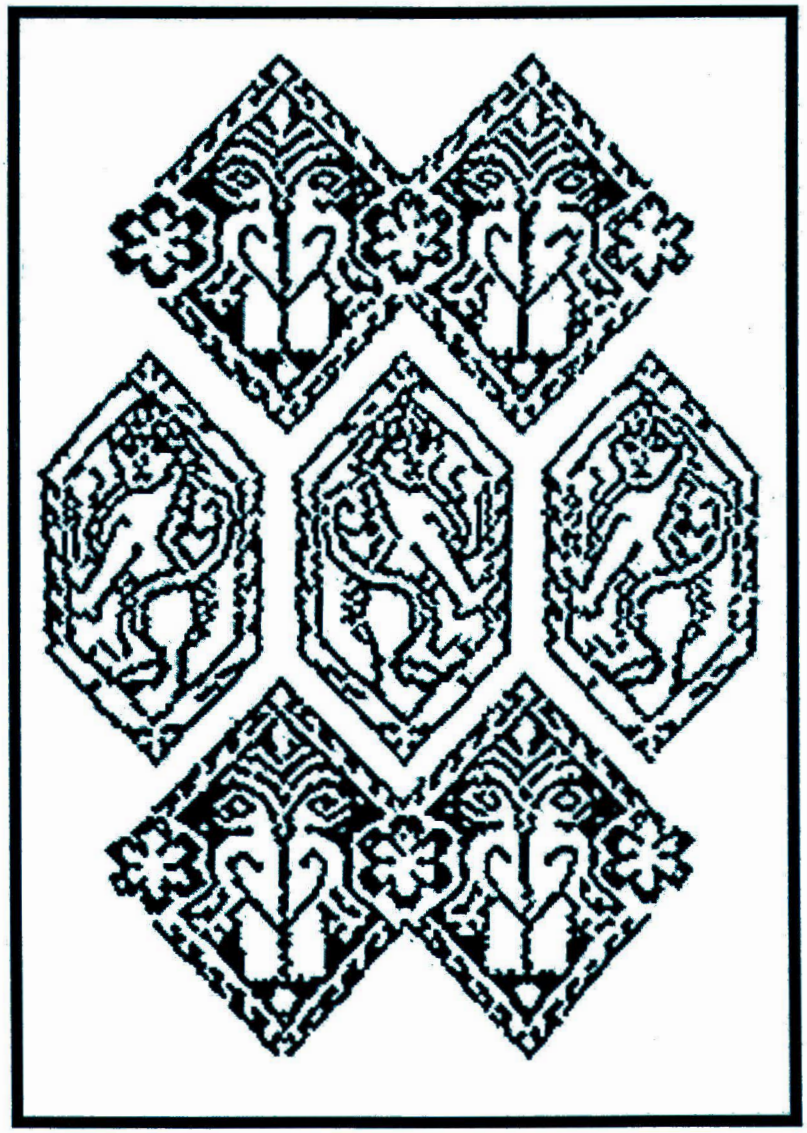
Archaeological Textiles Newsletter



Pattern of 13th century headcloth of Rudolph I of Hapsburg, King of Bohemia

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From the Editorial Board

Editorial

This number of ***Archaeological Textiles Newsletter*** deviates from the customary format and contains no notes, announcements, reviews of conferences or source materials. In an effort to bring the ***Newsletter*** back up to production schedule energies have concentrated on working through the backlog of articles which have accumulated during the past year.

Although ***ATN*** began its career as an instrument of short, informative pieces on archaeological textiles, regular readers have undoubtedly noticed over the past few years the increasing length and depth of articles. This is especially the case in the current number.

The present number opens with the first of two articles describing the funerary garments of the Hapsburgs buried at Prague Castle. As ***ATN*** has already published several articles on the clothing from royal burials, it is exciting to have this supplemented by current research being carried out in Eastern Europe.

Projects detailing the reconstruction of ancient costumes for use in museum exhibitions and public outreach programmes have become regular features in ***ATN*** as well. Taken as a group, these articles put ***ATN*** in the forefront as a forum for this very current trend in museum education. In this number, the production of costumes for a Viking-age chieftain and his lady for the Ribes Vikinger museum in Denmark is discussed.

Michael Ryder comments about the lack of finds of textiles at the Iron Age hillfort of Danebury (UK). Comparing the finds of sheep bones and textile implements with those found at other Iron Age sites, he ventures a suggestion as to the use of these implements and the type of fleece present. He notes the need for research into the spinning of different types of fleece with different weights of spindle whorl as an aid in interpreting finds of whorls at archaeological sites. Hopefully, current work being conducted by Eva Andersson of Lund together with the Textile Workshop at the Historical-Archaeological Research Centre at Lejre, Denmark, will shed some light on this.

Finally, an article addressing storage of archaeological textiles. It was the hope of the current Editor when taking over the reins of ***ATN*** in 1994 to include more reports of work addressing the preservation of excavated material, without which this newsletter would not exist. Fulfilling this hope has been less than successful. The rehousing of the collection of medieval archaeological textiles excavated from the cultural layers in the city of Trondheim, Norway, instigated the search for a different packaging system. A new system based upon polystyrene crystal boxes is presented.

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Analysis

Textiles from the Grave of Rudolph I of Hapsburg, King of Bohemia, Called Kaše

In December 1991, as part of a programme of examination and conservation of the remains of important historic individuals, the tomb in the Royal Vault in St. Vitus' Cathedral with the remains of Rudolph of Hapsburg, Duke of Austria (d. 1290), Rudolph I of Hapsburg, King of Bohemia called Kaše ("Porridge", d. 1307), and Archduchess Eleanora, daughter of Maximilian II (d. 1580) was opened. These remains had shared a common coffin since 1935; previously they had lain separately.

Both Rudolphs, who are closely associated with the history of Bohemia, were originally buried somewhere in the central area of the Roman Basilica of St. Vitus at Prague Castle. In 1373, they were transferred to the Chapel of Saints Simon and Jude in the newly built Gothic Cathedral of St. Vitus. Both graves were marked with lead plates at that time. The chapel, however, was later consecreated to the Holy Rood, and as the original name became forgotten, so too was the resting place of the two Rudolphs.

The graves were rediscovered by accident in 1870. From the first wooden coffin, a sword was recovered from Rudolph of Hapsburg, Duke of Austria. The remains of the skeleton and other items had already completely deteriorated. In the second coffin, that of Rudolph I of Hapsburg, King of Bohemia, called Kaše, fragments of bones were found together with textiles and gilded silver funerary coronation jewels.

After the remains and textiles were examined, they were reburied, but the inscription plates, coronation jewels and sword were not. The grave was opened again in 1929, and in 1935, both the Hapsburgs and Archduchess Eleanora were reburied in a divided tin coffin which was placed in the Royal Vault in St. Vitus Cathedral.

In 1991, the grave was opened for the last time as part of a larger anthropological research project. Upon completion, the remains were placed back in the tomb in the Royal Vault, but without the textiles. Closer examination revealed that the textile fragments represented an exceptionally valuable find, because they belonged to the Bohemian king, who died at the beginning of the 14th century. The office of the President of the Czech Republic engaged the W. Abegg Foundation in Switzerland for collaboration in the garments' restoration.

Before the textiles were taken to Switzerland, they were submitted to archival, historical, art historical and textile technological analysis. To protect all who came in contact with the textiles during the project, microbiological analysis of the fragments was carried out. Results indicated the presence of some pathogenic fungi and microorganisms. Appropriate protection was provided for the researchers.

The textile technological analysis revealed six different fabric types among the textiles. Two were made by the lampas technique. A golden pattern was woven with leather laces, with the outer side gilded and the reverse silvered. The ground of the fabric was originally a light natural colour. The first fabric was decorated with motifs of water birds with their heads turned to the ground, alternating left and right, and holding a twig in their beaks. The other fabric was decorated with motifs of Chinese dragons and clouds. Both fabrics were woven in Central Asia in the late 13th or early 14th century, and the male costume - tunic, surcoat and cloak - was constructed from these.

The third fabric was samitum with a silver patterned weft with a linen warp, originally in red and yellow. The fabric was decorated with lines of regularly re-

Figure 1 Patterned fabric of shroud and headcloth.

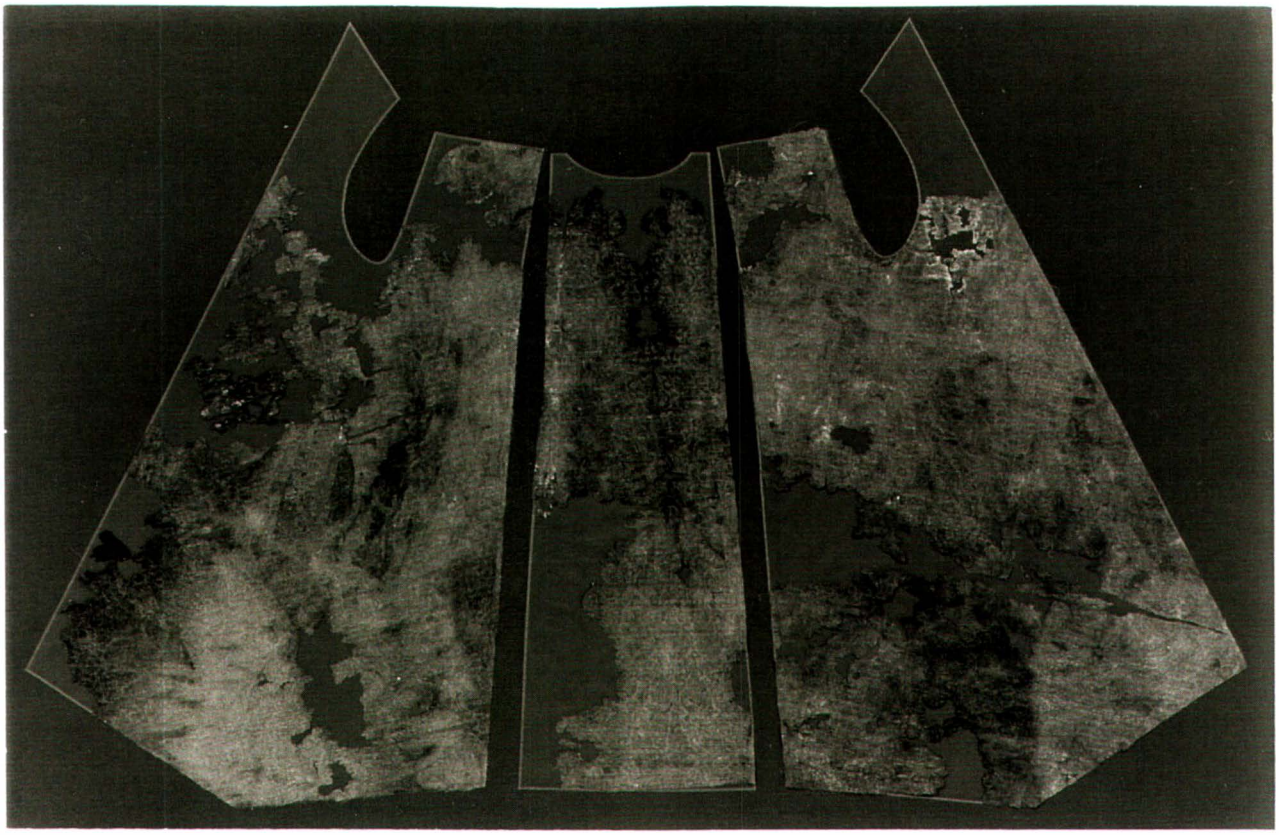

Figure 2 The original surcoat of Rudolph I.

peated rhombuses with birds and hexagons and the figure of a leaping lion (Fig 1). The absence of any cut edges led to the conclusion that this was the shroud. In comparison with other similar fabrics, it was identified as Spanish in origin from the second half of the 13th century.

The three remaining fabrics were silk and without any decoration. The first was used for a pillow, the second served for the lining of the tunic and surcoat and the third formed a cap to wear beneath the crown.

Due to the extreme brittleness of the original fabrics, it was necessary to flatten the garments into their assumed shape on panels covered by glass sheets, and make copies of them. The copies were constructed from fabrics with both Central Asian motifs, but these were printed, not woven.

The dead Bohemian king, Rudolph I, wore an almost complete male costume: tunic, surcoat and cloak. The cloak had a semicircular shape, with a tail at the back. The cloak was sewn from the Central Asian

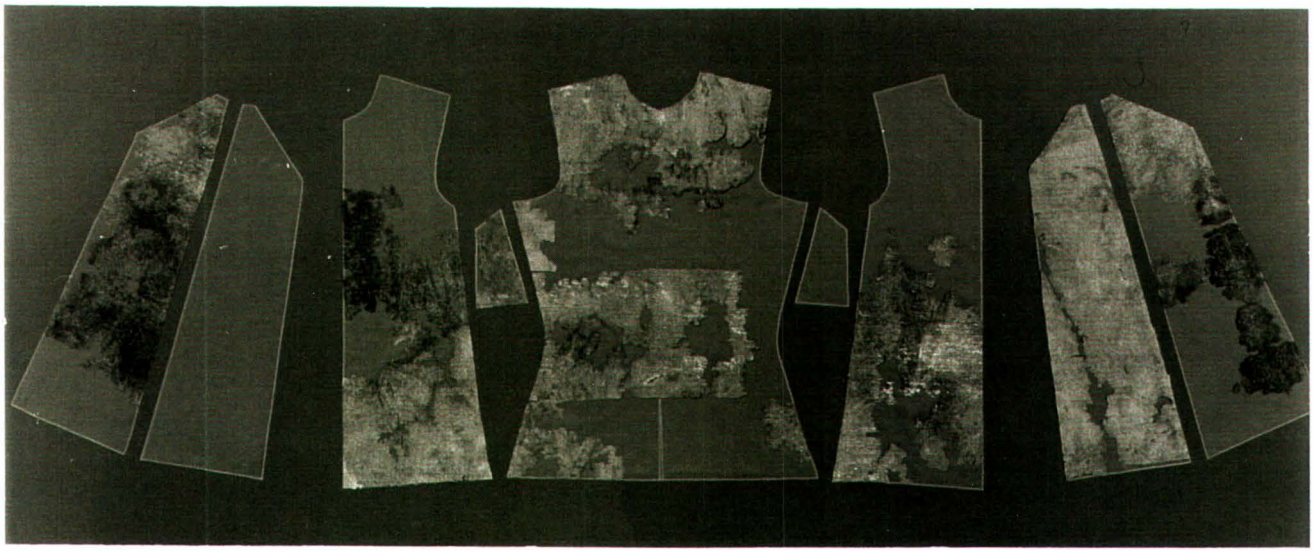

Figure 3 The original tunic of Rudolph I.

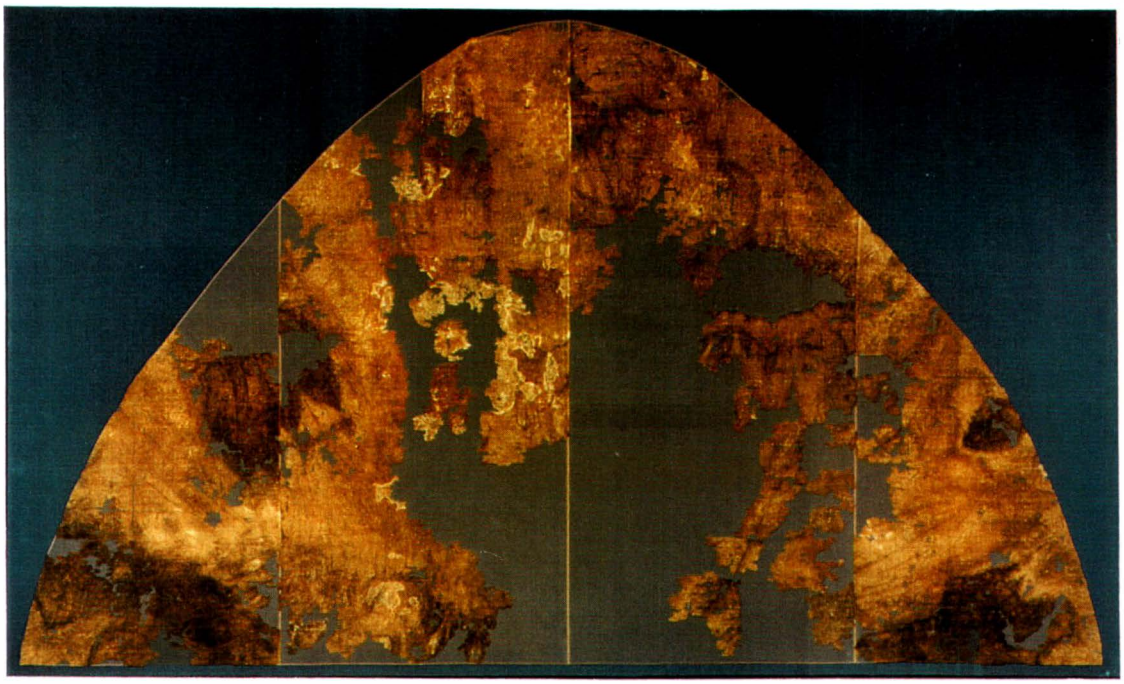

Figure 4 The original cloak of Rudolph I.

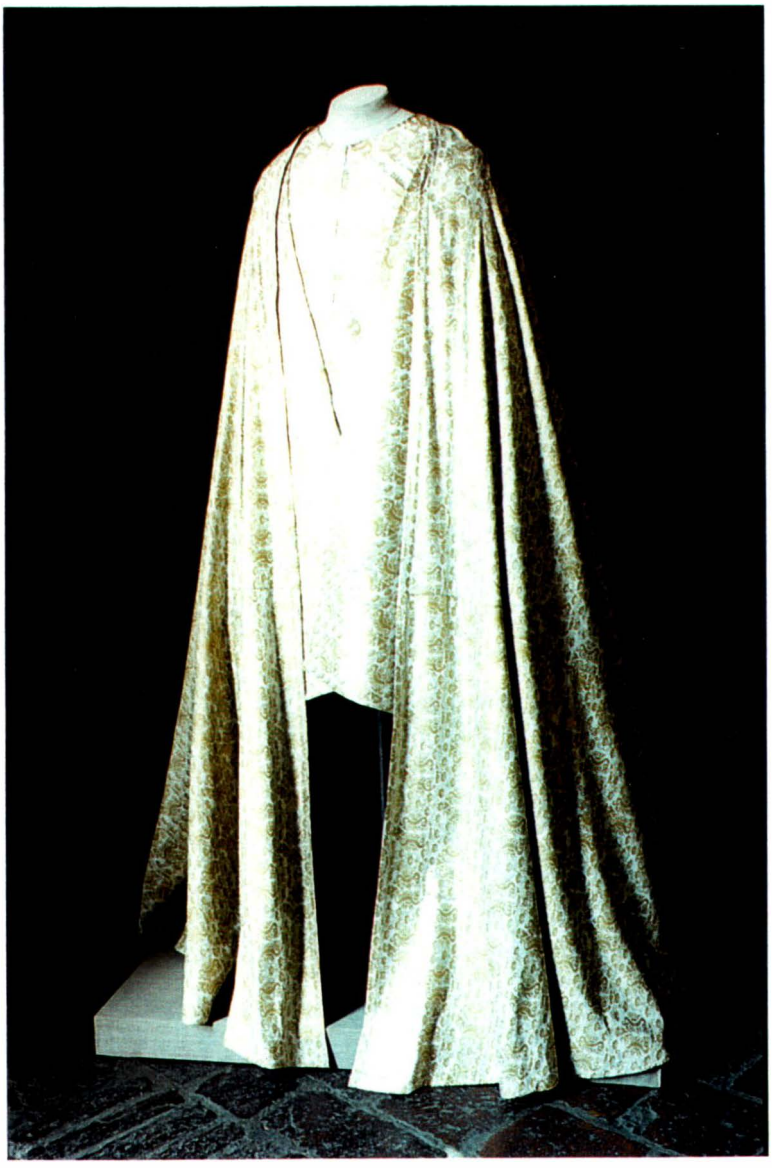

Figure 5 Copy of funeral garment of Rudolph I.

fabric patterned with the dragon motifs (Fig 4). It was not lined, but the fabric with the bird motifs was inserted in the reverse of the tail. The inside of the cloak must have been very impressive. The silvered wefts from the back of the outer fabric were seen on the unlined inside, and the tail was lined with a different fabric. The cloak was fastened by two brooches linked by a chain or lace. The semicircular cloak was the typical outer garment of the medieval gentleman and lady.

Under the cloak, Rudolph I wore a tunic and surcoat. The tunic was sewn from the Central Asian fabric with the dragon motifs (Fig 3). The sleeves widened at the wrists. According to the reconstruction, the tunic was very short, but this doesn't fully correspond with the study of contemporary iconographic sources. Such short tunics were worn mostly by the lower classes at that time, not by the nobility such as the king. A back section shows a short slit, and it is narrowed at the waist, by which means the close fit was achieved. This detail was very modern, because until now it has been thought that the close-fitting waist was achieved by inserting a wedge. The front consisted of two pieces, which were probably sewn together originally.

The surcoat was constructed of three pieces (Fig 2). The back piece is made of the bird-motif fabric and is slightly trapezoidal in shape. Both side sections, cut from the dragon fabric, continue around the body to form the front. The surcoat was sleeveless. It was a garment worn by both women and men, the men put it on over their armour.

It is assumed that the dead king wore breeches, chemise, and boots. These items, however, were not found. Another garment which was, was a cap worn beneath the crown, was made from two textile hemispheres, each constructed of three pieces. The king had a rectangular-shaped pillow under his head and he was covered with a headcloth.

The preserved funerary garments of Rudolph I represent a unique document of medieval dress (Fig 5). The garments were luxurious, but secular. Until now, we have not had preserved secular garments dating from before the beginning of the second half of the 14th century (the jupon of Edward Plantagnet, so-called Black Prince, the doublet of Charles de Blois, and the jupon from the Cathedral in Charte). These male jupons represent the new style of fashion, used only in the second half of the 14^{a} century. Their characteristic features are their close-fitting nature, front sections fastened by buttons, short length and narrow sleeves. From the reconstruction of Rudolph I's tunic, it seems that some of these details had appeared already. There are only a few original fragments of the tunic, so the reconstructed shape may be disputable. There are many more fragments of the cloak and surcoat, so there is less doubt about the reconstructed shapes of these.

In contemporary iconographic sources, kings are usually pictured in monarch's robes, i.e. in an ecclesiastical robe, a cape and a long dalmatic or tunicella. Rudolph I's garments are a luxury royal robe designed for stately occasions and recreation. Two analologies are the funerary garments of the Kings of Castille and Leon in Las Huelgas Monastery in Burgos dating from the second half of the 13th century, and the funerary garments of Cangrande I della Scala, who was buried in Verona in 1329. A similar cap worn beneath the crown has been preserved in the burial place of the Staufs in Speyer in the tomb of Henry IV, who died in the year 1106.

Due to the lack of preserved written sources we can not ascertain when and for which occasion Rudolph I had this garment made. It does not seem probable that it was simply a funerary costume made in haste. Kings were normally buried in monarch's robes, but Rudolph I reigned for only a short time, his life ending prematurely during a military campaign. He did not even have time to be crowned in St. Vitus Cathedral at Prague Castle. Surely a coronation robe would have been commissioned for such an occasion. It is assumed he did not have a coronation costume; therefore, was dressed for his coffin in ceremonial, but secular attire. Nevertheless, his widow had the funerary coronation jewels made for him. It is conjecture that Rudolph I brought his garment to Bohemia. He may have acquired it at the time of his first marriage to the French Princess Blanche of Valois, who died in 1305. France dictated fashion trends at that time. The events at which Rudolph I may have worn the ceremonial attire were in October 1306 when he received on oath of allegiance of Bohemia nobles and married his second wife, Elizabeth Richenza, and on 18. January 1307 when he received the oath of allegiance of the Moravian Estates in Znojmo.

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Reconstruction

Costumes for a Chieftain Couple at Ribes Vikinger Museum

During the latter part of 1994, the Ribe Vikingecenter (Ribe, Denmark) had the task of making costumes for a Viking chieftain and his lady. These were for the permanent exhibition at the then developing Viking museum in Ribe - Ribes Vikinger. Ribe is Denmark's oldest named city, and in 1973 an 8th century Viking market-place was discovered in the city centre (Fig 1). This marketplace was well-organised by AD 720 with plots on both sides of a street. Merchants and craftsmen went there to trade for more than a hundred years (Jensen 1991). As no trace has been found of substantial buildings but only of huts and small pit-houses, the market-place can hardly have operated throughout the year. It was presumably a seasonal affair where there was no activity during the winter, and where trading culminated in the markets held once or twice a year.

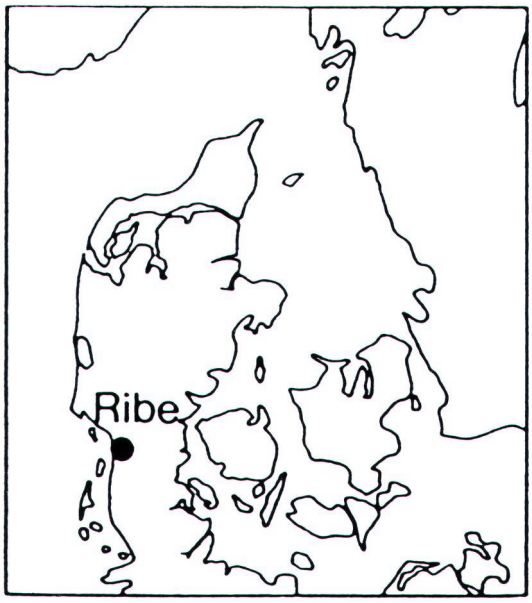

Figure 1 Denmark with Ribe.

Situated approximately 3km south of Ribe, Ribe Vikingecenter is a production school. We have already recreated parts of the 8th century market-place in full scale, and are currently constructing a chieftain's manor from Hviding, dated to AD 980. Students at the Vikingecenter weave and sew period clothing, among other things, for the people who work at these living period environments, and this involves close cooperation with the new museum.

The initiative for creating costumes for Ribes Vikinger came from Flemming Bau, the museum's exhibition designer. His colour illustration in *Skalk* (Bau 1983:17) was taken as the starting point for the woman's costume (Fig 2), along with a drawing by the textile specialist Inga Hägg's of a man's costume (Fig 3). These two sources provided some information about fabric type and quality, and this was complemented by consulting source material from, for example, Birka (Sweden) and Haithabu/Hedeby (Germany)(Hägg 1974, 1984 and 1991). The actual work of reconstruction was carried out by four students. We have neither spun nor dyed the yarn ourselves, we have not woven the cloth on a warp-weighted loom, nor have we tanned the skins ourselves. It would of course have been more *authentic* to have carried out this work in the manner of the Vikings, but we would probably still be at it!

Although little is known about Viking period clothing, due to the lack of preservation of complete costumes from Viking burials, we have based our reconstruction of the chieftain couple's costumes mainly on the studies of textile fragments from Birka and Haithabu (Hägg 1974, 1984 and 1991). Pieces of clothing from Birka are most often preserved associ-

Figure 2 Reconstruction of a Viking-Age woman's costume, by Fleming Bau.

Figure 3 Reconstruction of a Viking-Age man's costume, drawn by Inga Hägg.

ated with jewellery. Articles of metal produce metal salts, some of which have a biocidal effect on pieces of textile in intimate contact with them. Even though textile fragments rarely provide considerable insight into the complete cut of a costume, together with the placement of jewellery, they do give clues to the several types and layers of clothing worn, reveal the threads' directions of spin, and the density and pattern of weave employed, i.e., the quality of the clothing. In addition, jewellery styles and ornament can provide dating information. We assume that the fine clothing in which people were buried was essentially the same as that worn on special occasions, such as a Viking market. Most preserved clothing fragments probably belonged to the wealthier and more aristocratic Vikings. The finds from Birka encompass the period AD 800-975.

A multitude of clothing fragments have been recovered from the Viking harbour at Haithabu (Hägg 1984). These textiles are worn-out pieces of clothing, subsequently re-used in association with ship building. They were used either as cloth ends on tarring mops, thereafter thrown away into the water, or packed between the outer planking to make it watertight. The latter were found in the Viking ship remains recovered from the harbour. What differentiates the finds from Haithabu from other sites, is that they provide clues to the everyday clothing of this town. These finds can be dated to the 10th century.

By combining finds from these two sites, we recreated a dress for the fine lady at Ribes Vikinger Museum. It consists of an undergown, an overgown (*hängerock*, dress with shoulder straps) with an apron, a train and a kaftan. There is also a scarf and a pair of turnshoes. The first layer of clothing is the undergown. The linen is woven from semi-bleached, single ply flax yarn, with a thread count of 18/18 threads per cm. The pattern is taken from a one-piece undergown found at Vingåker in Sweden (Hägg 1974:24). This style is thought to date from prehistoric times. The undergown has long arms and a round neck which opens at the front. It is cut from a single piece of linen, with a wedge in the left side and a sewn-in wedge on the right, and is sewn with a turned seam.

The basis for the overgown are fragments Nos. 14A and 14B from the harbour at Haithabu (Hägg 1984). A diamond twill of a fine quality and closeness of weave was chosen, as should befit such a fine lady. Broken diamond twill is represented in 3-4% of textile finds from Danish burials of the 9th century (Bender Jørgensen 1986). A medium blue colour (from woad, *Isatis tinctoria*, or indigo, *Indigofera tinctoria)* was chosen, blue being associated with the better off in the Viking period (Walton 1991). The cloth is woven from thin two-ply wool yarn, with a thread count of 24/16 threads per cm. The warp threads are oriented horizontally in the dress, as in fragment No. 14A, and the upper edge is sewn with a herringbone stitch. A 2mm wide band is sewn over the seams at the sides. The band is *slendret* with three double threads, two blue and four grey.

The apron is also made in a broken diamond twill but this time one woven with a single-ply, golden-brown worsted yarn (thread count 12/10 threads per cm). The apron is 28cm wide, which is slightly wider than the 22cm-wide preserved fragment from Birka grave No. 597 (Bau 1981). The apron is shorter than the

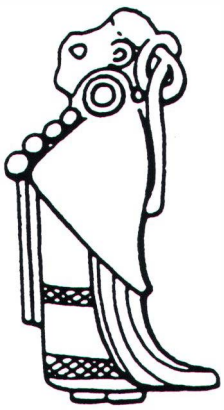

Figure 4 Figure of woman in silver from Tuna, Alsike, Uppland, Sweden. (Drawing: F. Bau.)

Figure 5 The reconstructed woman's costume. (Photo: Ribes Vikinger.)

overgown. It is provided with a lining of woven flax linen. At some point in the future a tablet-woven braid will be added to the apron. Numerous tablet-woven braids have been found, for example at Birka, of notably high quality in both craftsmanship and design (Geijer 1938). But, perhaps it would be most authentic to place the braid on the overgown as portrayed on the little silver figure of a lady from Tuna, Uppland in Sweden (Fig 4) (Bau 1983:16).

Many contemporary portrayals of Viking women show them wearing a train. As this must have been impractical to wear during work, the women are presumably shown in their finery. A train was thus seen as fitting for the chieftain's wife. It was woven in madder-red linen having a width of 110cm (thread count 18/16 threads per cm). There is a blue-dyed fragment of linen among the Haithabu finds (Hägg 1991:277). As madder (*Rubia tinctorum*) was not harvested in Scandinavia, it was a luxury import, and must have been the reserve of the well-to-do. The pleated train has straps which fastened to the brooches on the apron.

The tortoise brooches, which are reproductions of finds from Ribe's earliest Viking levels (the original mould for the brooch was recovered from excavations at the marketplace), have more than a decorative function. They fasten the overgown, apron and train in place. A key, a pair of scissors in a wooden case, and an antler comb in an antler case are suspended from one of the brooches. These items, along with necklaces of pretty glass beads were signs of a woman's rank, and these elegant finds have been consciously copied to show that this is a woman of high social standing.

The chieftain's wife was also fitted out with a kaftan, as evidenced in graves at Birka. The quality is based upon Haithabu finds Nos. 6A-B, 28A and 67 (Hägg 1984). The outer layer is a 2/2 twill, a weave common throughout the Viking period (Bender Jørgensen 1986). Undyed grey Spaelsau yarn was used in the warp, and a softer, undyed brown wool was used in the weft (thread count of 14/6 threads per cm). Here we have come close to Viking quality of cloth. The wool from Spaelsau sheep has hairy medium wool and underwool (short wool) like the sheep of the Viking period. For the lining we wove a piece of madder-red tabby (thread count of 12/12 threads per cm). The kaftan is open at the front with an almost V-neck. The arms narrow towards the wrists, and are sewn into a slightly rounded armhole, inspired by a sleeve from Haithabu (find No. 57) (Hägg 1984).

Figure 6 Reconstructed man's costume. (Photo: Ribes Vikinger.)

The chieftain's lady also has a headscarf, even though many of the small figurines portraying women are interpreted as seeming to have had uncovered heads. The head-scarf is woven from semi-bleached, fine single-ply linen yarn (thread count of 24/24 threads per cm). It is folded into a triangle and positioned on the head so that the two side corners are tied back together over the nape of the neck, while the third passes under the knot and hangs down the back of the neck.

Finally, the lady is fitted with a pair of turnshoes copied from find D. 6100 from Ribe (Nielsen 1991). Supple goatskin was used for the uppers and oxhide for the sole. The soles are rounded both at the heel and at the toe, and are sewn with a turned stitch like the original (Fig 5).

Finds from Haithabu have been used as the starting point for the man's costume: tunic, baggy Turkish-style trousers, leggings, kaftan, cap and boots (Fig 6). The tunic was inspired by find No. 18 (Hägg 1984). Walnut-brown, thin worsted yarn was used in the warp and a somewhat thicker brown yarn was used in the weft. These colours were used based upon finds of walnuts at Haithabu (Hägg 1984), again a luxury import which would have been a good dye as well as good to eat. The weave is a warp-faced tabby or repp (thread count of 20/6 threads per cm). This form of woollen tabby was much used in the Viking period in Haithabu (Hägg 1984). A very thin, strong and smooth warp thread combined with a thicker, airy weft gives a durable but soft fabric. The tunic is divided horizontally at the waist and has two triangular inserts in the skirt, one at the front and one at the back, and a round neck opening.

The chieftain is provided with baggy Turkish-style trousers, as seen in the 8th century Viking period portrayal of a horseman on a picture stone on Gotland (Nylén 1978:17). To us these may seem a little outlandish and impractical, but fashion and the display of wealth often disregard the purely practical. Such excessive use of fabric, in a foreign style, would presumably have been seen as a sign of high status. Finds Nos. 72A-B and No. 91A from Haithabu harbour were the inspiration for the trousers (Hägg 1984). The front and back of the original trousers were dyed in different colours, half red and half yellow-green. The chieftain's trousers were made of cloth dyed in these two colours also. The fabric is a warp-faced woven in a very thin woollen yarn (thread count of 20%12 threads per cm) and subsequently pleated. The fabric is very thin, and according to the description of the archaeological find was probably used doubled, which we have done. The reconstructed trousers are fastened at the top by two bone buttons in the waistband, and also by two more buttons just below the knees. This type of trousers requires stockings or hose, but we have not made these yet. They might be added later. If the hose were long, maybe garters were worn to hold them up as is interpreted from the buckles, strap sliders and strap ends found in the shin region of three male burials at Lejre (Roesdahl 1980), or maybe puttee-like leggings were used to hold them up. Leggings have been constructed in a broken herringbone woven in a fine quality madder-red wool (thread count of 22/11 thread per cm, as find No. 49B) (Hägg 1984).

The kaftan found at Haithabu came down almost to the knees and was open at the front. Finds Nos. 11 and S28 have been the inspiration for the chieftain's kaftan (Hägg 1984 and 1991). The fabric is a 2/2 twill. This time an undyed brown Spaelsau yarn was used for the warp and a soft, thicker yarn for the weft (thread count of 15/5-6 threads per cm, as in find No. 11). The cloth was lightly fulled after weaving. The kaftan can be closed by laying the front sides diagonally, one over the other. Both lapels are bordered with marten fur. The kaftan reaches to just below the buttocks and is cut close to the body with narrow arms. A belt of dyed leather with a silver buckle and silver belt-end adds a finishing touch Schetelig 1920:224, figs 223 and 226).

We have felted a light grey cap, bordered with a tablet-woven braid, for the chieftain. The pattern for the braid is from Birka (find Nos. B9, grave 855) (Geijer 1938). Very thin silk threads have been used in the warp, and silk threads and drawn silver wire, doubled, for the brocading weft of the band, as in the original

Finally, the boots are constructed based upon a find from Haithabu (Groenman-van Waateringe 1984:plate 3). The soles and the uppers are sewn together with waxed linen thread and a turned seam. A narrow strip of leather has been sewn between the goat-skin uppers and the back-leather soles, to strengthen the joint. The sole is pointed at the heel. This point, sewn on externally, makes any sewing at the heel itself unnecessary.

The use of silk cloth in the costumes was purposely avoided, even though we know that some of the upper classes had access to this luxury fabric (Østergård 1991). Museum visitors should not get the impression that it is Viking royalty they are looking at!

We are far from certain that a chieftain-class couple would have appeared precisely as we have portrayed them, especially since we collected information and inspiration from different geographical regions and periods. But this is our attempt, and we have at least endeavoured to use yarn types, patterns of weave, density of weave, colours and, as far as possible, cuts of clothing the Vikings used. It is now up to the observer to judge the result.

Acknowledgements
Translated into English by Spike Ekins, Ribe. Thanks also to Spike for some good advice.

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Comment

Fleece Types and Iron Age Wool Textiles

Ryder (1993) published a paper, *Wool at Danebury - a speculation using evidence from elsewhere.* Danebury is an Iron Age hillfort near Andover in southern Britain which was excavated by Barry Cunliffe over 20 years. The high proportion of sheep bones found and the finding of textile implements led to suggestions that Danebury had been a centre for large scale wool cloth making (Cunliffe 1984, Cunliffe and Poole 1991). My aim was to show how in the absence of textile remains from the site it was possible to use evidence from other Iron Age sites with such remains (Hallstatt in Austria and Vindolanda in Britain) to suggest the kinds of fleece that the sheep kept at Danebury are likely to have had. In addition to considering what type of fleece clothed the sheep bones found at Danebury, how the textile implements might have been used was discussed. A summary is given here for ***ATN*** readers.

The main evidence of sheep at Danebury comes from bone remains, which were more numerous than those from other livestock. The proportion remained constant during the 6th to 4th centuries BC at 56%, with an increase to 67% from the 3rd to 1st centuries BC. This is more than the average of 47% sheep bones from a range of 16 other British Iron Age sites, the percentage ranging from 25% to 91% at Glastonbury, which has strong textile associations. Grant (1984) suggested that the economy of Danebury was based on sheep. There was no indication of sex and so no evidence that would indicate the keeping of wethers (castrated males) for wool. There was more evidence of the age of animals at death. One third were from mature animals, which Grant considered were past the optimum age for meat, from which she suggested that they had been keep for wool.

The sheep bones at Danebury indicated a typical small, *prehistoric* breed, which Grant likened to the surviving Soay breed and which was constant over 500 years. I suggested that the Soay is more representative of Bronze Age sheep and that the Iron Age had another type, perhaps represented by the surviving native Orkney breed. She suggested that the Danebury sheep had a hairy fleece, which in the absence of shears at Danebury was harvested by plucking or by combing with *weaving* combs. *Hairy* is too imprecise a term to define the fleeces; it is not likely to have been of Neolithic *hair* type, nor of true Hairy type. I suggested from textile studies that the sheep are likely to have had primitive woolly as well as primitive hairy fleeces.

The Evolution, Harvesting and Use of the Fleece

Neolithic sheep did not have a fleece; the *wild* Mouflon sheep of Corsica show that they had an outer coat of very coarse, bristly kemp-hairs, which obscure very fine underwool. The skin clothing of the frozen man dating from the Neolithic found in the Alps during 1991 provided support for my view that a fleece was not fully developed until the Bronze Age (Ryder 1992). The main change involved in the development of a fleece was the narrowing of the outer coat kemp-hairs. As the outer coat became less coarse, the underwool became less fine. The evolutionary changes involved in the breeding of the main fleece types are shown in Figure 1. In the histogram showing the typical fibre diameter distribution of the Mouflon (top), the fine underwool lies to the left of the distribution, and the bristly kemp-hairs of the outer coat lie to the right.

The first change, seen in textiles of the Danish Early Bronze Age (Table I) involved a narrowing of the outer kemp-hairs and the retention of underwool as fine as that of the Neolithic coat. The first true fleece was the Hairy-medium type, in which some of the hairy fibres (fine kemps) have changed into fibres of medium diameter and the fine fibres have become less fine. Further narrowing of the remaining hairy fibres changed these, too, into wool fibres of medium diameter and produced the Generalised-medium type of fleece with only medium and fine fibres.

The lack of shears at Danebury suggests that sheep with continuous wool growth had not yet been bred. The fleece of Soay, Orkney and Shetland sheep moults naturally each spring. Such moulting fleeces were harvested by plucking before shearing became possible. Since the hairy fibres of Hairy-medium fleeces tend to shed later than wool, plucking allows one to obtain wool that contains fewer hairs than shorn wool. This explains why some Bronze Age wools contain more finer fibres and fewer hairy fibres than expected. It also implies the combing of the wool from the hair on the animal. But combing would only be necessary with hairy fleeces; Generalised-medium fleeces can be plucked and this is what was done without the help of a comb in such places as Shetland until recent times. Wool harvesting is a possible use for bone, so-called *weaving* combs, which were also found at Danebury, but they are not entirely suitable for this purpose. Combs are used to

Table I Summary of Fleece Changes in Sheep

	Neolithic	*Intermediate*	*Bronze Age*	*Iron Age*
Coat	coarse kemp & 15μ wool	1. fine kemp & 15μ wool 2. fine kemp & 20μ wool	Hairy-med. & Generalised-medium	same
Colour	brown	brown	brown	brown, black white, grey
Present breeds	tropical "hair"	none known	hairy & woolly Soay	hairy & woolly Orkney
Harvest	comb	comb	comb HM pluck GM	shear
Fabric	? felt	? felt	HM woollen GM worsted	same

1μ (micron) = 0.001mm

harvest cashmere from goats in China, but these are small rakes with a short handle.

Textile remains from the Iron Age show a predominance of the same, Hairy-medium and Generalised-medium fleeces that appeared in the Bronze Age, but they have a geater range of natural colour. In addition to the brown of Bronze Age wool there is black, grey and white. The British survivals of Iron Age sheep are the Orkney and Shetland breeds, characterised by a predominance of grey animals and a tendency to moult. A new fleece, the true Hairy type appeared in the Iron Age. This evolved by a change of many of the short hairs which are intermediate between kemp and wool (Fig 1, bottom left). The origin of hairs was associated with the change to continous growth. Moulting is a disadvantage in leading to loss of wool by the sheep keeper. There would be a wish therefore to selectively breed against moulting, but this could not begin until an alternative method of removing the fleece had become available with the invention of shears during the Iron Age. It is remarkabke that this technological advance preceded the biological change to continous wool growth.

Another technological advance associated with a biological change is the development of dyes, which provided the main stimulus to breed sheep with white wool. But wools of different natural colour were still woven together until well after the Middle Ages. Naturally coloured wools can also be dyed: of three samples dyed with indigo at the same time, white wool dyed light blue, grey dyed dark blue and brown dyed black. Wool cloth from Hallstatt and Vindolanda had been dyed. Evidence might be sought among Iron Age plant remains in Europe for an increase in dye plants as an indication of an increase in the number of white sheep. A bedstraw (*Galium sp.*) was the only specific dye plant among the remains at Danebury.

The final stages of evolution to give modern fleece types had also taken place by the Iron Age (Fig 1, right), but only a few of these were found at Hallstatt and Vindolanda. The Belgae are recorded as keeping fine-woolled sheep on the contiment and could well have introduced these to Britain. But they reached the Winchester area after Danebury had declined.

The Textile Implements

On the question of large-scale cloth making, I pointed out that since each warp-weighted loom has 20 to 40 weights the finding of several hundred loom weights on a site indicates only a few looms and this in turn may indicate no more than domestic cloth making. Since there were more loom weights than spindle whorls the excavators thought that the spinning might have been done elsewhere and the weaving concentrated at Danebury. I argued that to make comparisons between sites it would have to be established that a constant repationship exists between the number of spindle whorls and the number of loom weights. Departure from this constant might then be regarded as indicating the separation of spinning and weaving. In fact, it takes several spinners to keep one weaver supplied with yarn. If each loom had 20 to 40 weights, one would expect one spindle whorl to every four to eight loom weights. Ratios of 1:3 at Danebury and 1:4 at contemporary Maiden Castle in Dorset may merely reflect the greater number of spinners required to supply one weaver before the introduction of the spinning wheel. Or the ratios could indicate narrower looms with no more than 20 weights. If spinning had been carried out in one season and weaving in another, these ratios might have a different significance.

The 33 baked clay spindle whorls found at Danebury ranged from 25 to 53mm in diameter and from 10 to 41mm in thickness, while the weights fell into two groups: 18 to 28g and 44 to 88g. The perforations for the spindle ranged from 4 to 8mm wide at the narrowest point. All but one of these clay whorls had a diameter greater than the suggested optimun diameter of 25mm and they were mostly thicker than the typical thickness of 10mm to 20mm. The upper range of weights was heavier than on most sites, but the lower range was more typical. No whorl was as light as the 8g I found to be the heaviest weight of whorl that could be used to spin a woolly Soay (Generalised-medium) fleece in a free fall. The difficulty with this short stapled fleece was to insert sufficient *twist* to impart strength, before the weight of the falling spindle and whorl created too much *draft* and broke the strand of fibres. From this I thought the weight of the whorls found on archaeological sites might be related to the type of fleece being spun. I had suggested previously that in spinning direct from the fleece, a Hairy-medium wool would give a worsted yarn since the longer, hariy fibres keep the wool fibres parallel, while the shorter, Generalised-medium fleece would give a woollen yarn, because the fibres lie more at random. It can now be suggested that heavier whorls were used to spin the longer wools and the lighter whorls the shorter wools.

Another group of 94 chalk whorls ranged in diameter from 29 to 50mm, and from 14 to 33mm thick, and ranged in weight from 15 to 68g. The excavators stated that in one group of four sub-sperical whorls, in which the thickness was greater than half the diameter, the diameter multiplied by the weight gave values over 3,000. They considered that this indicated the spinning of a specific weight (presumably thickness) of yarn. A second group of whorls with a rectangular section and a thickness equal to or less than the diameter gave values ranging from 400 to 3,000, which they regarded as indicating a range of yarns spinnable. No explanation of this formula was given, nor was there any consideration of posible differnces in fleece type.

Given only one fleece type it is possible that the different whorls would spin different thicknesses of yarn. But spindles can be supported, and the spinner constantly controls the twist with a hand spindle. I concluded that only by experimental spinning of different types of fleece with different weights of whorl will these problems of interpretation be clarified.

The size of the hole to take the spindles in the chalk whorls ranged from 3 to 33mm. Since few ethnographic spindles are thicker than 10mm at the widest point, this accords with the excavator's view that whorls greater than 100mm in diameter and 300g in weight had another use. They could be used to twist two or more spun threads into multi-ply yarns, just as a heavy, wooden conical *spindle* (fearsaid) has been used for this purpose in the Hebrides.

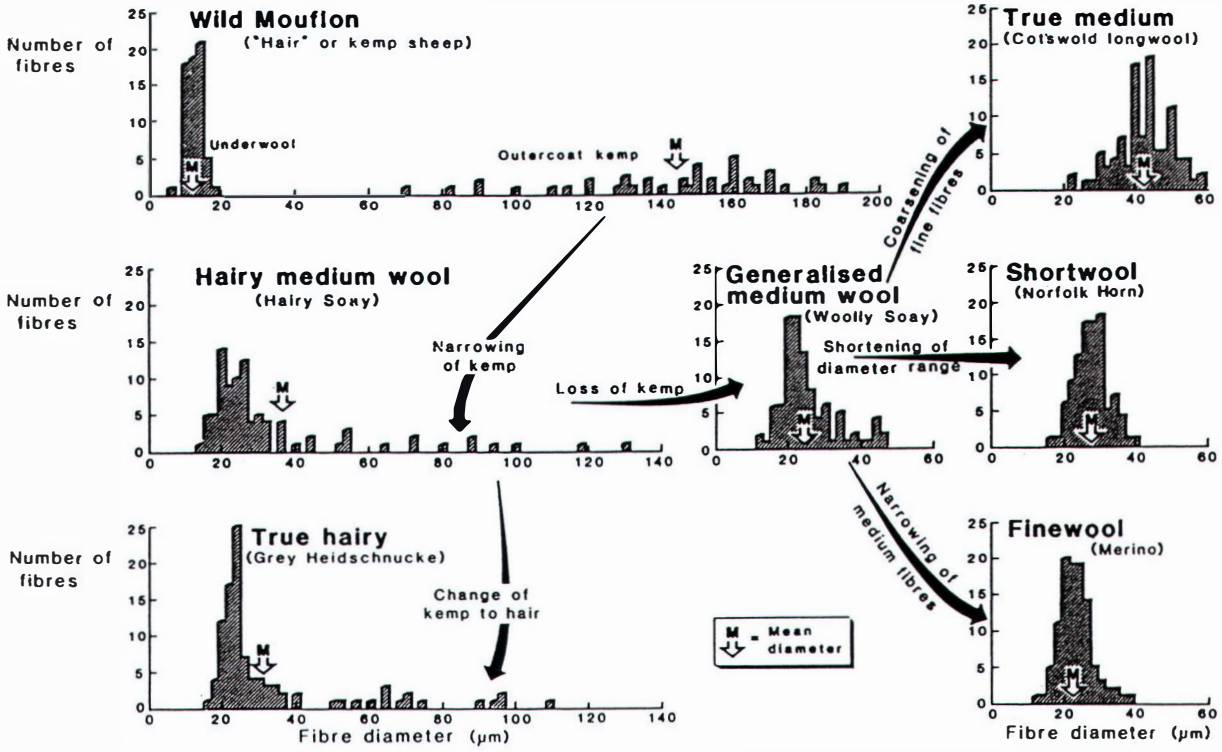

Figure 1 Changes in fibre diameter distribution during fleece evolution.

Danebury had 256 chalk weights, which appear to have been used as loom weights, a view that is supported by their association with spindle whorls and *weaving* combs. The overall range in weight was from 615g to 3.25kg with an average of 1.1kg, which compares with weights given by Barber (1991, p.95) of 500g to 1kg. One ounce (28.35g) of weight for each warp used by Bailey (1992) would mean that a 3.25kg weight would have 107 yarns, which seems an unmanageable number. A 615g weight with 22 warps and the average weight with 35 seems more appropriate, suggesting that weights greater than 1kg mean were not loom weights.

Danebury yielded 71 combs of bone and antler. These were 93 to 153mm long, and 25 to 36mm wide at the base of the 6 to 12 teeth. From the more restricted form of the combs at Danebury, the excavators suggested that only one type of cloth might have been woven. The debate on whether or not *weaving* combs could have been used for *beating up* the weft yarn in a warp-weighted loom has raged for a long time. Roth (1918) maintained that the concavitity of bone combs made them unsuitable for this purpose and in recent warp-weighted looms beating-up was carried out with a wooden *sword*. Although the teeth of such combs are worn in the *right place* another factor is that they are too narrow, and hand weavers still tell me that they could not have been used in weaving, although combs are used with frame looms and also in vertical carpet looms. While supporting this view, I have found it difficult to accept an alternative use. Bailey (1992), however, can demonstrate their use to disentangle wool before spinning, the comb being held in the left hand and the staple being pulled through it with the right.

Sellwood (1984, p.372) gave a detailed review of the subject, outlining experiments opposing and supporting the use of these combs in weaving. One author found the combs useful to push the weft into position before beating up with a sword, while another saw an advantage in the concave section in countering the tendency of the warps to *waist* in the centre. Sellwood particularly addressed the question of the wear patterns and breakage of the teeth. She suggested two main ways of use: first that a comb might have been used in conjunction with a sword by wedging the comb between the warps parallel to the weft and beating it with the sword within the shed. This could have led to the transverse wear grooves observed, and eventually to tooth breakage. An objection to this suggestion is that it would be difficult to prevent the comb from falling out. The second possibility is that the comb was turned on its side so that the teeth were at right angles to the weave and used as a pin-beater between pairs of warps. This would also explain the transverse grooves and the frequent breakage of the outside teeth. The transverse grooves vary greatly in character and are not the only wear patterns. It could be that the combs were used in different ways at differernt times, or that different people used them in different ways. Despite the very detailed treatment by Sellwood, it does not appear possible to draw any firm conclusions and more experimentation is called for. I here outlined the new light thrown on the concavity question by Touhy (1990) and the points made in my reply (Ryder 1991).

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Conservation

Housing Small Archaeological Textiles[1]

Numerous housing systems have been proposed for the storage of collections of archaeological textiles. These systems normally are designed to meet the particular requirements of specific collections, and often are versatile enough to be adaptable to the needs of other collections. Housing units, be it window mounts or containers, are custom made, after a fashion, to accommodate each textile specimen. That which is common to these solutions is their labour-intenseness in both time and skill. This makes such systems prohibitively expensive for many institutions to consider. In addition, these units are often unnecessarily elegant for textiles requiring a short-term or basic study-storage housing solution.

Archaeological textiles tend to require more customised packaging than many other archaeological materials. Archaeological conservation laboratories which experience a seasonal deluge of large volumes of freshly excavated finds often have neither the material nor labour resources to adopt custom-made systems. Thus, there is the need for solutions which bridge the gap between costly, elaborate systems and making do with no system at all. All too often, the more elaborate and fussy the packaging system, the longer it takes before the conserved find is finally packaged and makes the journey to the museum stores.

Another factor is that the conserved archaeological textile is increasingly becoming three-dimensional. Whereas, traditionally there was the aim when conserving an archaeological textile to return it to a neatness, it is now understood that there lies considerable evidence in the folds and creases (Pritchard 1990, Cooke 1988, Brooks et al 1996). A flat, tidy conserved textile artefact is no longer the ultimate goal, indeed the opposite is now the case. Therefore, the many systems based upon flat window mounts are now becoming less universal as the number of non-comforming, i.e. three-dimensional, textiles and fragments increases.

In 1995, Vitenskapsmuseum (Norwegian University of Science and Technology, Trondheim, Norway) earmarked institutional funds for the purpose of safeguarding the research collections. The Conservation Section was successful in its application for funding to rehouse the collection of medieval archaeological textiles.

The medieval collection consists of over 2200 pieces recovered since 1970 from excavations in the city of Trondheim. It encompasses a broad range of textile structures, with both animal and vegetable fibres represented. Although most of the textiles exist only in partial form, a sufficient quantity is extant to provide a remarkable overview of the textile technology and types of textiles which were part of medieval life in Trondheim.

It is not a heavily used collection. This is most likely the result of its existence not being widely known. Approximately 30 pieces are on permanent display in the museum's Medieval Gallery and in the new Archbishop's Palace Museum in Trondheim. There is no movement of items in the collection resulting from the coming and going associated with rotational display, nor is the collection in demand for loan to other institutions.

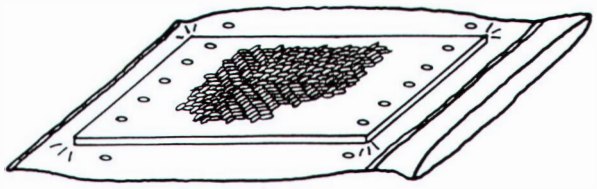

Figure 1 Vented polyethylene Ziploc bag. (Drawing: E.E. Peacock)

Over the years, the textiles had been packed, together with stainless steel or plastic Dymo® identification labels, in polyethylene plastic bags (some Ziploc®) generally without any form of support. These bags were then piled on top one another, several deep, in flat cardboard boxes with removable lids. One clearly can imagine what happened to the textiles every time a box would be moved about, or on and off a shelf. In addition, when someone searched for a particular catalogue number, the boxfull of plastic bags would be rummaged through. Bags would be picked up by their Ziploc® end to open, and the contents would duly slide to the bottom to collect in a crumpled mass. With time, there was so much residual silt and fibres clinging to the inside of the bags that one could see neither what was in the bag nor its catalogue number.

Beginning in the early 1980's, newly conserved pieces were laid on museum board, to which the Dymo® label was affixed, cut slightly smaller than standard

polyethylene bags, and then slid into vented bags and Ziploc®-sealed (Fig 1). The supported bags were then placed in shallow standard museum boxes.

The aim of the housing project was to design and implement a permanent housing system for the medieval archaeological textile collection, and to make it accessible for finds researchers. This required reaching a delicate balance between the finds' security and the needs of the *user*: the *user* being the textile specialist. The needs of the textile specialist vary, but the primary requirement is unobstructed and close-up visibility, i.e., direct access. Visibility to investigate fibre type, technique, elements of construction, use, etc. With archaeological textile fragments, this translates into access to both sides because there is no proper viewing side. In addition, there is access to that which is not visible; that which scientific methods of analysis can shed light on either non-destructively through *in-situ* analysis or destructively through sampling of the fragment. For this, any housing unit which permanently covers the surface of the textile, be it with Perspex® or Plexiglas® (polymethyl methacrylate), Melinex® or Mylar® (polyethylene terephthalate) or gossamer netting, is totally unacceptable.

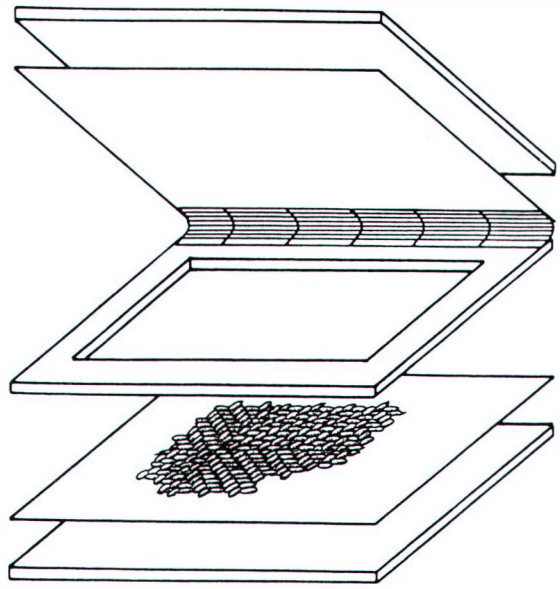

Figure 2 Hinged unlined window mount. (Drawing: E.E. Peacock)

The textile fragment has its requirements as well. It is however important for us as guardians to distinguish between the artefacts' own true needs and the ones we might impose on them unnecessarily. The pieces in the Trondheim collection needed to be physically supported without being immobilised, isolated in robust housing units, protected from light and dust, and easily visible without the necessity for handling.

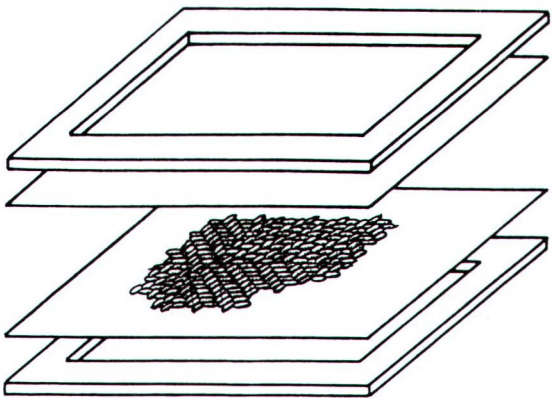

Figure 3 Double lined window mount. (Drawing: E.E. Peacock)

The rehousing system had to be compatible with the existing storage system. The collection is stored in the "wet" store which has a controlled environment (16 ± 2 °C, 52 ± 5% RH), and a high-density mobile storage system which moves along tracks by hand-turned cranks located at the end of each unit.

A comparative review was carried out of various housing systems proposed during the last 20 years for use with collections of small textiles. During this period, the movement has been away from encapsulation between two sheets of glass to systems based on museumboard window mats (Fig 2). Most systems protect the textiles and pack well in storage units. However, our own experience with units based upon the double lined window mount (Fig 3) led to seeking out an alternative system for the medieval collection (Peacock 1984). Many aspects of the construction process were labour-intensive and relied upon the use of adhesives, and neither a Melinex® nor a gossamer netting lined window mat provided direct access to the artefact.

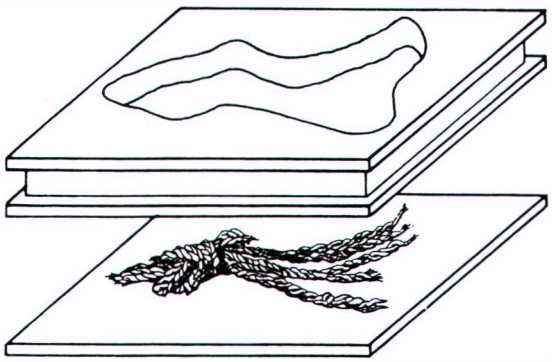

Figure 4 Shaped recessed well. (Drawing: E.E. Peacock)

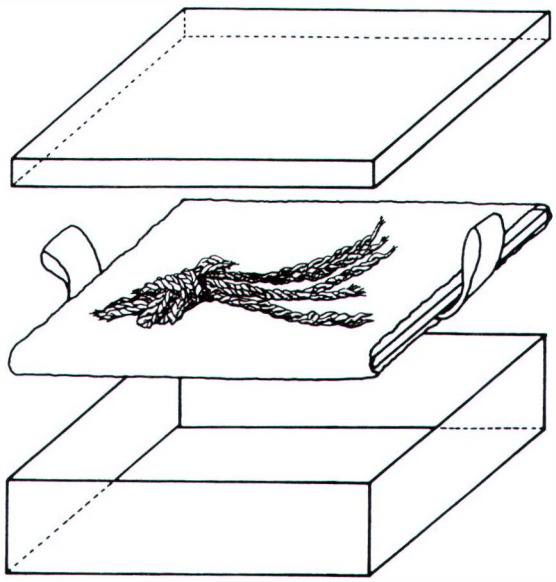

Figure 5 Polystyrene crystal box with museumboard tray covered with fabric slipcase. (Drawing: E.E. Peacock)

selected (Fig 5). Twill tape tabs stapled on the ends of the tray ease inserting and removing it from the box. The museumboard functions as a support upon which to extend the textile, which is held in place by the slight nap of the fabric. The fabric-covered board also doubles as a moveable base to be used to transfer the textile to a microscope or elsewhere for closer A solution was developed based upon the rigid transparent polystyrene crystal box. These are available in a range of modular sizes that fit together and are stackable. Instead of a shaped recessed well or recessed window mat (Fig 4) to house the textile fragment in the container, both of which obscure the delineation of the artefact, a museumboard tray covered with a cotton blend jersey knit slipcase was examination, and as a means of reversing the textile onto the shallow box lid for examination of the back without requiring that the textile be lifted or handled itself. This provides direct access while safely immobilising, without intrusive restraints of stitches, the textiles, some of which are brittle or still embedded with abrasive soil with the potential for causing mechanical damage to the fibres.

The process of preparing the containers can be carried out in a streamlined production-line mode because they are not specially crafted for each artefact. Museumboard can be cut to the standard sizes with a matcutter, and fabric sleeves sewn with a sewing machine in long continuous tubes of the various diameters corresponding to the selected board widths. Lifting tabs are constructed by running a continuous cotton tying tape under the museumboard and securing it with staples in loops at both ends. Lastly, the boards are inserted into the fabric slipcases and lowered into the containers.

For storage on shelves, shallow trays can be constructed of archival quality cardboard to fit side-by-side. Lining these with 3-mm thick Ethafoam® provides a non-slip surface for the polystyrene boxes, and absorbs vibrations which might arrise from movement of high-density mobile storage units. The stackability and modularity of the crystal boxes accommodates housing boxes of several sizes in one tray. In addition, this solution easily facilitates reorganising the boxes and trays if necessary.

Conclusion

A housing system cannot be designed in isolation. It must take into consideration the nature and history of the collection, the institution's collections policy, the physical storage infrastructure, and the financial and human resources.

The main drawback to the use of the polystyrene crystal boxes is the cost. However, their use allows for greater protection and less labour-intensive housing than other systems such as recessed museumboard wells or lined museumboard window mounts which have the inherent potential for problems such as pressure or stresses on brittle specimens when stored flat or upright, and static charge. It is a housing system which adequately meets the demands of the user without compromising the needs of the textiles themselves.

Notes

1. Abstracted from Peacock, E.E. and Griffin, E. (1998). Rehousing a collection of archaeological textiles. *The Conservator* **22**.

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