

An Interpretation of the Haithabu Harbour Trägerrock Fragments: 14 A and B

Extrapolating the available evidence to produce a justifiable garment

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The Extant Fragments	An Interpretation
 <p data-bbox="272 1200 671 1227">Haithabu Fragment 14A (Hägg 1984)</p>	 <p data-bbox="847 1200 1331 1227">The pattern piece referencing Fragment 14A</p>
 <p data-bbox="576 1272 730 1845">(cc) BY-NC-SA Ulrik Skans SHMM Silver ear spoon, Birka grave Bj. 507</p> <p data-bbox="405 1868 533 1895">(Lucas n.d.)</p>	

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Abstract

This research aims to derive an interpretation of a 10th Century Danish apron dress (hereafter referred to as a *smokkr* or *trägerrock*) that may be justifiable from the evidence provided by Haithabu (Hedeby) and related sites. It will outline the available evidence and provide an insight into the decision making that informed the interpretation attached in Appendix 1.

This paper will present an analysis of existing theories about the construction of this type of garment, before outlining alternative hypotheses that may be more closely aligned with the evidence provided by Haithabu Fragments 14A and B, the archaeological evidence from Haithabu and from sites that may be justifiably associated with Haithabu. In doing so it seeks to challenge some preconceived notions about *smokkr* construction.

This research does not aim to argue that this interpretation provides a definitive insight into what 10th C Danish women at Haithabu wore, that this interpretation is correct where others are incorrect, that all *trägerrock* style garments were similar, or even that this was a common style in 10th C Denmark. It simply aims to provide an interpretation of the relevant available evidence and put forward some theories about construction that fit with this evidence.

1. Introduction

Within reenactment contexts there are many interpretations of the ‘apron dress’, *trägerrock* or *smokkr*, with varied opinions regarding what is or is not an acceptable interpretation. As such, research into the evidence available may be valuable in clarifying these discussions and providing insight into what may be justifiable from the evidence. As no complete extant *smokkr* is known it is impossible to proclaim that one interpretation is correct whilst another is incorrect. Instead it is necessary to look at what interpretations may be supported by the available evidence.

Documenting garments from the Viking Era can be very different to documenting many other styles of clothing for a number of reasons. For 16th C Italian Dress, for example, scholars such as Janet Arnold provide detailed publications on the textiles, cut and construction of outfits, which are complemented by the availability of numerous whole extant garments that have been studied and published in detail (and in English). When studying certain styles of Norse clothing different challenges arise. Some of these include the scarcity of complete extant garments in addition to the lack of clear or easy to interpret extant iconography. Where textile fragments are available, often so much is missing that it is necessary to piece together a justifiable garment from sources with geographical (and thus often cultural) variance. Additionally, most of the key archaeological reports are only published in German or Scandinavian languages. Even when sites such as Haithabu are rich in archaeological evidence, many questions about the construction of specific garments arise that remain unanswered. These difficulties may make interpreting justifiable garments complex, and often fraught, but they are also what makes it so exciting. Documenting a *smokkr* is like piecing together a puzzle, written in multiple foreign languages, where all the pieces are scattered across Viking Age Europe. Far from opening a book and finding the information required, researchers must resort to some degree of Holmes-ian deductive reasoning.

Whilst researching the construction of *trägerrocks* Haithabu arose as one of the key sources of textile evidence and it is difficult not to get excited about Haithabu. It was the second biggest town in Viking Aged Europe, a hub of trade, a multicultural society and an urban environment. Not only that but the site provides three distinct archaeological zones of excavation, each with unique clues as to the cultural and economic contexts for this 9th - 10thC Danish town.

To develop a possible interpretation of a Haithabu *smokkr*, it is necessary to set strict parameters to ensure that any garment may be justifiable from the evidence. This research aims to use evidence dated from the late 9th and early 10th Centuries that could justifiably be linked to Haithabu through cultural similarities, such as distinctly Danish cultural groups, or sites with known direct trade linkages with Haithabu in this era. These

sites have been identified through mention in written sources or through accepted maps of Norse trade routes during Haithabu's settlement. Furthermore, this research prioritises evidence from sites where *smokkr* style garments have been identified in the archaeological record. This paper proposes that the combination of known trade linkages and similar style garments, may justify possible cultural connections and thus trading of knowledge and fashions.

2. Research Structure

To gain a meaningful understanding of the available evidence, it is useful to attain a basic understanding of the cultural contexts within which the garment was manufactured and worn. An overview of Haithabu as a town provides an historical context before viewing it as a series of archaeological sites comprising the settlement, the harbour and the graves. Given the scarcity of direct evidence relating to *trägerrocks* at Haithabu, this research also outlines the validity of evidence derived from other sites with direct trade linkages to Haithabu in the 10th C.

This paper then provides a basic overview of the specific textile finds from Haithabu harbour that form the foundation of this research, Fragments 14 A and B. Once a general understanding is established, it studies each aspect of the *smokkr* style garment required to inform a justifiable interpretation of the evidence from these fragments. The garment is divided into components following the order within which an interpretation would be manufactured, as such the analysis is ordered as follows: textile weave, dyes, stitching threads, construction stitches, darts and decoration, belting, loops and straps, the length of the garment and hemming, before finally using all of this evidence to inform theories regarding the way it may have been constructed.

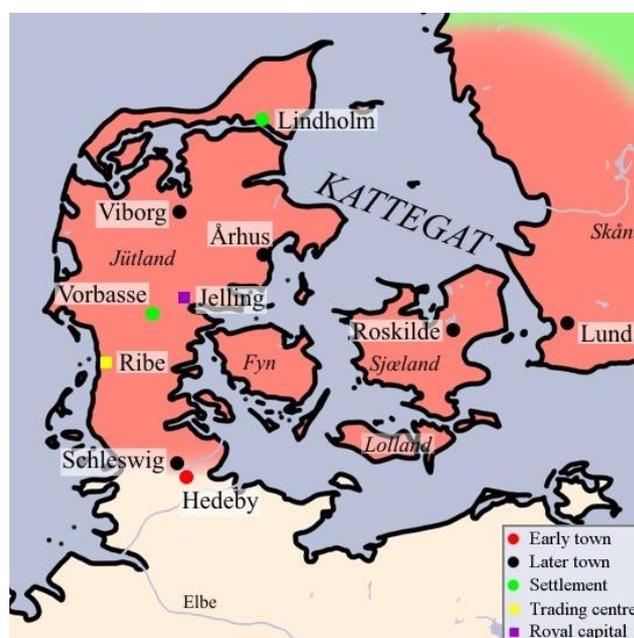
These components are analysed in light of other available evidence from broader geographical contexts and alternate excavations to inform a possible interpretation. This includes a critical analysis of the construction of the garment, considering the Haithabu fragments and other textile remains, and proposes alternate possible theories of construction. The evidence for each component is summarised and recommendations provided for the manufacture of a physical interpretation of the garment in question, as informed by the evidence outlined above. A progress diary of an interpretation is provided in Appendix 1.

3. Haithabu

Haithabu was considered to be one of the most significant, centrally located and largest towns of the Viking Era (Hojlund n.d.). As a settlement, it was probably not as rich as Birka (as indicated by fewer grave goods), but the workshops and trade goods identified in excavations represent it as a manufacturing and trading hub.

The remnants of workshops in addition to architectural disparities with nearby agricultural excavations indicate that Haithabu was a truly urban environment, a proto-industrial town, making and trading products rather than produce. It certainly questions any popular perception of a Norse dichotomy of agrarian workers or 'Viking' warriors. Haithabu was a manufacturing town, a trading port and a multicultural society that puts paid to any preconceived notions of a 'Viking' monoculture. Haithabu provides a fascinating study into a 9th and 10thC Danish urban environment, the evidence from which further encourages the questioning of popular interpretations of Norse fashions and throws up as many questions as it answers. It is a truly exciting place to study.

Geographically Haithabu is located opposite Schleswig in modern Northern Germany, but during its settlement, it was the first Viking Era settlement on the shore of Haddebyer Noor and a significant Danish town in both size and importance (Hojlund n.d., Kalmring 2009 pp.248).



Haithabu in Geographical Context (Hedeby 2016)

Haithabu was first mentioned in 804AD in Frankish annals, which noted that the then Danish King Godfred gathered his army and fleet there. The Annals also note that in 808AD, Godfred was responsible for the destruction of a Slavic trading post, known as Reric, before transporting the merchants from Reric to the Danish settlement (Hojlund n.d.). Haithabu is also mentioned in written sources under the names Slisswich, Schledwig or Haedum (Hojlund n.d.). Haithabu quickly became one of the most significant trading centres in Europe in the Viking Era, largely due to its location on the borders of the Carolingian realm and Scandinavia and its proximity to the Slavonic region (Kalmring 2009, Eisenschmidt 2009 pp.95). The town became a nexus for long-distance trade, providing a large sea-port, market place and fleet base (Kalmring 2009).

Although ostensibly a Danish settlement, written sources indicate that Haithabu was a cultural melting pot, with residents comprising Danes, Saxons, Frisians, Anglians and Slavs (Eisenschmidt 2009, pp.95, Kalmring 2014). Human bone analysis further indicates that there may also have been residents from Scotland or with Scottish ancestry (Carnap-Bornheim et al. 2013 pp. 181). In addition to residents, visitors are known to have come from further afield including the English merchant Wulfstan, Gunnarr Hamundarson (a warrior from

Iceland), diplomats from Cordoba including Ibrahim ibn Ya'qub and quite possibly a Byzantine diplomat, Theodosius (Kalmring 2014).

The settlement and harbour at Haithabu grew, particularly in the years 817AD, 836-57AD and 885AD (Kalmring 2009, pp.248) to accommodate expanding trade, the need for new harbour infrastructure and large ships. This expansion indicates that Haithabu became increasingly significant as a trading port in the mid to late 9th C, contemporaneous with other significant trading towns such as Birka. However, where Birka declined in the 10th C, Haithabu continued to expand, until its destruction in the mid-11th Century.

The last written references to Haithabu are somewhat contradictory, with some sources indicating that the town was destroyed in 1066AD by a Slavic army, and others suggesting that it was burnt to the ground by the Norwegian King Harold Hadrada in 1060AD (Hojlund n.d.). Either way, the archaeological evidence indicates that the settlement remained well populated until it was burnt down in the second half of the 11thC, thereafter losing significance and eventually becoming depopulated (Hojlund n.d., Carnap-Bornheim et al. 2013 pp. 175).

4. Haithabu Archaeology

As mentioned previously, Haithabu was a hub of international trade, a cultural melting pot and a significant settlement. Much of this knowledge is informed by archaeological evidence, specifically from three distinct areas of excavation: the harbour and surrounds, the numerous graves and cemeteries and the walled town (referred to here as the settlement). The site of Haithabu has been well preserved, as the rising water levels since its abandonment have preserved much of the wood there. This has allowed for accurate dendrochronological dating of many of the wooden structures from the settlement and the harbour (Short 2015). By looking at evidence from the settlement, the graves and the harbour as distinctive sites, a wealth of information is available, but it is also possible to do comparative analysis of data from each site to gain deeper insights into 9th and 10thC Danish culture and the way it evolved during that time.

Settlement

Published material on excavations of the settlement remain limited, however published research certainly deepens an understanding of the cultural context within which the graves and the harbour sat, particularly as a site for manufacture and workshops, supporting Haithabu as a trading centre.

Within the settlement, the most common finds comprise pottery and soapstone sherds and production waste from iron and glass working (Hilberg 2008, pp.103). 166 Viking Aged coins were also discovered, including Islamic Dirhams from 871/872AD (Carnap-Bornheim et al. 2013, pp. 175). Five metal detector campaigns discovered around 9,700 metal objects at the settlement, dating to the 10th and early 11thC, however these discoveries are kept in offsite storage and their details are yet to be published (Hilberg 2008, pp.103; Carnap-Bornheim et al. 2013, pp. 173). The prevalence of iron slag in the North-Western areas indicates blacksmith workshops whilst finds from the North-Eastern areas indicate a cluster of glass workers and metal casting workshops from the 9th and 10thC (Hilberg 2008, pp.105). The excavation of moulds, incomplete and complete craft products from the settlement provide information about the entire production chain of certain objects, revealing technical procedures and evidence of manufacturing industries (Carnap-Bornheim et al. 2013, pp. 175). Numerous finds of animal bones represent the presence of sixty-seven different vertebrate species, indicating a huge variety in the diet of the inhabitants of Haithabu including both terrestrial and aquatic resources. Carnap-Bornheim et al argue that this variety, in addition to the manufacturing of goods for trade, indicates a society based on the division of labour, rather than isolated groups providing for themselves, supporting the assertion that this was an urban environment (2013 pp. 180-1).

Geophysical surveys indicate a large main street, intersected by cross streets running from the harbour to the centre of the settlement (Hilberg 2008, pp.106). Small ditches were dug for rainwater drainage, whilst building plots were raised above the level of the streets, allowing the roads to serve as drainage channels. Timber

boardwalks allowed inhabitants to walk whilst keeping their feet dry (Carnap-Bornheim et al. 2013 pp. 178), an important consideration when looking at the likelihood of a *trägerrock* with a train.

In addition to streets and workshops, considerable study of the houses in the Haithabu settlement has been undertaken. Carnap-Bornheim et al. (2013 pp. 176) propose that an analysis of house structure indicates a shift from rural to proto-urban house design, with smaller homes foregoing the traditional livestock stalls and internal pillars of rural house design. The variations in house construction further indicates the presence of different cultural groups, such as squared oak log houses indicating the settlement of Slavic-Baltic groups and sloping external supports implying the settlement of Frisians, two pieces of evidence which support historic reports of a culturally diverse settlement. The houses tended to have reed or straw rooves that are attested to in the numerous burnt layers excavated (evidence of many intense fires) in addition to the burnt layer indicating the end of the settlement in the mid 11thC (Carnap-Bornheim et al. 2013 pp. 176,178).

Harbour

Some particularly valuable finds at Haithabu were excavated from the harbour. The textile finds from Haithabu harbour largely date from around the 10thC AD (Lewins 2003). These textiles include Fragments 14 A and B and comprise rags of clothing that were tarred and used to caulk ships that were found in the harbour (Cellio 1995). This means that although the garment layering cannot be identified as it might in a grave find, the tarring preserved larger pieces of textile that would have been lost in a burial environment (Thunem 2014). As a result, the tarring of Haithabu harbour Fragments 14A-B has preserved one of the largest and most complete fragments of a *smokkr* identified to date.

In addition to the textiles from the harbour, shipwrecks, ship building infrastructure and harbour facilities have also been identified, dating from the 9th Century (Kalmring 2009, pp.247). In Kalmring's 2009 report on the archaeological excavations of the harbour, he outlines the numerous sources for information that the site provides and what they disclose about Haithabu's development. The harbour's timber infrastructure continued to expand, particularly during the mid and late 9th Century, to a more comparable size with more established settlements such as Birka.

Kalmring asserts that the harbour was also used to dispose of waste from the settlement, with numerous finds of animal bones and iron slag causing the harbour depth to become shallower, resulting in the extension of harbour infrastructure to deeper water over time. Besides waste the harbour provides evidence of trade through the presence of objects that appear to have fallen into the water during disembarkation. These artefacts include iron bars, mill, whet and grindstones and soapstone vessels. Day to day objects such as fibulae, brooches, children's toys and model boats appear to have fallen between the harbour boards, whilst tools such as axes, adzes and wooden spikes indicate constant repair work on the timber infrastructure, possibly damaged each year by the winter ice-drift. Interestingly, ninety-four glass beads and what appears to be process waste have been found in the Northern shore area, signifying the possible presence of a bead workshop, whilst ten swords with evidence of their scabbards etched into the blades indicate possible weapon sacrifices (Kalmring 2009 pp.250-254). Thus a range of disparate finds in the harbour area provide evidence not only of clothing and trade at Haithabu but also provide a glimpse of the cultural and global contexts, and daily lives, of those living, working and sailing through the port.

Graves

To gain a deeper understanding of the clothing and cultural contexts of those living at Haithabu, it is of value to analyse the numerous grave sites around the settlement and the harbour. Six distinct cemeteries have been excavated, including 1,350 graves of both inhumation and cremation burials dating from the 8th to the 10th Century. Those excavated graves represent only a fraction of the actual number of burials at the site as researchers believe that there are probably more than 10,000 graves present in Haithabu and surrounds (Eisenschmidt 2009, pp.83). Eisenschmidt's study of the graves highlights key locations and finds in addition to cultural indicators provided by the grave sites. The older graves tend to be located to the Western side of the

settlement whilst the most recent burials are to be found nearer the shore. Given that fewer than ten percent of the graves have been excavated, and of those only twenty percent contain any grave goods (Eisenschmidt 2009, pp.94-95), it is not surprising that only one percent (sixteen of the excavated graves) contain brooches indicating a *trägerrock* style garment (Thunem 2014). When graves goods were found, they rarely numbered more than one object, however the most common grave goods include brooches and knives (Eisenschmidt 2009, pp.87). Hilberg (2008, pp.108) explains that because the specific burial excavations remain unpublished, it is necessary to rely on secondary sources for vague overviews of what was found.

During the late 9th and early 10th C there is evidence of a shift in burial practices at Haithabu, with fewer graves containing grave goods, the cessation of the construction of burial mounds and an increase in inhumation burials (Eisenschmidt 2009, pp.98). Eisenschmidt argues that this was influenced by the conversion of the Danes around 965AD, announced by Harald Bluetooth, and that these changes indicate an early conversion to Christianity at Haithabu through the work of the Ansgars missionaries (2009, pp.98).

As indicated previously, only sixteen of the 1350 excavated graves contained evidence of tortoise style brooches indicating a *trägerrock* style garment. This could mean a number of things. It could indicate that the *smokkr*, whilst worn at Haithabu, was not a common garment and may have become less common in the 10th C. This is argued by Eisenschmidt (2009, pp.100) who suggests that there may have been a shift away from *smokkr* style garments in the early 10th C. However, only twenty percent of the excavated graves contained any grave goods at all and there is a distinct shift towards Christian burial customs during the late 9th and early 10th Centuries at Haithabu in addition to the (so far unquantified) numbers of cremation burials. As such, the lack of brooches found in graves may not indicate that the *smokkr* was uncommon, rather it is as likely that burial customs simply do not reflect or preserve what the inhabitants of Haithabu were wearing day to day. Furthermore, burial customs may skew the evidence and may not provide an accurate indication of the proportions of people wearing specific kinds of garments in this instance. Therefore the *smokkr* style garment may have been relatively uncommon. Conversely, it could have been very popular, but simply not represented in the grave finds due to changes in burial practices. As such it is difficult to determine how prevalent the *trägerrock* was at Haithabu, without additional data from alternate sources. Regardless, there are two female grave finds with more than six grave goods indicating wealthy women's burials, particularly the wagon bodied coffin of Chamber Grave 5, dated from around 900AD. Although the finds from Grave 497 remain unpublished, other than the presence of riding gear, table wear and jewellery, Chamber Grave 5 contained evidence of a *smokkr* style garment. In this grave, the woman was buried with two large silver filigree tortoise style brooches, in addition to two golden pendants depicting the earliest known Terslev motif, depicted below (Eisenschmidt 2009, pp.91,100).



Grave goods from Chamber Grave 5 at Haithabu (Eisenschmidt 2009, pp.99)

Given that the highest status female grave yet identified at Haithabu contains brooches for a *trägerrock*, it is clear that the *smokkr* was worn by women of high status and thus may represent an elite style of garment. Taking into account the less wealthy status of Haithabu, perhaps the absence of many brooches in the graves may also indicate an alternative style of dress for working women. Perhaps it may also indicate that the expensive brooches were passed on, rather than buried, by less wealthy families.

Because both silver and bronze brooches have been identified in grave finds at Haithabu it is clear that precious metals were not always used in their manufacture. This provides credence to a theory that the brooches may have been worn at multiple levels of society at Haithabu, and questions any black and white hypothesis of the *trägerrock* being solely worn by the upper classes. Thus, although it is difficult to determine whether the *smokkr* was commonly worn at Haithabu during the mid 9th and 10th Centuries, simply by looking at grave statistics, its popularity could be argued both ways, however it was most certainly worn by at least some of the elite.

Therefore, the evidence from the Harbour, the Graves and the Settlement all provide snippets of information about the way people lived, worked and experienced the Danish town. This evidence highlights that Haithabu was a cultural melting pot, an urban manufacturing and trading environment with complex shifts in cultural expression, burial practices and Christian conversion. Whilst each of the archaeological sites provides a unique data set, they may be used to strengthen and inform evidence from the other sites, resulting in an overall deeper understanding of the cultural framework from which Fragments 14A and B emerged. The location of the fragments in the harbour shines a spotlight on the significance of Haithabu as a nexus in trade and part of a broader international community that unquestionably influenced the cultural context of the settlement.

5. Trade linkages and other relevant evidence

Relevance of trade linkages?

As mentioned previously, researching dark ages garments can be very different to many other styles of clothing, due to the scarcity of complete extant garments, difficult to interpret iconography, and the need to draw information from sources that are disparate geographically and historically. Although Haithabu is rich in archaeological evidence, many questions about the construction of this specific garment arise that remained unanswered. Each of the sites outlined above provides data that can inform an interpretation of a *smokkr* style garment. Fragments 14 A-B provide significant information about the shape, fit, textile choice and decoration of mid 9th to 10th C Danish *trägerrock* style garments. The Haithabu graves provide additional information about textile choices, dyes, loops and brooch placement, layering and undergarment textiles. The textile harbour finds reveal alternate textiles, dyes, stitching and seams whilst the settlement provides insight into technologies and cultural contexts. Yet questions remain unanswered from the evidence at Haithabu, that require answering before a justifiable interpretation may be proposed.

It is therefore necessary to look further afield to fill these gaps in knowledge. Given that Haithabu is centrally located within a broader international context, with complex trade linkages to sites across Europe, it is both necessary, and justifiable, to broaden the scope of research if these questions are to be answered. It is important to note that this approach has the potential to create more problems. By doing so, some researchers treat Norse societies as a monoculture, assuming that what was worn in one Norse settlement was worn in other settlements vastly different both geographically and culturally. Furthermore, in some re-enactment contexts, evidence from disparate times is often misrepresented, as it is fused into 'The Viking Age'.

Haithabu's trading partners

To know which sites have confirmed trade links with Haithabu in the 9th and 10th Centuries, it is valuable to look at written sources. Two 9thC accounts of sea voyages refer to ports at which Wulfstan and Ohthere docked before or after landing at Haithabu, including Truso in the Gulf of Danzig, Northern Norway, Kaupang, and past Jutland, whilst Rimbert's *Life of St Ansgar* links Haithabu directly with Birka and the Rhine (Wolf 2004). Additionally, the network of trade links have been well documented by a number of academics, including Kroch (n.d.) who provides a simple visual guide to known trading routes, in the image below. Unfortunately this is not comprehensive (as indicated by the written sources above) and does not provide dates for various routes indicated. Nonetheless it provides a useful overview of possible links that may be researched further.



Trade Routes as identified through linguistic analyses (Kroch n.d.)
(Additional sites added by the author are noted in blue)

Trade links are not only identified through written sources and researched routes, but also through material evidence at Haithabu harbour and surrounds. Trade connections with Norway and Western Sweden are

confirmed through the finding of products such as unused soapstone vessels in the harbour, tools from Eidsbord and reindeer antler from South-West Norway (Kalmring 2014).

Site Selection Methodology

This research aims to use only evidence dated from the mid 9th and early 10th Centuries, that could justifiably be linked to Haithabu through cultural similarities, such as Danish settlements, or sites with known direct trade links to Haithabu during this period. These sites have been identified through mention in historic written sources or through accepted maps of Norse trade routes during Haithabu's settlement. Furthermore, this paper only adopts evidence from sites where *smokkr* style garments have been identified in the archaeological record. This research proposes that the combination of known trade linkages and similar style garments may justify possible cultural connections and possible trading of knowledge, textiles and fashions.

Skjoldehamn

Many people use evidence from Skjoldehamn harbour in interpretations of 'Viking' clothing, however this research excludes it as a source for four reasons: unclear evidence of a direct trade link between the two sites; it has been dated to the 11th C; a lack of clearly identifiable *smokkr* style garments; and finally it is likely attributable to a cultural group quite distinct from the Danes. Thus, on four accounts, for this paper, evidence from Skjoldehamn harbour is not used to inform this 9th-10th C Danish garment theory.

Birka

In contrast although Birka was a Swedish settlement trade links between Birka and Haithabu are well known from *Rimbert's life of St Ansgar* (Wolf 2004). Trade between these centres continued during the 9th and 10th Centuries and there is evidence for *smokkr* style garments in 128 of the excavated graves at Birka (Thunem 2014). It is important to note that Birka was at its height during the mid 9th C, after which its status as a nodal trading point began to diminish. Evidence from Haithabu harbour indicates that during the mid 9th C Haithabu underwent a period of expansion, during the period of Birka's pre-eminence. That having been said, Haithabu and Birka were not strict contemporaries as Haithabu continued to develop until the mid 11th C, well after Birka's diminution in the mid-10th C. Therefore, although Birka was not Danish nor a strict contemporary of Haithabu, at the current dating of the Fragments 14A and B it is justifiable to use finds from *trägerrock* style garments at Birka to inform an interpretation of the Haithabu fragments, as there is a strong likelihood that cultural exchanges occurred between the sites prior to the currently accepted dates for the manufacture of the fragments. In addition, Birka provides evidence not available at Haithabu, such as complete front top panels (Birka Grave 597), placement of side seams and iconography. In doing so the evidence from Birka helps fill gaps in knowledge left by the evidence at Haithabu. Furthermore, Birka provides some of the most comprehensive evidence for this style of garment and as such cannot be excluded from a study of *smokkr* style garments. Therefore, it is of arguably greater value to use evidence from sites with known cultural or trade linkages to a specific site, than to make assumptions based on preconceived ideas or common interpretations.

Other Sites

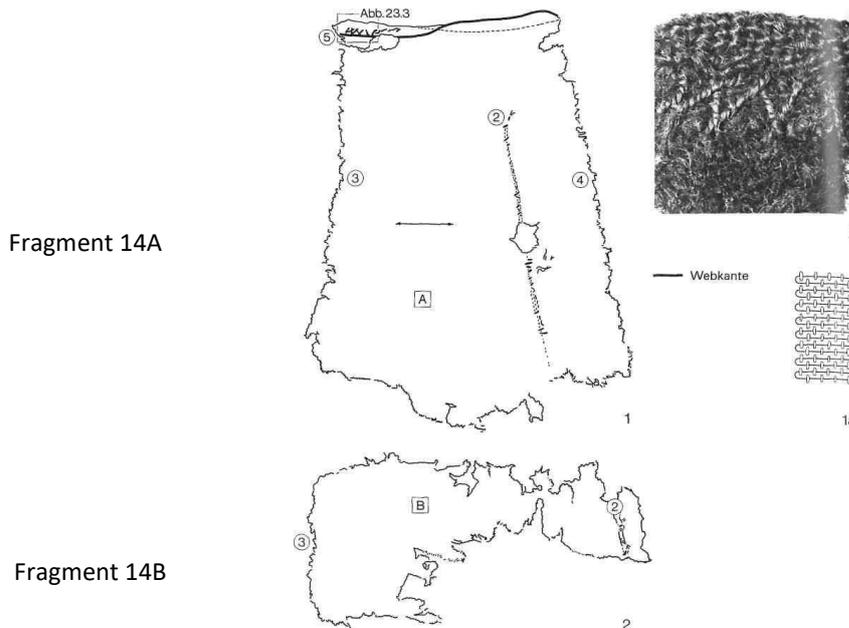
Other sites that were contemporaneous with Haithabu with female graves indicating *smokkr* style garments and viable trade linkages include Vernes, Sandanger, Leens and Kaupang and other sites in Sweden (Lewins 2003).

Given the scarcity of complete garments and the many questions left unanswered by the evidence at Haithabu, it is necessary to look at these sites with known trade, and thus possible cultural, linkages to help answer such questions. Through identifying sites with cultural connections in the same period as the dating of the fragments in question and evidence of similar styles of garment from the same period, it is possible to find justifiable evidence to assist in the interpretation of the Haithabu fragments, whereas in other cases it is necessary to resort purely to guesswork and conjecture. This research aims to justify any guesswork and conjecture with evidence where possible but acknowledges that some gaps necessarily remain.

6. The Haithabu Harbour *Trägerrock* Fragments

Once one has a basic understanding of the geographic, cultural and archaeological contexts for the Haithabu textile fragments, it is necessary to provide an overview of the *trägerrock*, or *smokkr*, fragments. Below is a very brief summary of the material evidence provided by the Haithabu harbour fragments in question. It is intended simply to orient the reader and provide a context for further detailed analysis of the fragments. Through interrogating this evidence a justifiable interpretation of the garment from which they derived may be better informed.

The two textiles at the core of this investigation are identified by Inga Hägg as Fragments 14A and B.

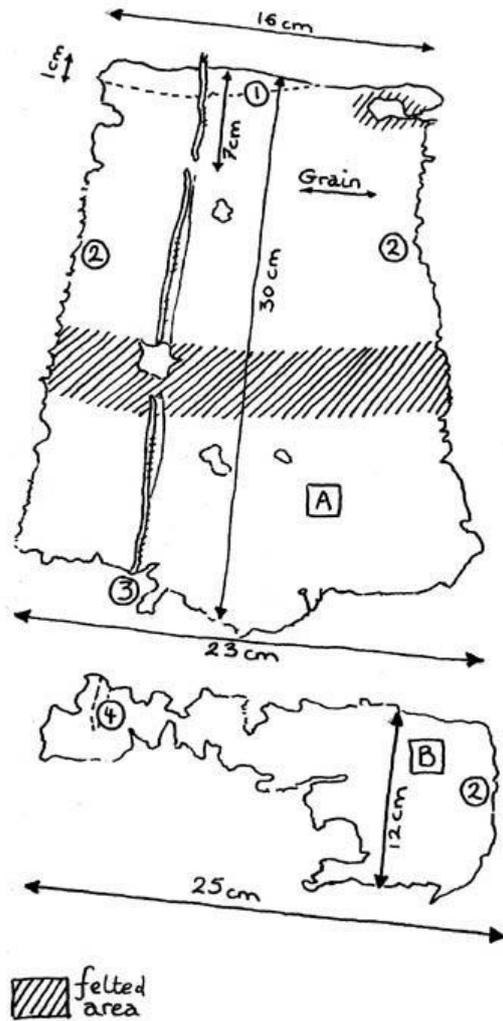


*Interpretive image of Fragments 14A and B, weave and upper hem (Hägg 1984, pp. 40).
(Please note, this drawing depicts the interior of the garment fragments)*

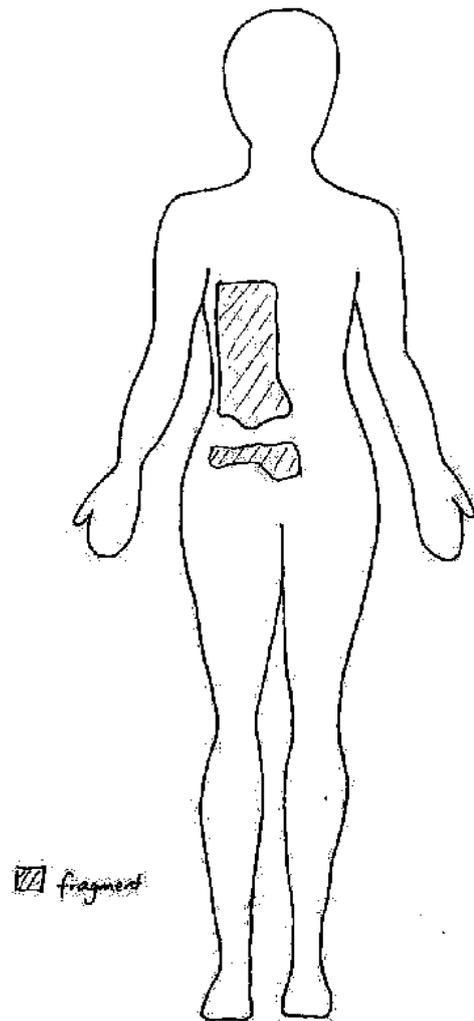
These fragments were worn, torn, tarred and used as ship's caulking, before they were excavated from Haithabu harbour. Both fragments were made from repped woven, woollen fabric, approximately 1mm thick and dyed with walnut dye. The two fragments appear to derive from the one garment, with a total height of around 410mm (Hägg 1984, pp.38). The largest piece (14A) is around 300mm high, 160mm wide at the top, and 230mm wide at the bottom where the garment is torn (Beatson and Ferguson 2008). The top hem of 14A is a selvedge, folded inwards and hemmed with a herringbone stitch, the bottom edge is torn so the overall length is not known. One side edge is straight, perpendicular to the grain of the fabric, whereas the other extends straight before flaring outwards. Rows of holes down both sides of the fragments indicate seams on both sides of the garment however the construction of these seams is unknown (Thunem 2014).

Around 70mm from the top edge, a dart is present that sits on the *outside* of the garment, running to the bottom edge of 14B. Over the dart a decorative braid in red and yellow wool is stitched, that extends from the top hem to the bottom edge of 14A. A band of felting and wear is present at the deepest point of the dart, approximately 150mm from the top hem, indicating that the garment was worn with a belt. A further patch of felting and wear, with an associated hole is present near the top hem towards one edge, possibly indicating the placement of the shoulder strap.

Lewins (2003) provides a line drawing of the fragments (depicted below) to assist with an overall understanding of the structure and condition of the fragments. Beside that is a pictorial interpretation of the placement of the fragments on the body, in line with Hägg's theories about the placement of the fragments.



Interpretive drawing of Fragments 14A (upper) and 14B (lower) (Lewins 2003)



Probable placement of textile fragments on the wearer (author's drawing)

Inga Hägg, who undertook and published the analysis of the textiles from the harbour at Haithabu, is considered one of the key researchers in the field. She asserts that the top hem, in conjunction with the shaping and location of the dart indicate that these fragments must derive from a *trägerrock* rather than a sleeve or some other article of clothing (Hägg 1984, pp. 39). Lewins (2003) takes this further, proposing that the cut, quality of stitching, dye, fine woollen weave and type of garment indicates that it was worn by a woman of the upper classes. Assuming that Hägg is correct in her interpretation of the fragment, the following research provides an exposition of the evidence available and a discussion of possible interpretations of that evidence. Hägg dates the textiles from the harbour to the 10th Century, with this date assigned based on the age of other finds from the harbour (Hägg 1984, pp.11). This date indicates the age at which the fragments were tarred and used to caulk the ship. By the time that this occurred, the fragments had deteriorated from what were probably high-class garments, to rags. Although the 10th Century is the period generally ascribed to these fragments, it is reasonable to argue that their date of manufacture was probably much earlier, given the degree of wear from use. As such, this research will utilise evidence from the mid 9th, to the 10th Centuries, as this is more likely to be indicative of the time it was manufactured and worn. This places the fragments within a time period contemporaneous with the height of Birka as a focal point for trade, and the numerous grave finds with evidence of *smokkr* style garments. As such, Birka has been used as the best comparable site, in line with current academic thinking.

7. Textile Choices

What were the extant fragments made from?

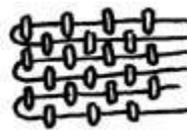
Before analysing cut and construction, it is always valuable to understand the kinds of textile used in an extant garment, as this will necessarily affect the hang and fall of the garment, the kinds of seams and stitches chosen and provide some understanding of the original aesthetic of the garment. In Hägg's analysis of the Fragments 14 A and B, she describes the textile as:

“Großes Stück von feinem, braungefärbtem Gewebe in ripsartiger Tuchbindung” (Hägg 1984, pp.39)

This roughly translates to a piece of fine, brown coloured fabric in *ripsartiger* plain weave (Hägg 1984 pp.38). *Ripsartiger* is usually translated as 'repped', which seems to have caused some confusion as to the interpretation, (see Lewins 2003) however, in Hägg's (1984) glossary on page 259 she clarifies the terminology stating that:

“Ripsartig. Ripsähnliche Gewebestruktur, durch wesentlich dichtere Kette als Schuß (oder umgekehrt) erreicht.” (Hägg1984, pp.259)

This translates as: “Repp-type: Repp-like weave structure, achieved through (using) a significantly thicker warp than weft thread (or vice-versa)” (Lucas pers. comm. October 2015). Essentially this means that the weave is a tabby weave in which one set of threads (either the warp or the weft threads) is significantly thicker than the other set of threads, as indicated in the image below.



Depiction of Repped Tabby Weave (Lewins 2003)

This is not an uncommon weave with more examples found at other sites, including Birka grave 835 (Lewins 2003). Geijer classifies this kind of textile as the W25-28 type (Lewins 2003). Broome (2015) takes this further, arguing that most textiles woven on a warp weighted loom demonstrate a repped weave of this type.

Numerous sources confirm that the fragments were made from wool (Thunem 2014). Hägg goes on to note that the fabric is approximately 1mm thick (Hägg 1984, pp 38). Jesch (2001) further describes the specifics of the weaves in the manner below:

“Technical description of weave - Wool, fabric is ~1mm thick. Finely woven tabby (1/1, Z/S), 15(warp) x 8-10 (weft) threads per cm. Simple unreinforced selvedge.” (Jesch 2001, pp. 15)

As such it is possible to put together an image of the textile from which Fragments 14 A-B were made. The fragments comprise a 1mm thick woollen fabric in a finely woven tabby weave, approximately 15x8 threads per cm, with one set of threads significantly thicker than the other, resulting in repped fabric.

It is important to note that although chemical analysis of the wool, to determine where it was grown and the kind of sheep from which it derived, has not been published, it is generally understood that the types of sheep farmed during the Viking Era no longer exist. Tests are being undertaken to determine which modern sheep have the closest DNA to the kinds of sheep that provided wool for Schleswig, however this research has not yet been published (Nikulina n.d).

Similar textiles identified at the site and associate sites

To complement an understanding of the textile from which the extant garment was constructed, it is also useful to gain an understanding of other kinds of textiles found at Haithabu, in addition to the kinds of fabrics used to construct *smokkr* style garments at other sites with direct trade links to Haithabu. In doing so, justifiable garments may be constructed from fabrics that are not brown repped wool, whilst still being

informed by relevant evidence. Hägg (1984, pp.140) provides a pictorial summary of various types of twill fabrics found in Haithabu harbour and the fragments from which they derive.

Given that wools and linens tend to be preserved in different kinds of burial environments, it is difficult to determine whether linen or wool was the preferred fabric. As wool is more easily preserved in certain burial environments, it is not unrealistic to presume that the discrepancy in the number of wool vs. linen fragments found in graves may not truly demonstrate the representation of each textile in everyday fashions (Thunem 2014). It is also interesting to note that there may be discrepancies between the types of textiles identified from grave finds and what people wore daily. The kinds of textile fibres and weaves identified at both the Haithabu settlement and harbour are roughly equivalent, whereas the ratio of textile types between the harbour and the graves varies significantly. The graves tended to contain textiles of a higher quality, with a greater proportion of those textiles made from a tabby weave (seventy three percent of textiles found in the graves were of tabby weave compared with twenty five percent of the textiles from the harbour and settlement) (Thunem 2011). This could imply that people were not buried in the kinds of textiles that they wore everyday, indicating that the evidence from the graves may provide a skewed understanding of commonly worn textile types and weaves.

Although it has been claimed that the fine nature of the textiles from which Fragments 14 A and B comprise indicates that they were imported, Andersson Strand (2009, pp.11) proposes that the spinning and weaving tools found at Haithabu were more than capable of manufacturing the kinds of woollen and linen textiles identified at the site. As such, the textile industry was probably local and these textiles were unlikely to have been imported.

To gain a broader picture of what was probable, it is also useful to identify the kinds of textiles on other extant *trägerrock* fragments identified at Haithabu and their known trading partners, specifically Birka and Kostrup. It is important to note that the majority of textile fragments in question were only preserved in close proximity with metal objects (Jesch 2001, pp. 15), as mineralised textile. This means that there are very few larger fragments of *smokkr*, like those from Haithabu, and much of this information is extrapolated from small fragments under brooches, pins and other grave goods. That having been said 4,800 textile fragments have been identified at Birka all of which derive from grave finds (Andersson Strand 2009, pp.11). Andersson Strand (2009, pp.11/14) compares textiles and tools from Haithabu and Birka, arguing that there is strong evidence that the majority of textiles found at both locations were produced on-site. According to Broome (quoting Hägg 1971, pp.51-52) most of the *smokkr* finds identified at Birka appear to have been constructed from diamond twill (Broome 2015). Thunem (2014) proposes that the majority of woollen *trägerrock* fragments from Birka are fine twills but specifies broken lozenge twill, in addition to some examples of repped wool and other tabby weaves.

Historic texts confirm that there was a direct trade route from Haithabu to Kaupang, as such it is justifiable to use evidence from late 9th and early 10th Century *smokkr* finds to derive information regarding what people may have been wearing at Haithabu. In Kaupang Grave C (late 9th, early 10th C), there are two fragments of tabby wool and a number of fragments of three different types of lozenge twill from a *smokkr* style garment (Thunem 2014).

Lucas (2009) provides a concise outline of the kinds of textiles and weaves found on *smokkr* fragments from numerous sites including Birka, Haithabu and Kostrup, all of which have known trade linkages indicated previously. Of those fragments included in the summary, the majority of *smokkr* fragments were of wool with variations of weave including diamond twill, other twills, tabbies and unknown weaves. However six of the *smokkr* fragments summarised were of a linen tabby weave. Of the examples from Haithabu, both linen and wool are represented, however only the woollen fragments represented a variety of weaves (Lucas 2009).

As mentioned previously, Andersson Strand argues against the theory that many of these textiles were imported, proposing that the tools of production (including spindles, loom weights, needles and so on) found at Haithabu and Birka were capable of producing the kinds of textiles found in archaeological excavations (2009, pp.14). The lack of identifiable textile workshops in the archaeological record at both Haithabu and Birka indicates that although textiles were not produced in a workshop environment, textile production was organized as a household industry. There was scope (and wealthy patronage) for professional specialisation and trade of textiles, but within a domestic manufacturing environment (2009, pp.14). Therefore, whilst Haithabu was probably not trading their textiles externally, domestic manufacture was probably traded within the settlement.

Trägerrock fragments have been identified at Haithabu and a number of trading partners including Birka, Kostrup, Kaupang and Pskov of various kinds of fabrics. These fragments comprise various textiles of both wool and linen, with woollen fragments woven in tabby, repped, and various twills. Therefore it is justifiable to argue that *trägerrocks* at Haithabu may have been constructed from fabric woven onsite, in either tabby weave linen or wools of various weaves including: tabby, repped tabby, diamond twill, broken lozenge twill, lozenge twill and quite possibly other kinds of twills.

8. Dyes

In addition to textile weave and fibre, to gain an insight into the way a *trägerrock* may have looked, it is necessary to analyse the dyes found on extant fragments. Identifying the colours of archaeological evidence can be complex as the colour of a textile may shift as the dye degrades, or may be disguised by corrosion products or other mechanisms of deterioration (Thunem 2014). Until more comprehensive analysis is undertaken to identify the chemicals present on each of the extant textiles, it is difficult to confirm which dyes were present or popular in 10th C Haithabu. That having been said, numerous fragments of excavated cloth indicate traces of colour, from both Haithabu and other associated sites. As such, it is valuable to look at the kinds of dyes used at Haithabu and other associated sites, so as to gain a deeper understanding of the kinds of colours that may have been popular for overgarments, particularly *trägerrocks*.

Fragments 14 A and B

So what colour were Fragments 14A and B? Hägg refers to these specific finds as being of a fine brown coloured fabric (1984 pp. 38) but was that simply due to discolouration? Hägg had a number of the brown textile fragments analysed to identify the kinds of dyes used, these are summarised in Appendix 2 by Helmut Schweppenburg (Hägg 1984 pp.289). Schweppenburg confirms that Fragments 14A and B were dyed brown with walnut shells, without apparent iron or copper mordanting (Hägg 1984 pp.289). Of the samples analysed a total of twelve other fragments were also dyed with walnut shells in this manner indicating that this may have been a relatively common dyestuff (Hägg 1984 pp.289). Of the remaining samples ten proved to be naturally brown wool, three were dyed with walnut shells and iron tannins (and/or salts), one fragment was of natural brown wool with iron tannins (and/or salts), two fragments were of natural brown wool over-dyed with walnut shells and one fragment of natural brown wool with parietin (possibly a yellow lichen, *Xanthoria parietina*) (Hägg 1984 pp.289).

The walnut dye itself is made from the shells of the walnut (*Juglans regia*) which contains juglone (5-hydroxy-1,4-naphthene-thochinon) which is used as a natural dye, to dye uncoloured wool brown (Hägg 1984 pp.289, CPD 1999). Thus Fragments 14A and B were analysed and identified as having been dyed with walnut shells without iron mordants or tannins (Hägg 1984 pp. 289). Although numerous textile fragments from Haithabu harbour were dyed with walnut dye and a large number of walnut shells of the *Juglans regia* species have been found at Haithabu it appears to have been an imported dyestuff. No evidence of the use of walnut timber has been found, nor has the presence of *Juglans regia* pollen been identified in samples from the site, indicating that the walnuts/shells were imported to the site (Sloth, Hanser & Karg 2012, pp.27-38). The presence of the

shells indicates that the textiles may have been dyed at Haithabu, rather than imported already dyed¹. The use of a (probably expensive) imported dye-stuff suggests that the walnut dye may have been a high status colourant, supporting the theory that this was probably an elite garment. The expense of the brown dye, in addition to the number of brown dyed textiles from harbour may also imply that perhaps brown was more fashionable than one might presume.

Given that the fragments were dyed with walnut shells, the question remains as to the colour that this dye produced. The use of various metal mordants can alter the colour of a walnut dye (Dean 2015), so it is useful to identify possibly colours for wool dyed with walnut shells without iron mordants. The image below depicts colours that can be achieved using walnut shells and leaves to dye wool without metal mordants (Dean 2011). The two skeins on the left depict colours achieved from walnut husks without metallic salts and may provide an indication of the colour of the original garment of Fragments 14 A and B. For further images of walnut dyes with various mordants, *Jenny Dean's Wild Colour* (Dean 2015) is valuable.



From the left, skeins 1 and 2 were dyed using fresh walnut hulls and skeins 3 and 4 were dyed using fresh walnut leaves (Dean 2011)

Other fragments dyed with the same dye

As indicated above a number of textile fragments from Haithabu Harbour were dyed brown with walnut dye and variations thereof. These variants include walnut dyed white wool, walnut dyed natural brown wool, and some overdyed samples. Most of these were from relatively coarse fabrics, however Fragments 18 and 55A were more similar to Fragments 14A and B in their fine weave (Thunem 2014). As Hägg believes that a number of these dyed fragments were from *serks*, there has been some speculation that the walnut dye was used partially as it may have some antibacterial effect (Hägg 1984, pp.175).

The antibacterial quality of the walnut dyed textiles from Haithabu has been widely discussed as a reason for its use. This theory is further investigated by Ghaheh et al (2012) who confirmed that although walnut shell does have an antibacterial effect, unless the dye is mordanted with metallic salts the effect is not durable after washing or exposure to light (Ghaheh et al 2012, pp. 477). Thus other textiles from the harbour which may have had metallic salt mordants could have achieved an antibacterial effect (Ghaheh et al 2011 pp.475). However the *trägerrock* fragments did not contain metallic elements, indicating this kind of mordanting and thus would not have achieved any lasting antibacterial effects. Therefore, it is more likely that Fragments 14 A and B were dyed with walnuts for aesthetic, rather than hygienic reasons.

¹ Through Thin Layer Chromatographic analysis, Gas Chromatography Mass Spectroscopy or Strontium isotope analysis of fragment samples, it may be possible to determine the place where the wool was manufactured, thereby confirming whether the wool was locally produced and dyed on (or near) the site, or both dyestuff and wool were imported.

Known available dyestuffs

As there are fragments of *trägerrocks* at Haithabu and other sites that have been constructed from both wool and linen, to gain an understanding of the kinds of dyes that may have been used on these garments, it is necessary to look at dyestuffs from both linen and woollen fragments found at Haithabu.

According to Priest-Dorman (1999) wool comprised the chief textile fibre used in the Viking Age and was available in white and natural shades of greys and browns which were often spun and woven without having been dyed (Priest-Dorman 1999). This is supported in Appendix 2 of Hägg (1984), in which fourteen samples appear to have included naturally coloured brown wool, ten of which were not over-dyed (Hägg 1984 pp. 289). The woollen fragments from grave finds at Haithabu tended to be a darkish colour, discoloured by corrosion products or decomposition of the body, causing difficulty when identifying the original colours of many woollen fragments. However blue and dark brown dyed fragments have both been identified in Haithabu graves (Thunem 2014) in addition to reds and greens from trouser fragments from the harbour (Hägg 1984 pp.164). Furthermore the dart decoration on Fragment 14A comprises three red and three yellow woollen yarns, although the dye stuffs are not identified in text (Hägg 1984, pp.38). Therefore it is safe to conclude that blue, red, yellow, green and brown woollen fragments have been identified at Haithabu.

Although the colour of the linen *trägerrock* fragments from Haithabu remains unconfirmed, other fragments of linen have been identified in graves, showing evidence of dyed linens. In fact, two *serk* fragments demonstrate the use of checked linen fabrics with a fine (5mm) blue and white check found in grave 27/1963 and a similarly fine red and blue plaid discovered in grave 159/1960 (Thunem 2014). Whether checked fabrics such as these were used in the construction of *smokkr* type garments is unconfirmed, however it is plausible. Either way, these samples provide an indication that linen was being dyed with both red and blue dyes and worn at Haithabu.

Dyes found at associated sites

Given that there is evidence for dyed linen at Haithabu, but that data is limited, it is valuable to look at linen finds from associated sites to provide a more comprehensive view of dyed linens within this context. Whilst most linen fragments appear to have been undyed, there is an example of a blue linen fragment with red string decoration in Grave 563 at Birka (Thunem 2014). Although the chemical analysis indicating the sources of these colours is not provided, the two different colours from the same burial environment indicate that the colours are genuine rather than discolouration (Thunem 2014). Furthermore two undergarments from Birka (Graves 60A and 762) appear to have been dyed blue and red respectively in addition to the blue linen *trägerrock* in Grave 563 (Thunem 2014). As such, it seems reasonable to argue that linen was dyed red or blue at the very least, with the possibility of checked fabric and is justifiable to use for both the *smokkr* and undergarments.

In addition to checked linens there is even evidence at Birka (Grave 1090) for what may have been a striped woollen *smokkr*, with 5mm wide stripes of blue and reddish brown (Thunem 2014). The dyeing of woollen *trägerrocks* is not limited to Haithabu and Birka as blue woollen *smokkr* fragments have also been identified at Kostrup, and other finds.

It is useful to know the colours identified at specific sites however most resources on Norse dyeing techniques tend to provide broader overviews of the kinds of dyes used in the Viking Age. Although this is less specific than the focus of this paper, such publications have provided the kinds of dye-stuffs and chemicals identified on dyed textiles which may then be extrapolated when looking at the colours of specific finds, where chemical analysis is unavailable.

Priest-Dorman (1999) provides some useful insights into possible sources for dyes in an analysis of 220 samples of Viking Age textiles, in which ninety provided evidence of dyeing. Whilst the research does not specify which samples were from Denmark but it does provide possible dye sources:

“The samples come from Dublin, Jorvik, and 19 sites in Norway and Denmark; the dyes mentioned are: red from madder or bedstraw; a purple derived from lichens; our mysterious yellow X [from an unidentified plant]; and a colorant identified as indigotin, almost certainly derived from woad. The insect dye kermes has also been found, and luteolin, presumably from weld, but only on imported silks. (Walton 1988b, 17) Yellow X is still unknown. Chemical testing has eliminated 25 possible dyestuffs, including weld, broom, buckthorn, heather, chamomile, and saffron (see Walton 1988a for a complete list of dyestuffs tested). Blended colors are also represented. Indigotin was used in conjunction with other dyes to produce several purples (with madder) and a green (with the unidentified yellow). Madder and lichen used in conjunction yielded a red-violet result (Walton 1988, 18, figure 9). Some evidence of brown from walnut shells has also been found, as well as one or two pieces that were intentionally dyed very dark brownish-black with walnut shells and iron (Hägg 1984, 289)” (Priest-Dorman 1999).

Priest Dorman (1999) goes on to identify the plant species for each of the dyes mentioned above, the specific chemical colourants and likely mordants. Each of the colours listed by Priest Dorman above has been found on textile fragments at Haithabu or direct trading partners, with the exception of the lichen dyes. As such those dyestuffs may have possibly been used at Haithabu.

In summary, the most accurate interpretation of the Haithabu Fragments 14A and B would use walnut shell dyed white wool. However it is justifiable to construct a *trägerrock* from either linen or wool dyed in the following colours, probably from the dye-stuffs summarised by Priest-Dorman above. Whether undyed linen was used for over-garments remains unclear, however, it would have been available and thus may be argued either way. Certainly the most common colours for dyed *trägerrock* fragments at Haithabu and associated sites are: blue, brown and red. However, other viable colours include:

Linen: red, blue, blue with fine white checks, blue with fine red checks, undyed linen.

Wool: un-dyed white, brown and grey wools. Dyed blue, red, yellow, green, brown, brownish black wool with or without thin (5mm) stripes (as found on a *smokkr* at Birka).

9. Garment Length

Unlike the dyestuff, there is no definitive evidence indicating the length of the *smokkr* at Haithabu. The Haithabu fragments do not reflect the length of the garment, nor does textile evidence from the Haithabu grave finds. In fact, according to Broome (2015) there is (to date) no archaeological evidence at all that identifies the length of *trägerocks*. This is largely because the metal artefacts that tend to preserve textile fragments are not placed at the lower end of the dress, or at the feet in these graves (Thunem 2014). Whilst the Haithabu fragments only extend approximately 42cm, and there is at least one grave at Birka with a chain and knife hanging to the hip that has preserved textile from the *smokkr* (Thunem 2014), beyond the hip there doesn't appear to be any archaeological proof of *smokkr* length. Therefore it is necessary to look further afield to derive evidence to justify *trägerrock* length. This research considers two different approaches to identifying length: loom width and iconography.

Loom width

Because the top seam of Fragment 14A is the selvedge, it is reasonable to argue that the length of the dress may be determined by the width of the fabric, to avoid wastage of fabric. This is assuming that the bottom edge would then also be either selvedge or hemmed selvedge, which would give the length of the garment. However, publications don't indicate the excavation of any extant looms at Haithabu or Birka that have identified loom width. Loom weights have been found but not extant looms. There are extant Norse looms including those found at Oseberg but this research has not directly linked Haithabu with Oseberg according to trade routes, to justify using material from this site to determine textile width.

Cook, Christiansen and Hamarlund (2002, pp. 205) provide some indication of possible loom widths of 2/1 twill cloths in reference to the standard size of sails from Viking Age shipwrecks. In spite of disparities in age,

almost all of the examples were found to have a loom width of 65-72cm. Whilst this provides some indication of the width of specific kinds of textiles that must have been known in a trading port such as Haithabu, whether these same widths were used for garment cloth manufacture is unclear. However this shorter width does not fall clearly in line with the iconographical evidence outlined below. Given that the average height for women in Viking Age Denmark was 158.1cm (Lucas 2012) a 72cm wide loom width, when cut according to the construction parameters outlined above, would not provide an ankle or floor length garment. It is interesting to note this slight disparity in the available archaeological and iconographic evidence, however without further data it is difficult to determine which may be more accurate.

Iconography

As such, it is necessary to look to iconography of female figures that may be associated with the time and place of Haithabu or known trading sites. The most comprehensive group of female figures from this time and place are the so called 'Valkyrie' tokens, a series of medallions found in numerous locations depicting female figures ranging from the 8th C to post 10th C (Lucas n.d.).

Unfortunately there is no iconography directly from Haithabu, therefore Birka provides the closest site with images of female figures that fit within the desired time period and trade routes. Other tokens have been identified, such as the Revninge woman (early 9th C), depicted further below and other figures from Uppland (8th -9th C) or Öland (10th C). However their variance in dates and a lack of clarity regarding their direct trade with Haithabu makes them less desirable as evidence for this research. That having been said, each of these tokens tend to support a similar conclusion. The three Valkyrie tokens of interest specifically for this research were found at Birka, and have been dated to the 9th and 10th centuries, which make them approximately contemporary to the Haithabu fragments.

Although that the Haithabu fragment is dated to the 10th C, this date may be misleading as it is the date of submersion, rather than manufacture. Thus taking this date as possible, but the mid 9th C as more probable, the three figures below are considered acceptable to use as evidence. The earliest of these tokens, from Birka Grave BJ507, appears to be wearing a dress that is floor length with a train with folds in the length of dress. The feet are not visible and the figure appears to be wearing a shawl (depicted on the left below).



9th – 10th C Birka ear spoon and drawings of 10th C Birka pendants (Lucas, n.d.)

The two right hand figures are believed to be 10th C, both garments appear to be quite long with many folds and both appear to have some degree of train or extra length at the back, however, both garments are slightly above the top of the ankle, indicating a shorter overall length. As the three tokens were found at one of Haithabu's key trading partners date from roughly the same period and all indicate a long garment with a train, the most justifiable interpretation (when considering the evidence, rather than speculation) is to make the *trägerrock* either floor length with a train, or ankle length with a train.

Whilst some argue that a train would have been unlikely for practical reasons, it is useful to remember that Fragments 14A and B are likely to have been worn by a wealthy woman in an urban environment with infrastructure (boardwalks) that facilitated the wearing of such garments without dragging them in the dirt.

10. Threads used for Stitching

Threads used for construction stitching on extant textiles

Once the cut, length, colour and textile of the garment have been identified, the next key decision for an interpretation involves the choice of threads used in the construction. Hägg (1984) provides a summary of the kinds of threads found on seams in Haithabu harbour on pages 254-256, however she summarises this stating that the sewing threads were almost entirely made from two strands of Z spun wool plied with an S twist. She also notes that occasionally the threads lie parallel to each other, but surmises that this has occurred as a result of the repeated spiral motion of whip stitching, when sewing against the direction of the S twist (Hägg 1984, pp.151). On Fragments 14A and B, the threads used on the herringbone stitch and the running stitch were both Z spun, S plied, however the dart decoration (unusually) is whip stitched on with a single Z spun thread (Hägg 1984, pp.151, 254). The grist and thread thickness is not noted in Hägg's analysis.

The colour of the threads used on the *smokkr* fragments are not indicated in Hägg's text and it is difficult to ascertain this information from other sources. Given that for other fragments, where there is a contrast in the stitch/garment colour it is noted in the text it is reasonable to assume that the stitch colour is not significantly different to the garment colour in this instance. Stitch colour is rarely noted in many of the primary source materials for these kinds of finds, which makes it difficult to determine whether it is appropriate to use contrasting stitch colours on these kinds of garments. However, there are examples from Haithabu Harbour of garments using contrasting coloured stitching, including Fragment 56A which has stitching in lighter and darker shades (Hägg 1984, pp.81). This indicates that it may or may not have been common practice at Haithabu, as it is common at other contemporaneous, but potentially unrelated Viking Age sites such as: London, Jorvik, Leens and Skjoldehamn Harbour (Walton 1989, Pritchard 1984 pp.58-9, Brandenburg 2010 pp.50).

Therefore, in the construction of a justifiable interpretation of Haithabu Fragments 14A and B, it would be most accurate to use walnut dyed wool with two strands of Z twisted wool plied with an S twist. However there is some evidence from Haithabu to justify using threads of a contrasting colour or shade to the rest of the garment.

11. Construction Stitches

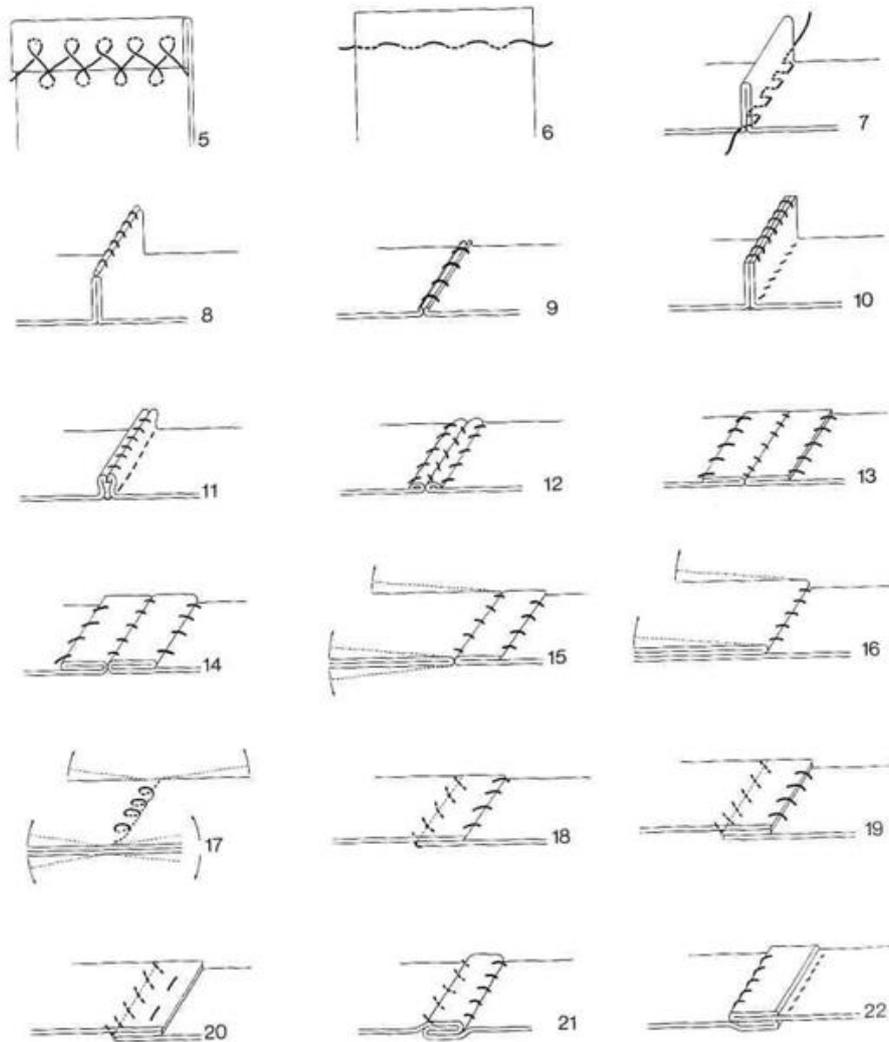
Evidence from Fragments 14A and B

It is interesting to note that Fragments 14A-B have not retained an indication of the kinds of stitches and seams used in their construction. However, the shapes indicate the original cut of the garment and the stitch holes remain present on both lateral edges of the fragments (Hägg 1984, pp.38, Beatson and Ferguson 2008). While this doesn't indicate the kind of stitch used in construction it does reveal that the original stitch interval was 5-6mm (Beatson and Ferguson 2008). This is quite a small stitch length when used for whip stitch or overcast stitch, however it is quite large for a running stitch. Given the fine stitching along the top edge it is more likely that the construction stitching was also comparably fine therefore a whip stitch is a more likely interpretation based on stitch length alone.

Construction Stitches found at Haithabu

While there are holes for stitches on the edge of the extant fabric, the thread has been lost so it is not known which stitches were used to piece together the garment. As such it is necessary to extrapolate the kinds of stitches that may have been used. Luckily, numerous stitches have been found on fifty six of the textile fragments in Haithabu harbour to use as evidence of the kinds of stitching being used in 10th C Haithabu (Hägg 1984, pp.151). From this data set, Hägg summarises that there are three main stitch types used: whip stitch (overcast stitch), running stitch and herringbone stitch, with whip being by far the most common, whilst Herringbone stitch was only represented on Fragment 14A (Hägg 1984, pp.151). Fragments 14A and B display

stitch types no#5, 7 and 8 depicted below, on the hem, dart and dart decoration. However this still does not clarify which construction stitches may have been used for the lateral edges.



Seam variants identified on textile fragments from Haithabu Harbour (Hägg 1984, pp.150)

The above image depicts the numerous examples of seam treatments and edge finishes found at Haithabu. These are further summarised by Walton (1989, pp.408) who particularly examines the more unique (for the Viking Era) seam constructions, such as no# 11 and no#10.

In addition it is useful to note that Hägg provides a very comprehensive summary of the kinds of stitches used on each fragment on pages 254-256 (a small part of which is depicted below). This provides the: fragment number, stitch length and distance, seam type, number of threads, how they were spun and the kind of garment they were found upon.

Tab. 27 Forts.	Fragment/ Naht	Stich-		Abb. ³ 102	Faden-		Funktion
		Länge (mm)	Abstand (mm)		Zahl	Drehung	
	11/5	5	4-5	9	2	zS	
	11/6	5	5-6	20	2	zS	
	11/7	5	5		2	zS	
	11/8	-	-		17	2	zS
	11/9	-	-	17	2	zS	
	11/10	3	2-3		2	zS	
	11/11	3-5	3-5	18/19	2	zS	
	11/13	4-5	3-5	9	2	zS	
	11/14	5-10	6-8	9	2	zS	
	11/15	3-5	2-6	9	2	zS	
	11/16	8-12	6-20	9	2	zS	
	11/17	3-6	5-8	2	2	zS	
	11/18	-	-	-	2	zS	
	13/1	-	4-6	-	1	z	Lodenwams*
	14A/1	2	2-3	8	1-2	zS	Trägerrock
	14A-B/2	3	5-6	7	1	z	
	14A-B/3	-	5-6	-	-	-	
	14A/4	-	5-6	-	-	-	
	14A/5	7-8	3-5	5	2	zS	

Excerpt of Hägg's table indicating seam and stitch details (Hägg 1984 pp. 254)

Extrapolating from Hägg's tables of stitch data (depicted above) some trends in seam construction and hemming may be identified. Seam no# 9 (depicted above) was by far the most common stitch type identified in the Haithabu harbour fragments with eleven examples of its use. Eight examples of both seam #17 and #19 were identified whilst only three examples of no#7, no#13, no#14, no#16 and no#18 were found. Only one example of no#5 was found, on Fragment 14A.

Below is a table indicating the number of times each seam type was identified on the fragments from Haithabu harbour, indicating the prevalence of each stitch type in the finds.

<i>Seam and Hem types identified on Haithabu harbour fragments</i>							
No# of times identified	1	2	3	8	11	12	13
Seam no# from Hägg	5,6,8,11,12,15,21,22	1, 4, 10, 20,	7, 13, 14, 16, 18	17, 19	9	2	3

Given the range of possible seam construction options available from the evidence at Haithabu, it is reasonable to focus simply on these types of seams without necessarily looking further afield. As the original stitch type cannot be ascertained from the evidence on Fragments 14A-B, the appropriate stitch type to use on an interpretation should be determined by a number of factors: selection from the known Haithabu stitches depicted above, the kind of fabric being used (wool or linen), how full a wool is, how much the fabric will fray and how strong the seam needs to be.

A number of the stitches depicted above have been tested by the author and all have proven useful in different contexts with different kinds of fabric. Given that these seams were being used in 10th C Haithabu, it is justifiable to argue the use of any of the seams listed above in an interpretation, as influenced by fabric choice and seam function, however a whip stitched seam is more plausible based on stitch length, possibly no# 9 as it was the most commonly identified construction seam on the Haithabu harbour fragments.

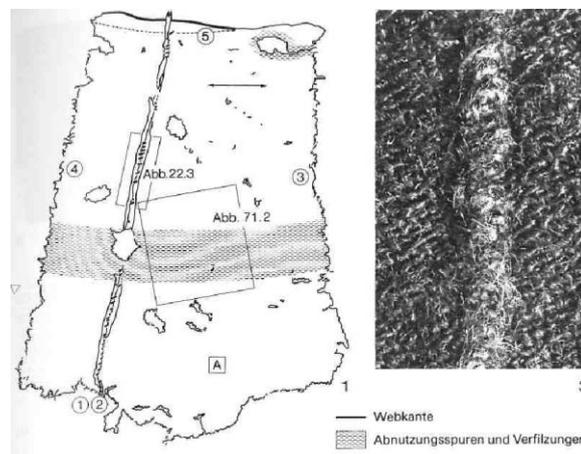
12. Darts

The dart found on the Haithabu *trägerrock* fragments has resulted in a large amount of speculation, particularly regarding what it implies about the garment itself: how fitted it was, whether the dart was located on the front or back, how long the dart was, if a garment was fitted how was it taken on and off and so on.

The presence of the dart in conjunction with the shape of the fragments indicate that this was intended to be a fitted garment, following (and highlighting) the contours of the wearer's body. In this manner, the Haithabu fragment dart has forced many to rethink preconceived notions about Norse clothing particularly with regard to the shaping and fitting of a *smokkr* of this type.

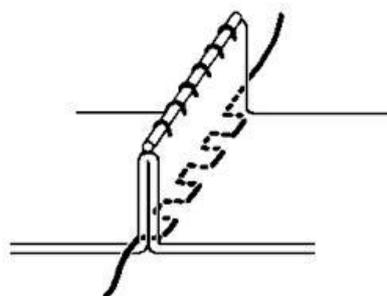
It is also exciting to note that the dart was located on the outside of the garment (the reasoning for this is extrapolated in the dart decoration section below). The variance from modern aesthetics is marked and often misrepresented on interpretations of this garment. However it is useful to focus on the dart itself and what is actually known before giving way to conjecture. The dart runs parallel to the straight edge of the fragments, beginning around 70mm from the top hem (Beatson and Ferguson 2008) and continues beyond the bottom tear of Fragment 14B.

The dart was constructed by pinching a small fold of fabric before sewing it in that position with a running stitch. The thread used was a single Z spun thread, with stitch lengths of 3mm and stitch distance of 5-6mm (Beatson and Ferguson 2008). The depth of the pinched fabric runs from 2mm to 5mm deep, with the deepest point of the dart sitting around 150mm from the top edge. At the deepest point of the dart the fabric is worn and felted (Beatson and Ferguson 2008).



Dart detail and interpretive image of dart placement (Hägg 1984, pp.39).

On top of the ridge produced by this dart, a braided cord was applied using a whip stitch as depicted above. The construction of the dart is represented in the image below.



Interpretive image of dart construction (Beatson and Ferguson 2008)

So what information can be derived from this evidence? The application of a decorative band to the top of the dart, that appears to serve only a decorative function, implies that the dart was located on the outside of the garment (Lewins 2003). From the evidence available it isn't possible to determine the length of the dart (although it extends at least 410mm), however the decorative band extends beyond the top of the dart to the hem of the garment. The decoration is lost on Fragment 14B, making both the total length of the dart and the total length of the decoration unclear.

The image above indicates that the dart was tightly stitched and that the decoration was also stitched tightly in place. The dart construction further uses a running stitch which allows no stretch. It is difficult to determine why this is so, however there is an implication that perhaps this tight stitching and lack of stretch may have provided some structural integrity to the dart. This gives credence to the hypothesis of a fitted rather than merely a shaped garment, as the dart may have provided some structure or support to the *smokkr*.

At the deepest point of the dart, the textile displays evidence of felting and wear, with a hole worn through at the dart (Beatson and Ferguson 2008, Thunem 2014). This indicates that the garment was probably belted at this point. This may indicate that it also marked the natural waist of the garment before it began to flare out (Lewins 2003). It has also been suggested that the narrowness of the dart indicates that it was located on the back of the garment (Lewins 2003). Whilst this isn't a compelling argument, the dart was probably located at the back of the garment for other reasons discussed in the construction section below. Lewins does however argue that the shape of the dart combined with the top hem indicates that this fragment comes from a *trägerrock*, as the depth in the middle helps indicate that it is not a sleeve or other garment as they are unlikely to have narrowed in this manner (Lewins 2003).

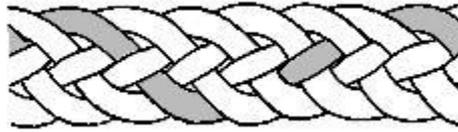
In summary the presence of the dart on Fragments 14A and B indicates that this garment was shaped or fitted. This hypothesis is supported by the belt wear, which reflects an attempt to define the wearer's figure. To create justifiable darts in an interpretation of the Haithabu *trägerrock*, it is necessary to place them on the *outside* of the garment. They should be constructed by pinching the fabric together vertically and affixing this with a row of running stitch. The stitches should be sewn with a single Z spun thread, with a 3mm stitch length and 5-6mm stitch distance. The dart should begin approximately 70mm from the top hem at around 2mm deep and progress to 5mm deep at around 150mm from the top hem, before becoming shallower again. It is plausible that the dart ends just below Fragment 14B, around the hips, as it there ceases to provide the function of shaping the garment, however this cannot be confirmed by available evidence. It seems logical that the dart is mirrored on the Proper Right side back piece. Whether the darts are echoed on the front of the garment is not known, as the front fragments of the Haithabu *smokkr* have not survived. To apply darts to the front may be justified if one argues that the shaping of the back indicates a shaped or fitted garment. If logically extended this would most likely require fitting on the front, to define the wearer's figure, however the depths of such darts would determine whether the garment was fitted or merely shaped. However this all relies on assumptions and is neither confirmed, nor contradicted, by existing evidence.

13. Dart Decoration

As noted previously the ridge of the dart was decorated. Geijer and Priest Dorman discuss the use of cords to strengthen selvages and linings at Birka (Priest-Dorman 1992) however these appear to have fulfilled both aesthetic and structural functions, whereas according to Lewins (2003) the Haithabu dart decoration appears to serve a purely decorative function. Given its aesthetic role, the dart decoration confirms two things; that the dart lies on the outside of the garment, and by extension the herringbone stitching lies on the inside of the top hem, thus serving a purely functional rather than decorative purpose. Conversely, the tightness of the stitching of the decoration, may provide some structural quality to the garment at this point, thus the dart decoration stitching may further justify the argument that this garment was more fitted rather than simply shaped.

Once the role of the decoration is understood it is important to know how it was constructed. Although the braid is badly damaged at points (Hägg 1985, pp.138) Thunem (2014) explains that it comprises a thin braid stitched onto the dart, approximately 1-2mm wide, constructed from six threads. Each of these threads is of two plied wool that has been Z spun, S plied, three of which were dyed red whilst the other three were dyed yellow (Beatson and Ferguson 2008). The threads have been woven into a six strand plait (as indicated in the image below) and then whip stitched to the ridge of dart (Beatson and Ferguson 2008). The colour of the

thread used to stitch the braid onto the dart is not noted in Hägg's analysis. It is useful to note that although the dart only begins 70mm from the top edge of the garment, it would appear that the braid extends beyond that dart to the hemmed edge (Hägg 1984 pp.38). Whether the braid continues down the garment is unclear as the decoration has been lost from the dart area of Fragment 14B.

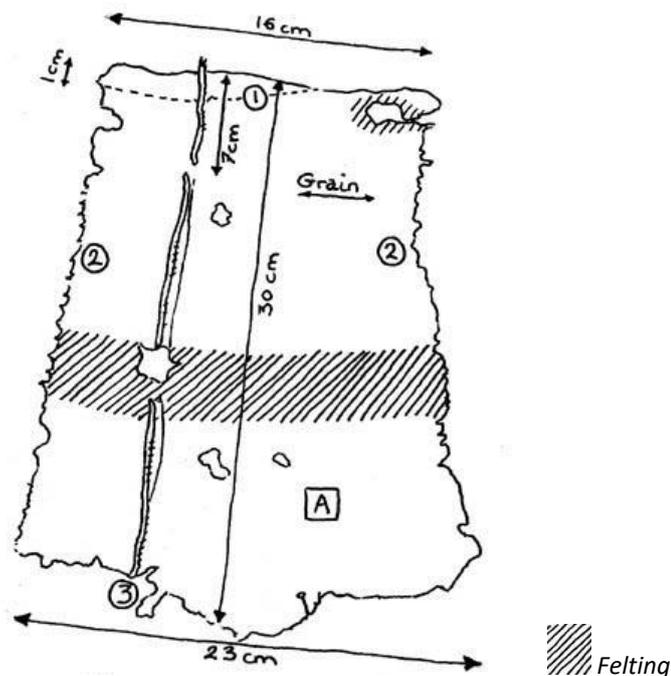


Braiding, six strand plait. (Beatson and Ferguson 2008)

During the manufacture of an interpretation of this garment it would be equally justifiable to end the decoration at the bottom of the dart or continue it down to the bottom hem of the garment, as there is too little evidence to determine which is more accurate.

14. Belting

There are very few fragments of *trägerrock*s that extend to the waist which means that there is little evidence indicating whether wear from belts was common. Furthermore, evidence of belt buckles and fittings in female graves is uncommon in the archaeological record (Beatson and Ferguson 2008) but not unknown. As a result many have taken this to indicate that belts were not worn by women over *smokkr* style garments. It is uncommon to see a belt worn over a *smokkr* in reenactment contexts however this fashion is not supported by the evidence from the Haithabu *trägerrock* fragments. There is a distinct zone of felting and wear evident on Fragment 14A including wear of the dart at its widest point, in addition to holes worn through the fabric that strongly suggest that this garment was worn belted at the waist (Thunem 2014, Hägg 1984, pp. 40). Beatson and Ferguson surmise that the belt wear on the natural waist of the garment, in addition to the garment shaping, indicates that the belt's function was to further define the wearer's figure (Beatson and Ferguson 2008). This zone of wear is indicated in the image below:



Detail of zone of felting and loss from wear on Fragment 14A (Lewins 2003).



9th C 'Revninge Woman' pendant (The Viking Museum Ladby, 2015)

Although only a little evidence of belting has survived in the archaeological record, there is a small amount of evidence available from iconography. The image above depicts a 9th C Danish pendant known as the Revninge woman (The Viking Museum Ladby 2014). Although the pendant does not appear to depict a *trägerrock* style garment, she does appear to be wearing what may be interpreted as a belt that has been tied (rather than buckled) at the waist. Although the pendant pre-dates the finds at Haithabu, it does provide an indication of how a textile belt may have been worn in 9th-10th C Denmark. There has been some speculation that the centre of the belt depicts a trefoil brooch (The Viking Museum Ladby 2014), however this is contradicted by the placement of trefoil brooches in graves, as none are located in grave finds at the waist, all are placed higher on the body.

The belting of female garments is further indicated by a 10th C Valkyrie token from Öland (located on an island off the coast of Sweden) as depicted in the earlier map. Direct trade links between this site and Haithabu are unclear at this time, however sailing routes did pass directly by Öland thus a link may have been plausible. This garment is not easily interpreted as a *smokkr* type dress however this is the case for most of the available iconography, yet it still provides an indication of belting garment length and trains.



Photo by Ulrik Skans SHMM.
Silver pendant from Klinta,
Öland.

10th C 'Valkyrie token' from Öland (Lucas n.d.)

There is very little evidence of belt furniture in female graves at Haithabu and there are certainly none present in certain better published graves such as Chamber Grave 5 (Eisenschmidt 2009, pp.100). Furthermore, Hägg does not mention the presence of cuprous or ferrous corrosion products present on either of the *smokkr* fragments as she does for buckled belted garments such as Fragment 45 (Hägg 1984, pp.73) although this is not surprising given that the *smokkr* fragments were probably located at the back of the garment.

Either way, there is a lack of evidence for belt furniture on Fragments 14A-B or in the Haithabu female graves. Given the obvious wear patterns on Fragment 14A it is reasonable to argue that some kind of belt must have been worn without the presence of metallic belt furniture. As such, the most likely interpretation of the evidence implies that a cloth or textile belt or cord (without a metal buckle) was worn at the natural waist.

Therefore it must have been tied with some kind of knot. This could have comprised a hemmed piece of fabric, a woven, knotted or plaited cord or a tablet woven belt tied at the waist. The prevalence of tablet weaving at known trading partners such as Birka implies that a tablet or woven belt of some kind is a reasonable interpretation, however this cannot be confirmed or discounted until new evidence is brought to light. Finally, there doesn't appear to be any indication of hanging belts or fabric on any 10th C iconography from the area which suggests that perhaps a shorter belt may be more arguable, however this is drawing a lot of suppositions from a lack of evidence, rather than deriving meaningful hypotheses from the evidence available. However taking into consideration the evidence of the Revninge Woman pendant depicted above, a long belt is also a reasonable interpretation.

15. Brooch Loops

Haithabu Fragments 14A and B do not retain any fragments of loops or straps that would have been affixed when the garment was worn. As such, it is necessary to look for alternate information sources to derive what may have been present. The best source of data for *smokkr* loops at Haithabu are the graves. Thunem (2014) proposes that the presence of tortoise style brooches in a grave (with textile loops attached) provides the best indication that the garment was of a *smokkr* type. Because metal salts from the brooches act to preserve the textile fragments underneath, these loops are more commonly preserved than other fragments of textiles in graves with a *smokkr*. As such, they provide some of the most comprehensive data sets available for these kinds of garments (105 Graves at Birka were found with loop fragments).



Detail of extant brooch loop (Thunem 2014)

The archaeological evidence confirms that the *smokkr* was affixed to the brooches using these textile loops. The front loops were generally short and would have been covered by the brooches (as evidenced in Birka Grave 464) however the loops tend to be torn at the edge of the brooch, meaning that the short front loops were affixed to the top of the garment, but there is minimal evidence for the longer back loops (Thunem 2014). Often multiple loops are found in grave finds in either the top or the bottom of the brooch, or both, more than could be from a single loop and a strap. Hägg argues that whenever the number of loops in the bottom of the brooch is greater than two, that the extra loops were used to carry tools. There is also evidence for the simultaneous wearing of two *smokkr* type dresses at Birka and other sites (Thunem 2014). However this paper focusses primarily on the loops affixed to the Trägerrock.

In most cases from Birka the loops comprise tubes approximately 10mm wide, in which the fabric is doubled over and the raw edges turned inwards, then the opening sewn shut and the raw ends of the tube tucked inside the top hem (Beatson and Ferguson 2008). Furthermore, Hägg confirms that at Birka the brooch loops tended to be constructed in linen, even for a woollen *smokkr*, however sometimes they were constructed from the same fabric as the body of the garment.

According to Thunem (2014) Hägg and Geijer argue that the loops were present to avoid puncturing (and presumably damaging or weakening) the body of the garment, thereby explaining their function. Taking this further the prevalence of linen loops makes perfect sense, having significantly greater crystalline structure (up to ninety percent crystalline) than equivalent wool (around thirty percent crystalline), the linen would have provided a much stronger loop than the equivalent wool (Timar-Balazsy & Eastop 2011, pp.11). Additionally, the crystalline structure of linen allows it to fold more easily and neatly resulting in a loop that is neater and easier to finish on such a small textile (Del Prat 26 Feb 2016 pers. comm.).

Evidence from Fragment 14A

Unfortunately there isn't any evidence of the kinds of loops used on Fragment 14A. There are no traces of short loops (as this is most likely the back of the garment) and there are no traces of straps, or back loops. The straps appear to have been lost from the garment. There is one worn out spot with associated felting present at the top edge of Fragment 14A, which Hägg suggests was where the loop attached (Beatson and Ferguson 2008). Beatson and Ferguson (2008) argue that according to their interpretation, this would more likely indicate an area of wear under the arm, however given that the top of the fragment is only 16cm wide and this paper argues that the fragment is placed on the back of the wearer's left side (Proper Left), the person wearing the garment must have been very tiny for this to have reached the arm-pit, to allow for such wear. Furthermore the fragment would need to be located on the opposite side of the body to Hägg's theory. According to Hägg's interpretation, the hole would be closer to the centre back and may very well have indicated the placement of the back loops.

Findings from trägerrock garments in the graves at Haithabu

Although there are no loops remaining on Fragment 14A there is still some evidence for loops found in the Haithabu graves. Only one percent (sixteen) of the excavated graves at Haithabu were found to contain tortoise brooches, yet some information may still be gleaned from the site. Extrapolating from a summary of some of the grave find provided by Lucas (2009) all of the dress loops identified were of tabby woven linen, except for two: one of which was wool and the other of an unconfirmed fibre (Lucas 2009). Hägg further asserts that at Haithabu almost all of the loops were linen, except for a few that were made from the same wool as the body of the garment (Broome 2015, quoting Hägg 1971, pp.54).

Given that the majority of the loops and straps identified at Birka and Haithabu were of undyed linen (as discussed above and below) some interpretations of the *smokkr* aesthetic are called into question. The prevalence of undyed linen *serks* in grave finds, in conjunction with undyed linen straps and loops, implies that the straps would not have been obvious against the undergarment textile. Visible straps are justifiable as evidenced by the extant examples that match the textile of the body of the garment. However it appears to have been fashionable to have straps that blend with the undergarment textile. This would have provided an aesthetic close to a strapless garment.

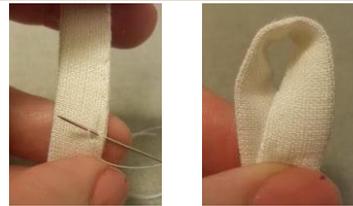
What's found at Birka/ trading partners

More information about loops may be derived by looking at other sites with known trade links to Haithabu in the 10th C, particularly Birka. 105 graves have been identified at Birka containing loop fragments which provides a wealth of information regarding *smokkr* loops (Thunem 2014). Given the structural and textile similarities to the loops found at Haithabu, it is justifiable to draw upon this evidence to help inform an interpretation of the Haithabu *smokkr*. Due to the sheer number of finds from Birka and the evidence they provide it is valuable to break that information up into manageable pieces: how the loops were constructed, what the loops were made from and how they were placed on the garment.

Loop Construction

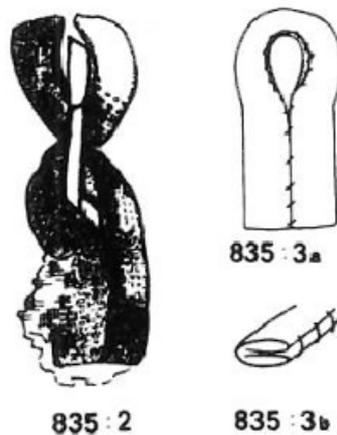
As mentioned previously, each of the loops were approximately 10mm wide when complete. They appear to have been constructed by folding a long strip of fabric in half lengthwise and then folding it again lengthwise, placing the cut edges in the centre of the fold and stitching down the long edge, as depicted below.

1. cut 40mm strip of linen, fold down 1/3 and iron
2. fold up other 1/3 and iron
3. fold this in half and iron, which places the cut edges in the middle of the V shape
4. pin the open edge closed
5. whip stitch down the open edge
6. fold around to create a loop



This stitching may run down the side, as found in Birka Grave 835 (and depicted above), or down the middle of the loop as found in Birka Grave 465 (Thunem 2014). Hägg hypothesises that the side stitching would result in a stronger loop due to the extra fold in the fabric (Thunem 2014). The loops were then sewn to the inside of the dress, with the raw ends tucked up inside the top hem (Beatson and Ferguson 2008).

Generally, the loops are simply that, and remain open until the edge of the garment, however in Grave 835, the shaft of the loop is stitched to itself as in the image below, leaving only a small opening (image below from Thunem 2014), however this seems to be the exception rather than the rule.



Interpretive images of stitched brooch loop (Thunem 2014)

Loop Fibres

Lucas (2009) provides a summary of some of the *smokkr*, loop and underdress textile fibres and weaves found at Birka, Haithabu and other locations. Extrapolating from that information, there appears to be more variation in loop type at Birka than Haithabu. At Birka while most of the loops are tabby woven linen, fourteen graves contained at least one woollen loop (Thunem 2014), with repped wool and tabby wool loop finds and a couple of unknown weaves and fibres (Lucas 2009). This may indicate that the woollen loops were placed on the *smokkr* and that the associated linen loops were used to hang tools, as per Hägg's theory.

Furthermore, twenty two of the excavated graves at Birka contained one or more silk loops, with several silk loops containing a linen core for strength (Thunem 2014), however of the twenty two graves with silk loops, only one is found at the top of the brooch indicating that it is unlikely that these silk loops were used to hold the garment up, but rather more likely that they were used to hang tools (Thunem 2014). This supposition is further supported by the presence of silk bands on various tools in these graves (Thunem 2014). Hägg postulates that a number of the longer linen loops found at the bottom of brooches also provided this function (Thunem 2014). It is important to note however that no silk loops have yet been identified at the entire site of Haithabu, indicating variations in trade or wealth between the two sites. Therefore, the textile fibre may provide some insight into the function of each of the loops found in archaeological brooches, where more than two loops are present at the top or bottom of the brooch.

Loop Placement

The positioning of the front loops and brooches may also provide information on the placement of the loops on the *smokkr*, with some of this information derived from the finds at Birka (Broome 2015). Hägg concludes that the fronts loops of the *trägerrock* were short enough to be completely covered by the brooches, which was particularly noted in Birka grave 1084 (Thunem 2014). This hypothesis is further supported by wear from brooches on *trägerrock* fragments in Birka graves 464 and 597 (depicted below) (Thunem 2014).

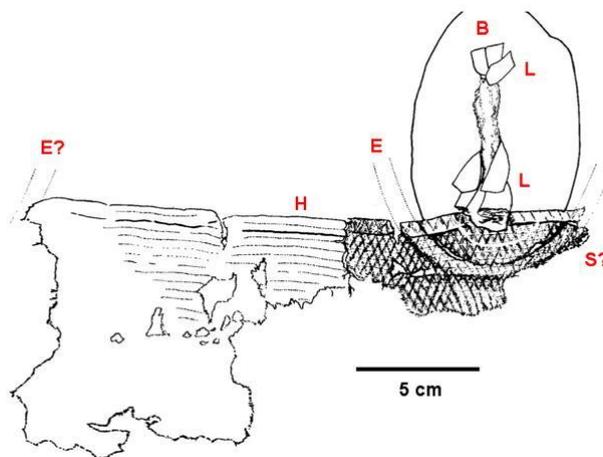


Image depicting placement of brooch loops (Beatson and Ferguson 2008)

From the positioning of the loops and wear from brooches in Birka grave 597 it is also possible to determine how far apart the brooches were set on this specific garment, the loops were set approximately 20-22cm apart on a single piece front panel (Beatson and Ferguson 2008). It is important to note that the spacing between the front loops may have varied according to the size and shape of the wearer, however these graves provide a general indication of the placement of the front loops.

It is clear from the image above, in addition to evidence of wear from brooches on preserved fragments mentioned previously, that the brooches sat quite obviously over the edge of the *smokkr* hem. The image above indicates that the brooch sat approximately 20mm down over the top of the garment. Furthermore, it is clear in this image that the pin sat deeper within the brooch and was relatively short, when compared with the overall size of the brooch. This is important, as it allows for the longer loops as seen in grave finds, whilst ensuring that the brooches sit lower down on the body and overlap the top of the garment. On many modern reproductions of these brooches, the pin is long, similar to the length of the brooch. This forces the garment to sit lower, and less of the top hem of the *smokkr* is covered. As a result the brooches sit awkwardly high on the wearer or the brooch loops are made much shorter to compensate. With appropriately sized brooch pins, set deeper inside the brooch, the garment is more likely to sit in a manner that more closely aligns with the evidence of the dress loops, hem wear and brooch placement in the graves.

In summary, loops may be justifiably constructed from undyed white linen, or the same wool as the *smokkr*, however linen appears to have been more common. These loops should be quite short and constructed as per the depiction above the tucked under the hem and stitched in place. The loops should be placed on either side of the chest as indicated by the brooch placement in graves, yet the best evidence is of a fragment where the loops are 20-22cm apart across the front of the chest.

16. Straps or back loops

In stark contrast to the large numbers of extant loops found in the archaeological record, very little is known about the straps that run over the shoulder and affixed to the other end of the brooch. In many excavations involving the presence of tortoise brooches there are loops of mineralised textile in the top and bottom of the brooch, often multiple loops for various purposes, as discussed previously. However, ultimately all that is known for certain is that the end of the long back straps ended in a loop, similar in shape and size to the short loops holding up the front of the garment. Because the textile remnants in the graves tend to have deteriorated at the edge of the brooch, or top of the loop, the archaeological record does not indicate the length or construction of these back loops, other than what is retained under the brooch (Thunem 2014).

Interpretations abound for the evidence at Haithabu and Birka, of which many are unconvincing. Lewins (2003) argues that the hole found on Fragment 14A may have been used to attach the shoulder strap, suggesting that the strap may have been passed through the hole and knotted. This theory is questionable for three reasons: there is no hemming or structural support for the hole, indicating that it is more likely worn and torn, rather than intentionally part of the garment; this construction contradicts the way the front loops are affixed, on the inside and stitched in place; finally, given that Fragment 14A is a back piece, it is difficult to see how the wearer could tie these knots when the garment is on, or why they might tie them on beforehand (rather than stitch them on) and then brooch the front loops. Beatson and Ferguson (2008) argue that this hole was more likely from wear under the arm, than wear from the presence of a loop, however, as this paper argues that 14A is a back piece, probably on the wearer's proper left side, wear from the arm at this point would be impossible. Instead this would place the felting and hole close to the centre of the back of the garment which appears to be a very reasonable placement for the base of a shoulder loop.

Other theories presented include the presence of two short loops and that the back of the garment rises up over the back to meet at the brooch, similar to a peplos. This seems unlikely for two reasons, the shape of Fragment 14A (as a back piece) precludes this functionality and there is no archaeological evidence of *smokkr* fabric attached to the top loops inside brooches within the archaeological record. Additionally, the large nature of the *smokkr* style brooches contrast heavily with the peplos style brooches and would weight down the garment in a manner unlike the earlier style of peplos brooches. Many reenactors also interpret *smokkr* straps using tablet woven bands, however Thunem clarifies that there is no evidence for the use of tablet woven bands for straps in the entire Norse archaeological record to date (Thunem 2014).

Finally, Flemming Bau theorises that the straps probably ran 'slant-wise' over the shoulder, in the manner of modern overalls (Thunem 2014). Many scholars have been quite critical of Bau's theories, and while Bau's justification for this hypothesis isn't clear, it is plausible. If Fragment 14A is a Proper Left back fragment, then the placement of the wear/hole supports the theory that the strap was affixed close to the centre of the back. Furthermore, the author has trialled straps in various locations across the back of the garment and the further out from the centre they are placed, the more they fall off the wearer's shoulders. Thus the evidence from Haithabu supports the practicality of wearing such garments.

As such, the small amount of evidence available indicates that the loops were:

- More commonly undyed linen, occasionally the same wool as the *smokkr*.

- Very unlikely to be made from silk due to the scarcity of silk loops at the top of the brooch at Birka and there is no evidence for them at Haithabu.
- Approximately 1cm wide and sewn similarly to the front loops.
- Probably affixed close to the centre of the back, running 'slant-wise' over the shoulders.

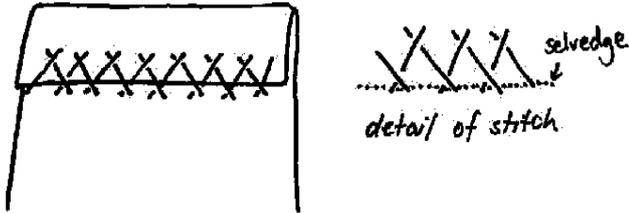
This leaves the question of whether they are long loops or straps with a short loop sewn onto the end. Unfortunately, with the evidence currently available this cannot yet be resolved and either interpretation may be justifiable. However, it doesn't appear justifiable to sew linen loops onto woollen straps, or use tablet woven bands for the shoulder straps as neither of these theories are supported by archaeological evidence.

17. Hemming

With an understanding of how the garment is constructed and attached, it is necessary to determine how it should be finished. Although the Haithabu *trägerrock* pieces no longer have a bottom hem attached, the upper hem has been retained on Fragment 14A.

Evidence of Hemming on Fragment 14A

Fragment 14A indicates how the top of the *trägerrock* was hemmed. Hägg provides a detail photograph of the hem in her 1984 treatise which is interpreted below in the adjacent drawing.

	
<p><i>Photograph of 14A Top Hem (Hägg 1984 pp.38)</i></p>	<p><i>Interpretive image of placement and order of stitching, derived from adjacent photograph.</i> Some other interpretive images such as Beatson and Ferguson (2008) appear to have depicted the stitching backwards.</p>

Essentially, the top seam of the fragment, comprising the selvedge, was folded down approximately 1cm (Hägg 1984 pp. 38) and stitched in place with a herringbone stitch² as depicted above. The stitching was undertaken with 2-ply woollen thread (Z-spun S-plyed) with a stitch length of 7-8mm and stitch interval of 3-5mm (Beatson and Ferguson 2008).

Given that the decorative dart braid sits on the opposite side of the fragment to the herringbone stitch, it is fairly safe to assume that the braid is intended to be seen and therefore, the fold-over and the herringbone

² Herringbone is also commonly referred to as catch stitch. Hägg's use of the term *Ösenstich* (1984, pp.38) to describe this hem appears to have confused some interpretations of the evidence, which have utilised the '*Ösenstich*' identified on the Oseberg cushion fragments. This is not the same stitch, it is simply a confusion of the terminology. It is of greater value to analyse Hägg's photograph to confirm the stitch type used, here referred to as Herringbone.

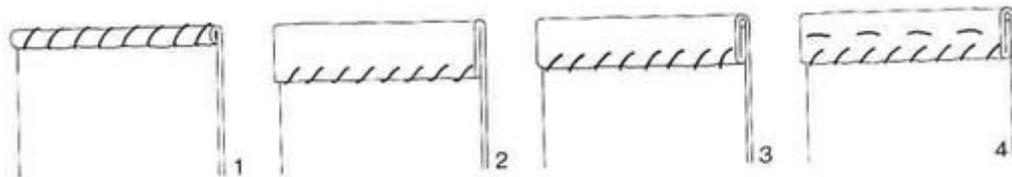
stitch are located on the inside of the garment (Lewins 2003). This means that the hem on the outside of the garment simply appears as two rows of small stitches.

It is important to note that the herringbone actually straddles the selvedge with the top row of stitches penetrating two layers of fabric and the bottom row only penetrating one, as visible in both the photograph and the interpretive drawing above. The bottom stitches sit only just over the selvedge line, acting to support the selvedge (which is not strengthened by the weave). It is also interesting to note that the horizontal stitches of the herringbone are actually incredibly small, picking up only one or two threads with each stitch. So although the stitch length for the crossed stitches is 7-8mm, the stitch length for the horizontal stitches is likely to be very subtle on the front of the garment. It is also interesting to note the uneven nature of the herringbone stitch depicted in the image above.

The herringbone stitch provides the dual function of holding the selvedge flat against the top of the garment, whilst also allowing the hem to stretch (much like a zig zag stitch) as it is put on, preventing the stitching from tearing or breaking (Beatson and Ferguson 2008). Given the probable tailoring of the garment, it is likely that it was shaped to the body of the wearer. Whether it was fitted tightly cannot be confirmed however either interpretation may be justifiable from this tailoring. Therefore, the stretch afforded by the herringbone stitch is quite important when pulling the narrow top hem down and over the wearer's shoulders.

Unfortunately there is no evidence available from Fragments 14 A and B as to the construction of the lower hem of the garment. It is unlikely that herringbone would have been used, given that the bottom hem is not required to stretch in the aforementioned manner, the fact that herringbone is not located on the bottom hems of any other fragments at Haithabu (such as tunics, coats or sleeves) and that it would catch if it were dragging along the ground on a garment with a train.

However, Hägg (1984 pp.150) does provide a pictorial summary (below) of the kinds of hems found at Haithabu harbour, which allows for a number of options for the bottom hem. On pages 253-6, Hägg provides a summary of the types of stitches found on each fragment, extrapolating from that data set, the most commonly identified hemming stitch was no# 3 depicted below which was identified 13 times, closely followed by hemming stitch #2 which was identified twelve times. Both #1 and #4 were only identified twice and were probably less commonly used.



Depiction of hemming stitches found in Haithabu Harbour (Hägg 1984, pp.150)

The author's experience indicates that, using a two-ply wool (as is found on the top hem) with hem stitch #1 on a garment that drags on the ground quickly results in the fraying and loss of much of the hemming with minimal wear. Whereas trained garments hemmed with the same thread, using stitches #2 and #3 in the image above have survived much better. Whether to use #2 or #3 has been dictated by the thickness of the fabric chosen and how full it is. Hemming stitch 4 may also prove effective for a trained garment on a finer weave fabric.

Given that hemming stitches two and three proved significantly more common on the textile finds in Haithabu harbour and in practice have proven more successful for trained garment hems than #1, either of these would be appropriate for the bottom hem of an interpretation. The choice between the two may be dictated by the thickness of the fabric chosen, and the degree of fulling for a woollen textile. No#3 would be more appropriate for a textile that is more likely to fray, or for a thinner textile to avoid a bulky hem. No#2 would be

more appropriate for a more fulled wool, or a thicker textile to avoid a bulky hem. Therefore either of these two hems may be justifiable to use on an interpretation of a *trägerrock*.

18. Interpretations of Construction

Once the textile and dye choices are understood it is necessary to engage with the more complex problem of construction. Because no complete extant *smokkr* has been found and the available evidence is fragmentary and incomplete, it is difficult to determine how such garments were constructed. To derive a construction theory that may arguably have been used for *trägerrock* style garments at Haithabu in the 10th Century, it is necessary to look at the relevant evidence from Haithabu and associated sites from this time that provide an indication of construction features. Even so, this merely provides for a plausible construction with the current available information, it is not yet possible to provide a definitive pattern for this type of garment. Before taking this further, it is necessary to acknowledge the debate surrounding whether the *smokkr* was an open or closed garment. Most scholars seem to agree that the Haithabu *Trägerrock* was probably closed given the shaping and evidence of fitting. Thunem (2014) has discussed the various debates in detail, therefore it is unnecessary to reprise them here.

As mentioned above to develop a justifiable theory of construction, it is first necessary to look at the relevant evidence from Haithabu and associated sites that may inform an understanding of the construction. It is then helpful to outline any justifiable assumptions that may provide a framework for the development of theories. Once a context has been established, existing hypotheses are analysed for how they fit within the evidence, before putting forward a number of alternate theories which are then assessed within that same framework.

Haithabu Fragments

Below is a short summary of the evidence of construction that may be derived from Fragments 14A and B.

- Fragment 14A has one straight edge and one flared edge, upon which is located a dart.
- Given the size, shape and the placement of the dart numerous scholars (including Lewins, Thunem and Hägg) believe that the fragments came from the back Proper Left of the garment, with a centre seam down the middle of the back.
- The placement of the fragment in this location causes the flare of the remaining textile to sit in the centre of the back, providing for the inclusion of a train.
- The fragments therefore flare out at the centre back, which accommodates the train theory outlined in the section on garment length above.
- The fragments were stitched to other pieces on both side seams.
- The shaping, belting and fitting (from the dart) indicates that it was a closed garment that was intended to be form fitting, rather than loose.
- Although there is some evidence for lined *smokkr* type garments, the Haithabu fragment does not appear to have been lined³.
- A hole appears to be located in centre back indicating loss/placement of one of the shoulder straps.
- The top hem is the selvedge, and the grain runs parallel to this, therefore the garment must be cut out sideways across a piece of fabric.

Evidence from associated sites and iconography

- There is no archaeological evidence to indicate the presence of a centre front seam on any *smokkr* style garments.
- Birka Grave 597 provides the top hem edge, running 20-22cm long from one brooch to another, with no indication of a centre front seam (Thunem 2014).

³ For further information on a lined *smokkr*, investigate Birka Grave 464

- The same find indicates that the brooches (and loops) were set 20-22cm apart, with the front panel extending 4-5cm beyond each loop (Thunem 2014).
- Birka Grave 464 has preserved a side seam 4-5cm beyond the front loop, indicating the placement of the front of the side seam.
- The iconography from 9th and 10th C Birka and other Danish sites indicate that the garment was probably ankle or floor length with a train.

Assumptions

Whilst this research aims to avoid assumptions and guesswork, preferring to use available evidence whenever possible with regard to construction, some assumptions and guesswork are necessary until more evidence emerges, providing a definitive indication of *smokkr* construction. In this context some assumptions are necessary to provide a framework for the development of construction theories.

- *Assumption 1*: that this is a closed garment as indicated by the shaping. Hägg also postulates that this provides a natural evolution from the woollen peplos from the Iron age, such as the Huldremose find (Thunem 2014).
- *Assumption 2*: that the pattern pieces should be laid out on the fabric to eliminate as much wastage as possible of valuable textiles (Beatson and Ferguson 2008).
- *Assumption 3*: assuming that Fragments 14A and B are from a back piece with a centre seam, it is reasonable to assume that this piece was mirrored on the other half of the back. There is evidence from Birka indicating that the front panel was a single piece, extending 4-5cm beyond the brooch loops. Furthermore there is no published evidence in the archaeological record of a centre front seam on a *smokkr* style garment remnant. Given that Fragment 14A extends only 16cm from the centre back, and that the front pieces only extend 4-5cm beyond the nipple line, the front piece could not have met the back pieces unless the wearer was a child or particularly small. Thus it is justifiable to argue that there must also have been two side panels, connecting the sides of the back panels with the sides of the front panel. As such the *trägerrock* from the Haithabu fragments must have been constructed from a pattern with five pieces around the top hem.

Summary of evidence and assumptions informing construction theories

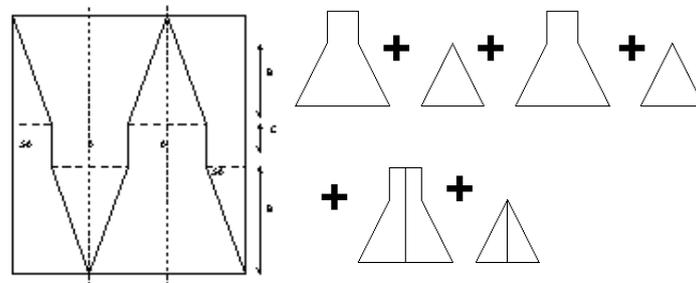
The following provides a framework for possible construction theories. To be considered plausible, any pattern must incorporate most, if not all, of the following features:

- Five piece pattern: single front piece, two sides and two back pieces shaped liked Fragment 14A.
- It is a closed garment, i.e. sewn down all of the seams.
- Ankle or floor length with a train.
- Form fitting, flaring out at the natural waist (approximately 15cm from the top), at the belt line especially centre back, with a dart on each side at the back, and possibly the front.
- Cut sideways across the fabric that facilitates the selvedge placement at the top hem.
- The pattern layout must result in minimal fabric wastage.
- The garment is unlined.
- The top hem should sit in line with the brooches found in graves, thus reaching approximately the top of the armpit.
- The front panel should extend approximately 4-5cm either side of the front loops, which should be placed around 20-22cm apart.

In looking at as many of the published interpretations of *smokkr* construction as possible and comparing those with these features, none actually account for all of the evidence summarised above. The key features of which are a straight edge and a flared edge *upon which is found the dart*. This element contradicts those interpretations that place the fragment on the side of the garment. The interpretations flared on both sides ignore the straight edge with stitch holes. Those with numerous flared parts don't make sense when laid out on fabric as they are inevitably very wasteful of fabric which does not seem logical. Therefore, it is useful to analyse some of these existing construction theories.

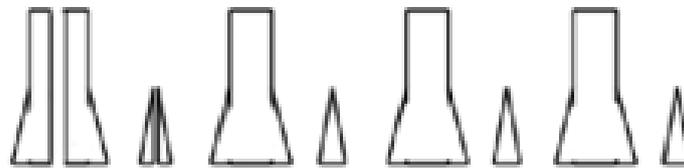
Analysis of existing theories of construction

Below, a number of existing theories of construction are presented. The positive and negative features of each theory are concisely summarized, in light of the parameters outlined above. This is simply intended to provide an indication of some of the reasons why existing theories have been set aside, in search of one that more comprehensively accounts for the evidence available. These theories may be appropriate for the interpretation of different finds or evidence, however they do not appear to fit with the evidence from the Haithabu fragments.



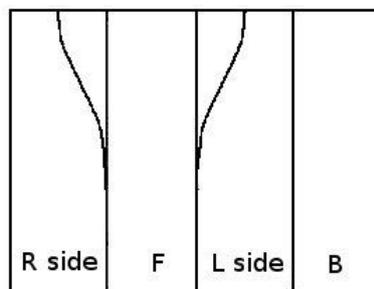
Cello (1995)

This theory incorporates the straight and flared edges of the back pieces and allows for fitting whilst also incorporating a flare and the possibility of a train. However in the construction plans, the back pieces are reversed placing the flare at the sides, rather than the centre back. Furthermore, the three piece top pattern does not account for the specifications outlined above and results in a seam centre front, for which no evidence exists. Finally the top hem is not placed on the selvedge in this theory. As a result, this theory does not fit with the evidence from Haithabu.



Diane Dooley (Thunem 2014)

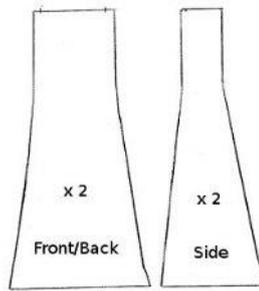
Assuming that the shape here is an unclear depiction (rather than an unusually long body) this pattern successfully accounts for the single front panel and the five top piece pattern. The top hem may be cut on the selvedge and the pattern allows for fitting, flare and a train. However, the back panels are placed backwards when compared with the analysis above and it is difficult to logically lay out this pattern in a fabric efficient manner. Regardless, this is the closest justifiable pattern that fits within the aforementioned parameters.



Beatson and Ferguson (2008)

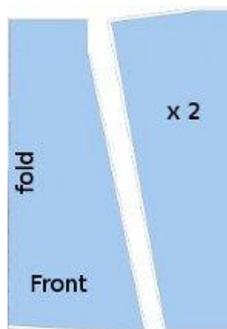
Although this pattern accounts for the selvedge top hem and the straight and angled sides, it places the flared sections at the side of the garment which is inconsistent with the placement of the dart and the conclusions

drawn above. In addition, it does not account for the five-piece top hypothesis, nor does it allow for a train or reasonable flare. As such, it does not appear to be consistent with the parameters outlined above for an interpretation of the Haithabu fragments.



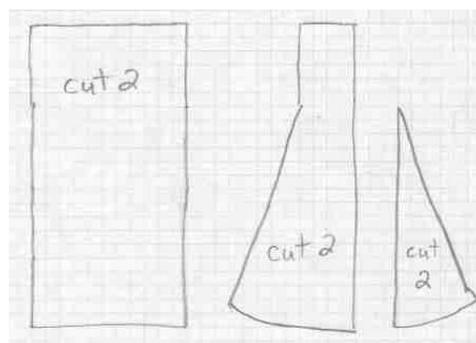
National Museum of Antiquities (Thunem 2014)

This construction theory allows for the selvedge to be placed on the top hem of the garment and it allows for the top of the garment to be fitted. However, it doesn't account for the straight and flared sides of Haithabu Fragment 14A, nor does it allow for much flare or the presence of a train. If the side piece is intended to represent the Haithabu garment, the dart would be incorrectly placed. Furthermore, this theory does not allow for a centre back seam as stipulated in the information above, nor does it conform to the five piece top theory. As such, this pattern does not fit within the parameters outlined previously for a *smokkr* informed by the evidence from Haithabu.



Nille Glaesel (Thunem 2014)

This hypothesis does account for the straight and flares sides, the top hem of which may be placed on the selvedge. Conversely, the extant piece was not placed on a fold, as there are stitching holes evident on both lateral edges. Additionally, this pattern does not allow sufficient fabric for a skirt with a train, nor does it fit into the five top piece pattern requirement. On this pattern the dart and loop hole would be incorrectly placed on the interpretation when compared with the extant garment and the finished *smokkr* is unlikely to be adequately fitted. For these reasons, this hypothesis does not fit within the parameters outlined previously for the manufacture of a justifiable interpretation of the Haithabu fragments.

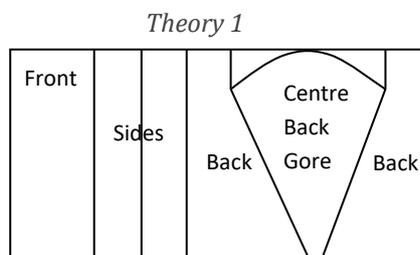


Thora Sharptooth (Priest-Dorman, 1993)

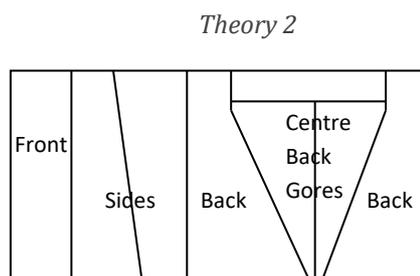
It is possible to accomplish a fitted top using this pattern but it does not allow for the five piece top pattern. The pieces accounting for the Fragment 14A straight and flared edge are placed on the side of the *smokkr*, in contrast with the conclusions drawn previously resulting in the incorrect placement of the dart and strap hole. Furthermore this theory does not account for the train, nor does it provide a very full garment and is rather inefficient in its use of fabric. Therefore this pattern does not fit within the parameters outlined previously and would not provide for a justifiable interpretation of the Haithabu fragments.

Alternative Construction Theories

Given that the theories put forward by a number of researchers fail to account for all of the available evidence for the Haithabu fragments and associated finds, it is necessary to develop alternate theories that more closely align with the evidence. Once each theory has been outlined it is necessary to submit it to the same critical analysis in light of the available evidence to determine its plausibility. Each theory is depicted below as it would be cut from the fabric, to show how it would be laid out, each piece is clearly visible and any unnecessary wastage is highlighted. Each of the theories also accounts for the correct placement of the section derived from Fragment 14A.

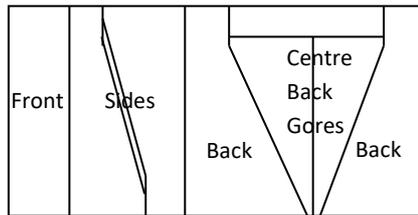


This pattern accounts for the five top piece pattern and results in minimal wastage of fabric. It accounts for a fitted top with a flared body and train, whilst ensuring that the top hem is all selvedge. However, the flare on this theory is very limited at the waist and only occurs at the centre back, resulting in it hanging strangely on the wearer. Furthermore, it doesn't make a lot of sense to have three straight pieces for the front and sides. The seams provide no function and the same shape could be achieved without the seams, thus it doesn't neatly fit within the evidence from Birka for the side seam placement. Regardless, this pattern allows for the garment to be cut from fabric that is *not* the same on the front and the back.



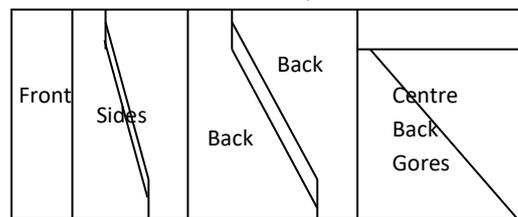
Many of the positive and negative points for this pattern align with the previous hypothesis, with the exception of the flared sides. This theory accounts for the five piece pattern, is conservative in its use of fabric, has a selvedge top hem and facilitates a train, yet it provides more flare and shaping than the previous pattern and the side seams are less redundant. However, the shape of the side pieces reduces the level of fitting around the top resulting in a slightly baggier garment which contradicts the shaping and dart function on the extant fragments. Additionally the top of the centre back gore becomes quite bulky in the small of the back. Unlike the previous theory, this pattern is not practical on fabric that is not reversible.

Theory 3



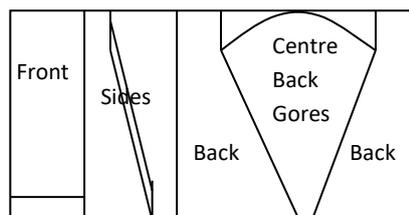
The layout of this pattern also minimizes the wastage of fabric during patterning whilst facilitating a train, a fitted but flared garment and fits within the five piece top pattern where the hem is the selvedge. This theory also provides fabric for straps, for those *smokkr*s where the straps are of the same textile as the garment. The top of the *smokkr* retains a close fit, but the separately flared pieces make sense according to the Birka seam placement and provide the correct flared shape. However, this theory does not work for fabric that is not reversible and results in a bulky section at the top of the centre back gore. In addition, the train length is dictated by the back flare, which may limit certain interpretations.

Theory 4



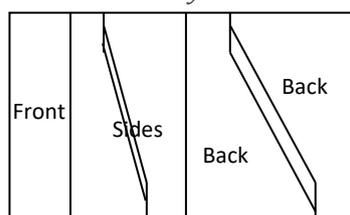
As per the previous hypothesis, this pattern is fitted around the top with the hem placed on the selvedge, accounts for the five-piece top, flares at waist and is conservative with its use of fabric. This pattern allows for fabric for straps if required and the shape of the side pieces makes sense with the placement of the side seams. In contrast with the previous theory, the train may be as long or short as desired, or as the fabric allows, however the top of the gore remains quite bulky. Again, this theory is not applicable to fabric that is not reversible.

Theory 5



This hypothesis meets all of the criteria previously mentioned and has very similar positive and negative features to the previous three theories. The curved base of this gore is not accounted for in the evidence of the Haithabu harbour fragments, however it is similar to the Over-tunic fragment gores identified. In contrast with some of the previous theories, the top of the train gore is less bulky as the centre seam is removed from this pattern.

Theory 6



This final theory accounts for the fitted top, flare and five piece top pattern where the top hem is the selvedge. However, this pattern does not include additional gores for the train at the centre back. With sufficiently flared back pieces and placing that flare at the centre back, as per Fragment 14A, it is possible to achieve an appropriate train without any gores at all. This is more efficient in fabric usage, produces a train that is smaller, and more in line with the iconography, is less bulky in the centre back and sits better on the wearer. As with a number of the other theories, this pattern is not appropriate for non-reversible fabrics.

Thus the contenders for the *most* justifiable theories of construction may be narrowed to three. Each of these theories was then tested and in practice they revealed more information which is outlined below.

Theory 4

This theory fits with all of the parameters outlined for a justifiable interpretation of the Haithabu fragments, it fits well and provides ample flare and train. The shorter front panel allows for ankle length, or floor length front which is then extended out into the train. However, this pattern can be a little bulky and pulls somewhat at the top of the train gore and the train often hangs unevenly and doesn't flare out whilst walking. Additionally, the bottom hem of the garment must be trimmed to get an even bottom line.

Theory 5

This theory also fits with the parameters laid down in this paper to achieve a justifiable interpretation. It also fits well and provides for an adequate flare and train. This theory is less bulky at the top of the gore but also pulls and hangs rather oddly. The train hangs better than Theory 4, however the gore shape is less supported by the evidence at Haithabu. The bottom hem of the garment must also be trimmed to get an even bottom line.

Theory 6

Whilst testing theory 6, the angle of flare from the extant fragments was followed, this resulted in a significant flare in the centre back seam highlighting that additional gores were entirely unnecessary if the dimensions of the original fragment are followed. The removal of the gores resulted in the train sitting more smoothly without bulk or pulling in the centre of the back. Furthermore, if gores were added to the flare as informed by the extant piece, the train would be much larger than is indicated in the iconography. However, the bottom hem where the front meets the sides, also required trimming for a smooth bottom hem.

It is important to note that some of these theories were tested with the hypotenuse of the flares facing forwards, and others facing backwards. Unfortunately the forwards hypotenuse resulted in the garment sitting very strangely and didn't create the smooth trained effect indicated in the iconography. Also, it flared out awkwardly at the sides. Although there are extant garments that support the flares all facing backwards interpretation, they are not here used as evidence as they have not been directly linked to Haithabu. That having been said, it seems the most logical placement, to avoid a garment that hangs unflatteringly.

Although Theories 4, 5 and 6 are all justifiable from the evidence, each have positive and negative features to their construction. However through testing each of the theories on a trial garment, the positives and negatives of each theory were highlighted. This indicated, that if the dimensions of the original fragment are taken into consideration, then Theory 6 is the most plausible from this list.

This paper does not argue that this is the correct interpretation of the evidence, simply one justifiable interpretation that more closely aligns with the evidence available than many others. No definitive theory of construction may be put forward until more comprehensive evidence, or more complete fragments, have been brought to light. In the meantime, it is reasonable to argue that Theory 6 represents an acceptable interpretation of the evidence provided by the Haithabu Fragments 14A and B. As such, for the purposes of this research, Theory 6 has been chosen as the test theory for the manufactured garment.

19. Analysis and Conclusions

During the experimental archaeology phase of this research, a series of test garments were manufactured using the information gathered from each area of this research. In doing so, hypotheses regarding the construction, cut, fitting, stitch types and so on were tested for their efficacy on a functioning piece of clothing. In doing so, some of the successes and shortcomings of the various aspects of an interpretation were highlighted. For further analyses of the final interpretation of the garment, please see Appendix 1.

Successes

Whilst testing out different theories of construction, the shortcomings of the placement and structure of certain aspects such as the dart, or degree of flare at the sides were illuminated. When following the flare of the extant fragment, it became clear that the gores were superfluous and that Theory 6 more than adequately accounted for the flare, train and achieved a silhouette more in keeping with the iconography illustrated above. Whilst the other theories are justifiable from the evidence, Theory 6 most closely aligns and is thus considered to be the most plausible theory presented in this paper.

Shortcomings

This research has demonstrated some of the difficulties of manufacturing a modern interpretation of an extant garment of this type. To begin with, even if one was to spin and weave a repped woollen fabric similar to Fragments 14A and B, the types of wool used in 10th C Haithabu are no longer available (Nikulina n.d.). Even if one was to accept modern wool variants, the information regarding the loom widths used at Haithabu and trading partners is far from clear, making it difficult to weave an accurately sized piece of cloth. Thankfully *Juglans Regia* hulls are readily available to dye the fabric. For the purposes of this research a modern, commercially manufactured and dyed merino wool of the appropriate thickness and thread count in one direction was used for the interpretation, however this does not provide the repped aesthetic required for a more accurate interpretation. Further research into belting the garment may provide more historically informed choices, however conclusive evidence regarding what was worn at Haithabu is not available. Further research into known trading partners with Haithabu and a more comprehensive study of the excavations associated with such sites would certainly broaden the scope of this research whilst potentially filling in more of the puzzle with regard to information such as loom widths, belting, dyestuff manufacture and trade and loop structure. Furthermore, this degree of analysis and extrapolation of the evidence with regard to overgarments, undergarments and accoutrements would most certainly better inform an interpretation of this style of clothing in the context of 10th Century Haithabu.

Regardless, whilst this research may not provide a definitive approach to the construction and manufacture of an interpretation of the Haithabu harbour Fragments 14A and B, it does provide an interpretation and construction theories that are largely justified by the available evidence at Haithabu and sites associated by known trade links with similar clothing styles. In addition, whilst the theories presented do not provide a conclusive pattern for the manufacture of an interpretations, they allow readers to challenge preconceived notions of how a 10th C Danish *trägerrock* may have looked and provide alternative options that more closely align with the available evidence.

Researching Viking Era garments, such as the Haithabu *smokkr* fragments, provides a complex puzzle from which few definitive conclusions may easily be drawn. However, through utilizing the available evidence from Haithabu and other related sites, it is possible to extrapolate reasonably justifiable interpretations of the evidence, thereby furthering an understanding of the way people may have lived, and dressed, in 10th C Haithabu.

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Glossary of Terms

Please note that these terms may have very distinct meanings in other contexts. The definitions provided here are simply intended to orient the reader regarding their interpretation within this paper. Any mistakes are the author's own.

Term	Meaning in the context of this paper
Apron Dress	The term commonly used to refer to a <i>smokkr</i>
Baltic	Cultural groups surrounding the Baltic Sea
Carolingian	The Frankish ruling monarchs from the 7 th to the early 10 th Centuries
Caulk	Textiles, or plant fibres driven between the planks in a ship to ensure that the vessel is watertight
Construction	In this paper, this term is used to describe the pattern, in addition to the way the garment is made
Construction Stitches	The stitches used to create, and finish, a seam. As opposed to decorating or hemming stitches
Danish	Pertaining to Denmark, here specifically referring to cultural groups associated with Denmark in the Viking Era
Fibre	The raw material that is spun, woven or felted to create a piece of fabric
Fibulae	A brooch or pin designed for fastening garments
Frankish annals	A series of Chronicles written at the court of the Frankish monarchs, detailing military, social and political occurrences by year
Frisians	A Germanic ethnic group, located in the Netherlands
Geophysical survey	Instrumental analysis of sub-surface detail in an archaeological investigation
Haddebyer Noor	A lake, previously an inlet of the Baltic Sea
Haithabu	A 9 th -10 th and early 11 th C Danish trading port located in what is currently Northern Germany
Hedeby	The Danish spelling of Haithabu
Herringbone	A stitch that crosses over itself, also known as Catch stitch, depicted in section 19
Inhumation	The practice of burying the dead, as opposed to cremation (burning the dead)
Mineralised Textile	Where textile threads in a burial environment are replaced with metallic oxides, that may or may not also preserve some organic matter
Mordant	A chemical used to set dyes onto a textile, as it forms a matrix with the dye and the textile fibre
Norse	A term encompassing Scandinavian cultural groups, often referred to (incorrectly) as 'Vikings'. In the context of this paper, it does not refer to Norwegian cultural groups.
Norwegian	Pertaining to cultural groups from Norway
Overcast Stitch	Another term to describe whip stitch
Proper Left	This is the Left hand side of an object, if the reader were to put themselves in the place of the object. If you were wearing a dress, it would be the left hand side of the dress, as you are wearing it. If you then looked at that same dress, the proper left side remains the same, even though it is now on the viewer's right hand side.
Repped	A tabby weave in which one set of threads are significantly thicker than the other set of threads
<i>Serk</i>	Common term used to describe a tunic like undergarment, worn beneath a <i>smokkr</i>
Slavic / Slavonic	A term encompassing cultural groups from Central and Eastern Europe and North Asia, in the 8 th and 9 th C, these groups were primarily located between the Baltic and the Black Sea
<i>Smokkr</i>	The term used by some researchers to refer to an apron dress like garment, held up with loops/straps and two large brooches

Tabby	A textile weave in which the weft thread runs over run warp thread and under the next, the over the next and so on
Tarred	Coating with hot tar
Terslev motif	A unique design found on Danish jewellery, refers to finds from Terslev, Denmark
Textile	Plant or animal fibres that have been woven or felted to create a cloth
Tortoise Brooches	Large, ovoid brooches found in female graves from many Norse cultural groups, generally located on each side of the chest, below the collar bone. Used to affix the straps and loops of a <i>smokkr</i> , thereby holding the dress up
<i>Trägerrock</i>	The term used by Inga Hägg to refer to a <i>smokkr</i>
Train	Extension of the back of a garment so that it runs along the ground, behind the wearer
Twill	A weaving pattern where the weft threads travel over two warp threads, then under one, then over two, and so on
Viking Age / Era	The period between the late 8 th C and 1066AD during which Scandinavian peoples expanded, traded and migrated throughout Europe
Whip stitch	In which the needle penetrates the edge of the fabric upwards, is pulled through the textile, runs around the edge of the textile and again penetrates the fabric upwards, creating a diagonal line of thread between each penetration, on the edge of the fabric

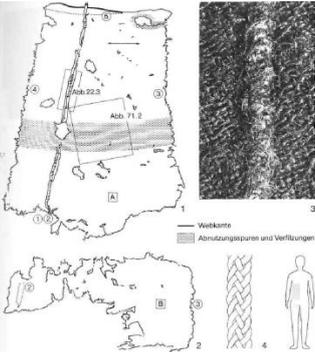
Appendix 1

Experimental Archaeology – Making the *Trägerrock*

Studying the available evidence to derive justifiable theories regarding the interpretation of a garment is fascinating, but it is through experimental archaeology that it is possible to get a real sense of which theories are plausible. The information derived through this research provides a framework from which it is possible to manufacture a garment that is as closely informed by the evidence as possible, yet it is in the making and the wearing of that garment that clarifies what works and what doesn't.

This interpretation of the Haithabu *Trägerrock* is informed by the parameters set out previously in the research paper. It is intended to test the various theories put forward in an attempt to clarify whether a functional garment is possible from these theories. Below is an explanation of the steps taken in the manufacture of the *Trägerrock*, with explanations of the ideal contrasted with the pragmatics of making the *smokkr* in a modern context. It is laid out in the order that the garment was manufactured for ease of replication.

To provide an overall sense of the success of the garment, the images below provide an overview of the aesthetic in addition to the fragments in question.

The Evidence	An Interpretation
 <p data-bbox="247 1391 726 1420">Haithabu Fragments 14A and B (Hägg 1984)</p>	 <p data-bbox="874 1397 1337 1426">The back pieces referencing Fragment 14A</p>
 <p data-bbox="571 1447 686 1890">  Ulrik Skans SHMM Silver ear spoon, Birka grave Bj. 507 </p> <p data-bbox="422 1906 550 1935">(Lucas n.d.)</p>	

Textile Choice

Ideally, this interpretation should be made from wool taken from 9th -10th C Danish sheep varieties. It should be hand spun very finely and woven on a warp weighted loom in a repped weave. I do not know whether it was dyed in the wool, after spinning or as cloth, however at some point it should be dyed with walnut shells without a metallic mordant. The total width of the woven fabric is uncertain but most likely at least wide enough to provide a single piece from armpit to floor on an average sized 10th C Danish woman (around 120cm) and the selvedge should be unreinforced. As mentioned in the text these wool varieties are no longer in existence, so modern wool variants must be accepted as a realistic alternative. Given that we don't have access to the authentic varieties of sheep, any modern wool choice is anachronistic but provides a necessary compromise. Unfortunately I was unable to access repped wool and my skills do not extend to spinning or weaving, to weave an appropriate fabric. As such I chose the closest textile that I could find that was commercially available: a finely woven merino wool, approximately 1mm thick, with 15 threads per cm (in both directions, rather than the 15 x 8 on the original), woven in a tabby weave, 1/1 S/Z. Unfortunately it isn't repped, it has a reinforced selvedge, is commercially dyed, made from a modern type of wool and is slightly full. So whilst it isn't entirely accurate, it will provide a sense of what the extant garment may have looked like. For this garment I have chosen to adhere as closely as was easily achievable to the extant textile, whereas through looking at other extant examples of textiles from *smokkr* type garments, a wider range of textile choices may also be available to someone looking to make a justifiable garment in something other than walnut brown repped wool.

Dyestuffs and Colours

Given that I haven't spun or woven my own repped woollen fabric from descendants of Norse sheep varieties, it will come as no surprise that I chose not to dye the aforementioned fabric with walnut shells. As such I investigated the possible colour variants achievable from walnut shells without metallic mordants and chose a fabric that is similar to the first colour in the walnut dyed skeins depicted below. I acknowledge that it has a slightly greener hue than the redder hue of the walnut dyed skein but it was closest colour available with the correct thickness and thread count.

	
<p><i>Walnut Dyed wool skeins, Image taken from Dean 2011</i></p>	<p><i>Fabric from the interpretation, Image by the author</i></p>

As previously discussed I think it is entirely justifiable to construct a Haithabu style *trägerrock* interpretation from fabric with various coloured dyes (indicated in the paper), if we know that these dyes were available and used at Haithabu and at related sites. However for the purposes of this experiment I am attempting to interpret the evidence from Haithabu Fragments 14A-B as closely as is reasonable thus I have chosen a woollen fabric that closely matches the colour of wool dyed with walnut dye. I acknowledge that a dye colour is not fixed and varies with fading, dyebath strength, mordants etc, however I think that this is at least a reasonable interpretation. I recognise that it would be more accurate had I dyed the wool myself using walnut

shells and traditional Norse dyeing techniques; however the prospect of eating sufficient walnuts most definitely impacted upon my decision making...

Choice of Garment Length

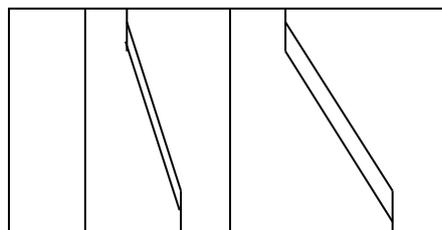


Lucas (n.d.)

The figure above represents the iconography that most closely fits with the Haithabu fragments in terms of date and location (if one considers the aforementioned hypothesis that the Haithabu fragments may date slightly earlier than the 10th C, possibly mid 9th early 10th). As such it is the closest iconographic image in date and known trading location that provides an indication of possible garment length. Therefore I believe that it is most justifiable to manufacture a garment in line with this depiction, i.e. a floor length garment with a slight train. As such I measured from the desired top of the garment to the floor, over the bust, before adding seam allowance at both ends (10mm at the top selvedge, 20mm at the bottom). The train on the interpretation is slightly longer than indicated in the image but was informed entirely by the flare of the extant fragment, so I consider it to be justified by the evidence in that respect.

Construction

After determining which construction theory I wanted to manufacture (for further detail, please see Construction section in the attached paper), I marked out Theory 6 onto my fabric.



I chose to make the front panel 28cm wide (+4cm seam allowance) as this closely aligned with the panel from Birka that was 20cm between brooches and 4-5cm either side of the brooches to the side seam. I decided to use 4cm rather than 5, as my bust measurement is small. The side panels were determined by the size of the front and back panels. As my front panel was 28cm wide at the top and each of the back panels were 16cm wide (as per Fragment 14A), I measured my bust, subtracted the front and both back panels and then divided the final figure by two, to achieve the side measurements:

A = Front = 28cm

B = ½ Back = 16cm

C = Bust measurement

Side measurement = $(C - (A + 2B)) \div 2$

The drop length of the side panel was determined by the drop length before the flare on the extant fragment, approximately 20cm.

To determine the shape and size of the back panels, I decided to attempt to match, as closely as possible, Fragment 14A. To achieve this I printed out a 100% sized image of the photograph of the original fragment

and cut the paper to shape. This allowed for 16cm across the top hem and 23cm wide at the base. I then marked the 16cm (plus 4cm seam allowance) on my fabric, and placed the photograph of the extant fragment on the wool, accounting for the unfolding hem and some possible distortion of the textile.

This allowed me to follow the contour of the flare on the extant fragment, to determine the flare on the interpretation. This was surprisingly large! After marking out the extension of the flare on the fabric, I determined that Theory 6 is absolutely acceptable for a fragment with this kind of flare at the back, as it would certainly provide significant amounts of train and flare, without the need for gores. The width of each Back piece at the base of the skirt extended to 98cm!



Angle of flare as indicated by extant fragment

When drawing the pattern onto the fabric I modified the lines slightly each time, to ensure that the bottom of each flare did not end in a point, as the hemming of these points is always bulky and awkward. As such I altered the line of flare so that they ended in a flat line rather than a point to mitigate this trimming.



Pattern pieces cut out (note small wastage)

I accounted for 2cm seam allowance on each seam, to allow for just under 1cm seam after double folding, to more closely align with the hemming seam allowance, this ended up being a little too much, in future I will use only 1.5cm seam allowance on each seam.

I then ironed each of these seams twice, to create a double fold and pinned the seams in place. In doing so, each of the pieces were 5mm wider than originally intended. As a result, I decided to leave the side-piece front

seams un-ironed, to allow for final fitting before the garment was constructed. In the past I have had the same problem and ended up with a garment that was too big and had to be taken in. By leaving the side seams unfinished until I know the full size of the garment, I was able to ensure that the *smokkr* was as fitted as intended.

Construction Threads

Given that there is some evidence for contrasting coloured threads used for seam construction at Haithabu, I think that it is justifiable to do so on an interpretation of the *smokkr* fragments, however given that Hägg does not mention contrasting coloured threads present on Fragments 14A-B I chose to use a similar coloured thread for this interpretation. Ideally the wool for the construction threads would be from Viking Age varieties of sheep, however as discussed in the attached paper this is not possible. Therefore it is necessary to use a modern wool variant which ideally should be hand spun, 2 plied (Z spun, S plied) wool dyed with a walnut dye. In reality, I don't have the skill to spin fine and even enough wool for this purpose. As a result I purchased a commercial thread with 50% merino wool and 50% acrylic (i.e. not at all authentic) that has been synthetically dyed an appropriate colour that is 2 ply Z spun, S plied. In this instance I decided it was more important to use a thread with the correct aesthetic, than spinning my own (admittedly un-authentic wool) construction threads that would be too lumpy and thick to provide the correct aesthetic. That having been said, trying to spin a more accurate construction thread would significantly improve the authenticity of this garment.

Construction Seam Stitches

Hägg states that whip stitch (such as construction seam stitch no's #9, #12, #14, #21 etc) was the most common stitch found on textile fragments in Haithabu harbour. When viewed in light of this, the stitch length on Fragments 14A and B may provide some insight into the possible stitch used. The hole spacing (indicating stitch length) was approximately 5-6mm on the fragments. If running stitch were to have this kind of spacing it would appear loose and clumsy which is not in keeping with the fine quality of stitching on the hem or the quality of textile and dye. Whereas this stitch length, when used with a whip stitch, appears relatively fine and provides a stronger seam. As such it is reasonable to argue that although the construction stitches have not been retained on the extant fragments, when viewed in light of stitch length and the construction stitch chart provided by Hägg, that the construction seams for Fragments 14 A and B were probably whip stitch.

The stitch choice for a linen interpretation is more complex given that no linen fragments were found in the harbour (Hägg 1984, pp.11) and Hägg's summary is only indicative of stitches found on woollen garments. Therefore for linen interpretations the most appropriate choice must be determined by the requirements of the garment, selected from the options provided in the paper. Given linen's propensity to fray, a seam where the edges are encased would be more appropriate, as such #14 and #21 may be entirely justifiable choices.

From the summary of stitches identified by Hägg, for a woollen fabric less likely to pull or fray, then #9 would provide the most obvious choice, as it was the most commonly found and the stitching holes could be made to match those found on Fragments 14A and B. For a fabric more likely to fray or pull, then #14 or #21 may be more appropriate as they encase the cut edge, but still utilise the whip stitch.

Therefore stitch type #14 was used in this interpretation. This stitch was chosen to ensure that the raw edges didn't fray, even though it is a relatively uncommon stitch in the harbour at Haithabu (from Fragment 57, Hägg 1984, pp.253). It also fits with the hypothesis previously mentioned that the stitches on Fragment 14A and B were most likely a whip stitch. The stitch length indicated by Hägg for the hemming stitch section of no#14 also matches the holes spacing on Fragments 14A and B at between 3 – 5mm.

The stitch length of the joining stitches for #14 is between 1-3mm (Hägg 1984, pp. 253). As such the stitching on the interpretation follows these stitch lengths. The hemming stitches on the interpretation tend to range

between 4-5mm and the joining stitches between 2-3mm. The threads used were 2ply, Z spun, S plied thread, as indicated by Hägg, however the interpretation uses 50% merino wool and 50% acrylic with a synthetic dye, whereas the original was 100% wool with (presumably) walnut dye.



Hemming of each piece, thread type and achieving a consistent stitch length

Each of the pattern pieces was hemmed down each side, leaving the top selvedge to be hemmed separately and the bottom hem to be trimmed as required. During the hemming process, if the seam allowance isn't exactly adhered to, the garment will end up substantially bigger or smaller than the initial measurements, this occurred with two of the trial garments that were far too big. Thus, the straight front edges of the side panels which were left unhemmed to allow for later fitting. Once each of the pieces were hemmed down the sides, the back pieces were sewn together and the sides attached to the back.

The front was then pinned to the front of the side panels to determine how much of the fabric had to be trimmed to ensure a fitted garment, this ended up being around 50mm on either side. These two edges of the side panels were then hemmed and sewn to the front panels to create the closed garment intended.

When all the panels were sewn together, the side panels were much longer than the front so had to be trimmed to create an even bottom hem as depicted in the iconography. The centre back seam was rounded off, simply because I thought it looked better than a pointy centre back of the train, I have no evidence for whether this was done or not. On subsequent trials, I would make the line of the hem (indicated in the right hand image below) much smoother to ensure a more gradual shift to the train.



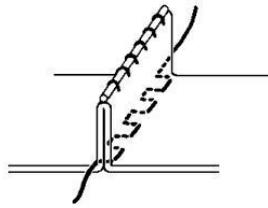
Before Trimming

After Trimming

Darts

In this interpretation I have attempted to copy the original dart placement, size and stitching as closely as possible. Each of the back darts is placed approximately a quarter of the way across each back piece, as on

Fragment 14A. The dart begins 70mm from the top hem, the top of the dart is around 2mm deep and the deepest point of the dart is around 150mm from the top hem and 5mm deep.



Interpretive image of dart construction (Beatson and Ferguson 2008)

The length of the dart is approximately 410mm, as this reflects the overall length of the two fragments upon which the dart sits. The dart on the original garment may have been longer, however we don't know the original length due to loss of textile from the fragment. As such, the dart on this interpretation is as close as we have evidence for.

To construct the darts I used a 2ply Z spun, S plied wool to stitch the dart in place. This should ideally have been a single Z spun strand, however I simply used the thread I had as it was convenient. Hägg doesn't state whether the thread used for the dart is the same colour as the garment. Where the thread colour is different, it tends to be noted in the text, thus I have chosen to use thread similar to the colour of the garment. I used a running stitch to affix the pinched dart fabric, with a stitch length of around 3mm and stitch distance of around 5mm, as noted by Hägg on the original. There is some variation in stitching on the interpretation, as was also noted on the original fragment. I have not overstitched the dart, as I have not yet completed the dart decoration which is over-stitched in place. The dart is mirrored on both back pieces, based on the assumptions discussed in the construction section is the main paper.



Placement, length and depth of back darts

Given the obvious evidence of shaping of the garment, I would argue that it is entirely justifiable to include darts on the front of the garment, as this is in keeping with the intent of the shape of the garment. I feel that it is equally justifiable not to include darts on the front of the garment as there is no extant evidence for this. For this interpretation I have chosen to include darts on the front to achieve the fitted aesthetic that I believe the darts, the shape of the fragments and the belting imply. To achieve this fitted aesthetic I think that it is necessary for the front darts to be deeper than the back darts, however if one were to interpret this as a *shaped* rather than a *fitted* garment, shallower darts would also be justifiable. When trialling deeper darts on the front, but constructing them in the same manner as the back darts, the amount of fabric bound in the whip stitching made the darts bulky, structural and affected the hang and look of the garment. So to achieve deeper front darts with a similar aesthetic to the back darts, a slightly different approach was required. Upon

looking back over Hägg's construction stitch diagram one of the stitches achieved a very similar look without requiring such a bulk of fabric.

Construction stitch no#11 was found on Fragment 72A/1 (a pair of red hose with a green crotch gusset!) with a stitch length of 3-5mm and stitch distance of 2-3mm. This seam involves the running stitch base and the whip stitch over the top, however the fabric was cut and folded inwards, bound by the whip stitch.

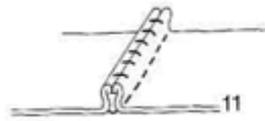


Image of construction seam no#11 (Hägg 1984, pp.150)

By utilizing this stitch, I was able to achieve deeper darts required for shaping on the front of the garment, with a similar aesthetic to the shallower back darts. When the garment was constructed I pinned the dart and affixed it with the running stitch. I then cut the excess fabric out from the dart leaving a 5mm seam allowance. This was then pushed inwards on either side with a pin and whip stitched in place. The stitch length on the dart were slightly smaller than those found on Fragment 72A as was necessary by the small seam allowance, however the stitch distance ranged between 2-3mm.



Image of trial attempt at stitch no#11

Dart Decoration

Ideally, the dart decoration should comprise 6 strands of Z spun, S plied wool, hand spun from 9th - 10th C Danish sheep varieties. Three strands should be dyed yellow and three dyed red, with dye stuffs as outlined by Carolyn Priest-Dorman, however the specific dyes have not been identified. As mentioned in the text, these wool varieties no longer exist and the correct dye stuffs have not been ascertained, so an authentic interpretation is not possible. Although the dart decoration remains incomplete, an acceptable compromise would involve 2 ply Z spun, S plied wool or similar, dyed an appropriate red and yellow shade and plaited into a 6 strand plait, with 3 strands of each colour. The finished braid should be around 1-2mm in width and whip stitched tightly to the top of the dart with a single Z spun thread. The decoration should begin at the top hem and extend either to the end of the dart, or down the length of the dress, as the overall length of the decorative braid cannot be determined from the available evidence.

To undertake the dart decoration I used 2 ply Z spun, S plied yarn comprising 50% merino wool and 50% acrylic, as this was what I had ready access to. The yarns were synthetically dyed but emulated colours achievable with the dyes discussed earlier. When I first attempted to undertake the 6 strand plait, I cut the threads and attempted to plait them loose. This resulted in a knotted mess. I then attempted the plait with the excess thread bound in plastic bobbins. This also resulted in a tangled mess. Upon receiving some very useful advice, I finally wound long threads onto lace making bobbins, tied in a knot at the top and pinned to a

cushion. This made undertaking the plait very easy, methodical and helped to regulate the tension beautifully, however I have no evidence as to whether this was a technique used at Haithabu.

I cut long pieces of thread and wound each onto a wooden lace maker's bobbin, 3 red, 3 yellow, which I tied in a knot and pinned onto a cushion.



Image of dart decoration plaiting using lace bobbins

The left most thread was woven over one thread, under one thread and over the next. Then the right most thread was then woven over the adjacent thread, then under the next (the original thread which was previously woven). This resulted in a successful six strand plait however I am unsure as to whether this plaiting methodology aligns with the original plait as I have found it difficult to reproduce a braid similar to the interpretive drawings.

Depending on the initial pattern of thread colour, I achieved different patterns in the resulting braid. As no indication of the extant colour pattern is given in the source material, I tested two different patterns and rather arbitrarily chose the one I liked aesthetically, which began with three red threads on one side and three yellow threads on the other.



Image of pattern achieved on the 6 strand plait

I chose to make each of these lengths of braid 500mm long as this would allow them to extend to the top of the garment, as on the extant piece, and then continue down the length of the dart (410mm). Given the loss of textile from the original, the length of the dart and the length of the decoration cannot be ascertained from the evidence. As such I feel that it is difficult to make an informed decision about the length of the braid. I have chosen to make the braid the same length as the dart, however it would be equally justifiable to continue the decoration down the length of the garment, beyond the end of the dart, as occurs at the top of Fragment 14A, where it extends beyond the dart to the top hem.

I have folded the top of the braid over the top hem of the garment, however the analysis doesn't confirm whether this occurred or not, I simply did so to achieve a neat top. At the bottom of the braids I left a small tassel of loose threads, as I was unsure how to finish the braid and this was evocative of what I have interpreted as the knotted ends of the belt on the *Revninge* woman.

The decoration should be attached with a single Z spun thread and whip stitched tightly onto the dart. The colour of this thread is not mentioned by Hägg, and so any theories regarding colour choice remain inconclusive. Initially I hypothesized that this thread would also be brown (or it may have been noted in Hägg's text) however the tight stitching affixing the braid, if brown, would significantly disguise the colour of the braid, diminishing the decorative effect. Therefore I chose to stitch the braid in place using red thread so as to accentuate, rather than disguise the decoration, however I acknowledge that this choice was derived from assumptions rather than evidence.

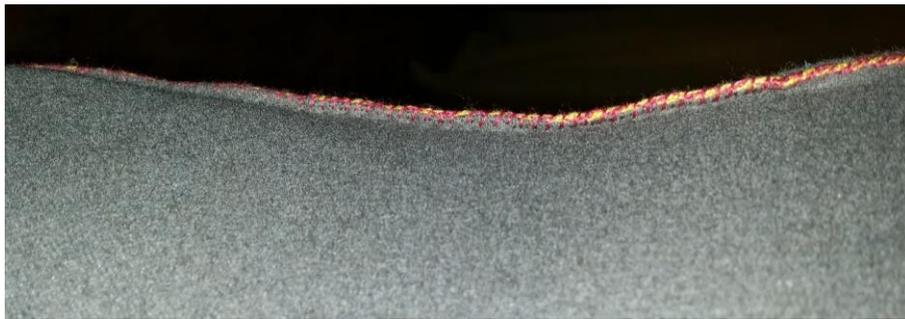


Image of braid stitched to the ridge of the dart.

I used a 2 ply Z spun S plied 50:50 wool:acrylic thread, rather than a single Z spun woollen thread, simply because I didn't have any readily available Z spun red woollen thread. This of course detracts from the accuracy of the interpretation.



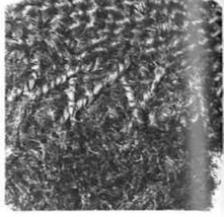
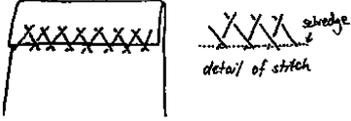
Image of braid stitched to the smokkr.

I do not believe that the decoration was applied to the seams, only the darts, as there is no evidence of extra stitch holes along the lateral edges of the fragments that may indicated a second row of stitching to attach any more decoration. It is unclear whether front darts, if they existed, were also decorated. It is my supposition that if darts are placed on the front of the garment, as in this interpretation, that these darts should also be decorated similarly to the back darts. As such I have attached decoration to both the front and the back darts.

Top Hem

The top hem on Fragment 14A was unreinforced, as such the ideal interpretation would also incorporate and unreinforced selvedge. Unfortunately the fabric used in the interpretation had a reinforced hem, somewhat detracting from the authenticity of the garment. That having been said the entire top hem of the

interpretation has a selvedge which has been folded inwards approximately 10mm, as per Fragment 14A and stitched in place. As discussed in the body of the paper, the top of the garment was hemmed with a herringbone stitch placed on the inside of the *smokkr* with a stitch length of 7-8mm and stitch interval of 3-5mm. The thread used was of a 2-ply woollen thread (Z-spun S-plyed) the colour of which isn't noted so I have presumed that it was the same colour as the garment.

	
<p><i>Photograph of 14A Top Hem</i> (Hägg 1984 pp.38)</p>	<p><i>Interpretive image of placement and order of stitching, derived from adjacent photograph.</i></p>

As depicted in the above image the herringbone stitch straddles the selvedge, is relatively uneven and the top and bottom stitches are actually very small. When attempting to replicate these stitches, the same stitch length and interval was used, with only a couple of threads picked up on the front of the garment at the top and bottom. This resulted in two small rows of dots from the front that was quite subtle. The narrow spacing of the stitches and the straddled selvedge led to a neat flat hem with stretch, if slightly uneven stitching. To accomplish the same pattern of thread placement as depicted in the interpretation above, I actually had to sew with the edge of the hem facing towards me (the garment was upside down) from left to right, on the inside of the fabric upon which the stitching is visible. This contrasted to previous trials where the stitching was approached from the outside of the garment and the garment up the right way, yet these trials resulted in the incorrect thread placement when compared with the original. Therefore this interpretation is more in keeping with the original fragment hemming that the trial versions.



Interior of herringbone stitched hem



Exterior of herringbone stitched hem

Loops

I chose to use undyed linen for the manufacture of the loops for this garment. Although loops were sometimes made from the same fabric as the garment, undyed linen loops are far more common in the archaeological record at Haithabu. As such I have chosen to use the more common fibre type. I cut a 40mm

wide strip of linen, so that once the edges were folded in and then folded in half, they would measure approximately 10mm, as per the specifications of the majority of extant loops. The edges were ironed inwards towards the centre of the strip, to create a neat crisp loop and then this was folded in half, encapsulating the cut edges inside the linen. This methodology is depicted in the attached paper.

As per the stitching noted by Hägg on the extant loops, I used whip stitch down the side of the strip to close the loops. I used cotton thread to achieve this, I acknowledge that the thread should have been linen, however the linen thread that I sourced was not white and would not have matched the aesthetic of the extant loops. I decided that it was of greater importance to produce the correct loop aesthetic, with the incorrect stitching thread, than vice versa. This is of course an area of improvement that could be made on subsequent interpretations. Once I had whip-stitched down the sides of the strip, I folded it around, following the contours of the loop indicated in the image of the 'loop' section of the attached paper. To be more accurate, the cut ends should have been stitched under the hem of the garment and left unfinished. However, I made the loops and straps prior to the garment. As such, I stitched closed the end of the loops to avoid significant fraying whilst the rest of the smokkr was made.

The loop is intentionally shorter than the extant loops appear to ensure that the brooch sits over the edge of the garment as much as possible as discussed in the attached paper.



Placement, shape and construction of loop

Straps

Again, I chose to use undyed linen for the manufacture of the straps for the same reason as outlined above in loop manufacture. From there I cut two long strips of undyed linen, 40mm wide, to allow a 10mm wide strap once constructed, as per the extant examples. I then ironed each edge inwards to create a crisp edge, and then ironed this in half encapsulating the cut edges within the strip. The edges were then whip stitched down with white cotton thread, discussion of which is provided above.

From there the decision had to be made regarding making one long loop extending from the back of the garment, through the brooch and then to the back of the garment, or whether it was a single strap with a loop stitched into the end. I have trialled both versions of the strap manufacture and each seem equally justifiable from the evidence, and equally comfortable. I decided to go with the strap with the loop sewn into the end simply because I made the long loops for the last trial garment.

I believe that for this interpretation of the evidence, the loops on the end of the straps are actually too short and should be lengthened, as there is no evidence of stitched ends on loops in the tops of brooches. The loop

extends beyond the edge of the brooch in each instance. Thus, for this interpretation, the sewn loop should at least extend beyond the edge of the brooch. This is another area that could be improved on subsequent interpretations. Finally I stitched closed the other end of the long loop. This is not justified by any evidence, however I did it to stop the strap end fraying while I constructed the rest of the garment.

The loops were placed on the garment in the location of the hole/felting visible on the extant fragments. The justification for this is provided in the paper, however when wearing the garment with the loops in this position, it is actually very comfortable and the straps do not slide off the wearer's shoulders.



Placement of the straps near the centre back of the garment

Bottom Hem

Although there is no evidence for the stitches used on the bottom hem of the Haithabu Fragments 14 A and B, as discussed in the paper, stitch types no#2 or no#3 are the most probable for a garment with a train, and the most commonly identified from the harbour. Given the propensity of this fabric to fray slightly, I chose to use stitch no#3, to avoid any risk of fraying. This has resulted in a slightly bulky hem.



Hemming Stitch no#3 on the bottom hem of the smokkr

Conclusions

There are, of course, numerous aspects of this interpretation that could have been improved to provide a more authentic interpretation of the evidence. These include longer loops on the straps, stitching with linen thread for the loops and straps, dyeing the wool with walnut dyes and spinning my own woollen construction threads. It would also have been improved with the use of woollen threads on the dart decoration and a single Z spun thread to affix the decoration. Other aspects are more difficult to incorporate such as finding an appropriate wool more closely related to 10th C Danish sheep varieties, weaving a repped woollen fabric from such wool or determining the appropriate fabric width from which to construct the garment.

However, in undertaking an experimental archaeological approach to constructing an interpretation of Fragments 14A and B, I consider this research have been successful. Through following the contour of the

original fragment flare I was able to confirm that gores in the centre back were not required to achieve the appropriate train and flare. The herringbone placement and stitch size look elegant on the front of the garment whilst achieving the required stretch and flat hem at the top. Whilst the stitch type on the front darts is a more tenuous interpretation of the evidence, I believe that it is justifiable and results in a similar aesthetic to the back darts without the bulk of previous trials. It also facilitates a fitted garment as implied by the shaping, darts and belting of the extant fragments.

Finally, I believe that the overall aesthetic of this garment is in line with the available iconography and achieves a sense of what may have been worn at Haithabu in the 9th and 10th Centuries. Through studying the available evidence, then using that information to construct an interpretation of what the evidence suggests, it has been possible to develop a plausible theory about the construction and cut of the garment from which Haithabu Fragments 14A and B derived.



The completed smokkr.