akademie der Wissenschaften
Studies on ancient textiles currently know a considerable growth. This volume contributes to the field, focusing on craftmanship. By surveying various cultures of the Ancient Near East and the Aegean, the compiled articles offer an overview of textile workers in action from the Stone Age to Late Antiquity. Combining various approaches such as archaeology, text studies, and experimentation, the contributions explore the social status, gender, age, and working conditions of the textile workers. Moreover, they investigate their intellectual capability, through a study of the acquisition, performance and transmission of skills. This collective work aims at opening a new perspective in the field of textile studies, in particular in the history of textile crafts in ancient societies.
ISBN-13: 978-3-7001-8138-5
€ 100,00
https://austriaca.at/8138-5?frames=yes
or https://verlag.oeaw.ac.at

***The Competition of Fibres. Early Textile Production in Western Asia, South-East and Central Europe (10,000-500 BC)* (2020) edited by Wolfram Scheir and Susan Pollock. International workshop Berlin, 8-10 March 2017. Ancient Textiles Series 36, Oxbow Books, Oxford & Philadelphia**
The central issues discussed in this new collected work in the highly successful ancient textiles series are the relationships between fibre resources and availability on the one hand and the ways those resources were exploited to produce textiles on the other. Technological and economic practices - for example, the strategies by which raw materials were acquired and prepared - in the production of textiles play a major role in the papers collected here.
Contributions investigate the beginnings of wool use in western Asia and southeastern Europe. The importance of wool in considerations of early textiles is due to at least two factors. First, both wild as well as some domesticated sheep are characterized by a hairy rather than a woolly coat. This raises the question of when and where woolly sheep emerged, a question that has not up to now been resolvable by genetic or other biological analyses. Second, wool as a fibre has played a major role both economically and socially in both western Asian and European societies from as early as the 3rd millennium BCE in Mesopotamia, and it continues to do so, in different ways, up to the modern day. Despite the importance of wool as a fibre resource contributors demonstrate clearly that its development and use can only be properly addressed in the context of a consideration of other fibres, both plant and animal. Only within a framework that takes into account historically and regionally variable strategies of procurement, processing, and the products of different types of fibres is it possible to gain real insights into the changing roles played by fibres and textiles in the lives of people in different places and times in the past.
With relatively rare, albeit sometimes spectacular exceptions, archaeological contexts offer only poor conditions of preservation for textiles. As a result, archaeologists are dependent on indirect or proxy indicators such as textile tools (e.g., loom weights, spindle whorls) and the analysis of faunal remains to explore a range of such proxies and methods by which they may be analyzed and evaluated in order to contribute to an understanding of fibre and textile production and use in the past.
ISBN-13: 978-1789254297
$41.25
https://www.oxbowbooks.com/dbbc/the-competition-of-fibres.html

***The Fabric of Civilization: How Textiles Made the World* (2020) by Virginia Postrel. Basic books**
From Paleolithic flax to 3D knitting, a global history of textiles and the world they made
The story of humanity is the story of textiles -- as old as civilization itself. Since the first thread was spun, the need for textiles has driven technology, business, politics, and culture.
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PhDs

In January 2020 **Anita Malmius** was awarded a PhD by University of Stockholm, Sweden for her dissertation *Burial textiles. Textile bits and pieces in Central Sweden, AD 500-800.* The publication can be downloaded at http://su.diva-portal.org/smash/record.jsf?pid=diva2%3A1375949&dswid=-1538

In 2020 **Astrid Pajur** was awarded a PhD by the University of Uppsala, Sweden for her dissertation *Dress Matters: Clothes and social order in Talinn 1600-1700.* The dissertation is published at Studia Historica Upsaliensis.

In August 2020 **Rosannguaq Rossen** was awarded a PhD by Ilisimatusarfik/University of Greenland for her dissertation *Branding igennem moden - den vestgrønlandske kvindedragt som symbol* (Branding through fashion. The female costume of West Greenland as symbol (text only in Danish)). The defense can be seen at: https://www.youtube.com/watch?v=q4Q-1mlrcUA

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Guidelines to Authors

The *Archaeological Textiles Review* aims to provide a source of information relating to all aspects of archaeological textiles. Archaeological textiles 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 accounts of work in progress. This general category includes research/ activities related to archaeological textiles from recent excavations or in museums/galleries. Projects may encompass technology and analysis, experimental archaeology, documentation, exhibition, conservation and storage. These contributions can be in the form of notes or longer feature articles.

3. Contributions may include announcements and reviews of exhibitions, seminars, conferences, special courses and lectures, information relating to current projects and any queries concerning the study of archaeological textiles. Bibliographical information on new books is particularly welcome.

4. The authors' guidelines can be found at www. atnfriends.com. Please check the current guidelines as they are updated regularly.

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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 imbedded in text. Colour images are welcome. Only illustrations with cleared copyright ownership, permission for internet publication, and full name of the photographer can be used.

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