

## THE IRON TUNIC FROM VIMOSE (FUNEN, DENMARK): FURTHER RESEARCH INTO THE CONSTRUCTION OF MAIL GARMENTS

### LA TÚNICA DE HIERRO DE VIMOSE (FIONIA, DINAMARCA): NUEVAS INVESTIGACIONES EN TORNO A LA CONFECCIÓN DE COTAS DE MALLA

POR

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#### ABSTRACT - RESUMEN

The coat of mail from Vimose (Funen, Denmark) is extraordinarily well preserved for an artefact from the Roman Iron Age. Examination demonstrates that its construction is similar to that of the Roman tunic and differs from later medieval mail shirts. The fixtures for regulating the neck opening appear a local Germanic phenomenon. The blend of Germanic and Roman elements in the Vimose coat is evidence for local manufacture of mail armour in the Barbaricum.

La cota de malla de Vimose (Fionia, Dinamarca) se encuentra en un estado extraordinario pese a corresponder a un artefacto de época Romana. Un examen detallado demuestra que su confección es muy similar a las túnicas romanas y difiere de las cotas de malla medievales. Los apliques para regular la apertura del cuello parecen un fenómeno germánico local. Precisamente esta mezcla de elementos germánicos y romanos en la cota de Vimose es excelente evidencia para el estudio de la manufactura local de las cotas de malla en el ámbito germánico septentrional.

#### KEYWORDS - PALABRAS CLAVE

Mail Armour; Roman Iron Age; Weapon Offerings; Barbaricum; Construction.

Cota de Malla; Época Romana; Ofrendas de Armas; Barbaricum; Confección.

## 1. INTRODUCTION<sup>1</sup>

As a specific type of body armour, the coat of mail, made up of thousands of interconnecting metal rings, has featured prominently in many studies on the development of arms and armour. But it was not until the mid-20<sup>th</sup> century, with the publication of E. Martin Burgess's (1953b) *Further Research into the Construction of Mail Garments*, that the construction of the mail coat was better understood<sup>2</sup>. This volume, however, concerned only 'historical' mail coats from the Late Middle Ages and the Renaissance which had survived into modernity being passed down from owner to owner.

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<sup>1</sup> The contents of this paper derive from my ongoing PhD research at VU University Amsterdam, which consists of a study of mail armour from the Iron Age and the Roman Period.

<sup>2</sup> In this paper 'construction' does not refer to the manufacture of the rings, or to the type of weaving technique employed (4-in-1; 6-in-1; etcetera), but to the (constructional) pattern of the coat of mail as a whole.



Figure 1. Vimose coat of mail (photograph M.A. Wijnhoven).

The construction of archaeological mail from the 14<sup>th</sup> century and earlier, by contrast, has remained unexamined mainly due to the fact that mail from archaeological contexts is usually much corroded and fragmented<sup>3</sup>. These conditions reveal little, if anything, about their construction. However, there is one fortunate early exception: the coat of mail from Vimose, Denmark. This extraordinarily well-preserved example is not only complete but also still entirely flexible (Fig. 1). Even though it came from the Roman Iron Age, its condition is comparable to that of late historical mail coats<sup>4</sup>.

Mail armour has a long history in Europe, having been in continuous use from its earliest appearance around the turn of the 4<sup>th</sup> to 3<sup>rd</sup> century BC until recent times<sup>5</sup>. The information that historical examples from the Late Middle Ages and later can offer in regards to mail construction is valuable but refers only to the pinnacle of mail use. The coat of mail from Vimose, in contrast, opens a window into a much earlier time. The coat is nowadays in the permanent exhibition of the National Museum of Copenhagen<sup>6</sup>.

<sup>3</sup> The historical hauberk accredited to St. Wenceslaus is one of the few items of mail which with certainty is older than the 14<sup>th</sup> century. It has been thought that it may even date to the 10<sup>th</sup> or 11<sup>th</sup> century AD (Checksfield *et al.*, 2012: 239).

<sup>4</sup> For more detailed information concerning early mail armour, see: Hansen, 2003; and Robinson, 1975.

<sup>5</sup> This date for the first appearance of the coat of mail is based on my own research. Hansen (2003: 122), who devoted large part of his study to mail armour of the Iron Age, situated its origin slightly earlier, during the 4<sup>th</sup> century BC.

<sup>6</sup> Inventory number C 1078.



## 2. BOG FINDS FROM VIMOSE

During the first five centuries AD the practice of offering militaria in wet areas thrived in the South of Scandinavia. Vimose is just one of over 20 bogs where war booty deposits have been found. Archaeological excavations took place in 1859 and in 1865. Many objects from the site were also retrieved during peat digging or non-scientific excavations, especially throughout the 19<sup>th</sup> century (Pauli Jensen, 2011: 35).

The finds from Vimose include, at present, more than 5,600 objects consisting mostly of weapons besides items of personal equipment, tools and horse equipment (ibid. 2009: 54). Many of the objects were described by 19<sup>th</sup> century archaeologist Conrad Engelhardt (1869) in *Vimose Fundet*, the first book written about the site. Engelhardt (1869: 12, Pl. 4) also discussed the items of defensive equipment, including various fragmentary remains of mail armour and associated fixtures. The complete coat of mail is not mentioned, because it was not discovered until the 1870s. The exact find location and archaeological context of the coat of mail are unknown since it was retrieved by dragging a so-called “catcher” net along the bottom of the bog (Pauli Jensen, 2008: 217).

The absence of context makes it difficult to assign a date to the mail shirt. While it must have been part of a war booty deposit, Vimose comprises at least eight such deposits between the start of our era and c. 600 AD (ibid. 2011: 39-40). The bulk of the weapon finds comes from the 2<sup>nd</sup> to early 3<sup>rd</sup> century AD (ibid. 2007: 131).

## 3. APPEARANCE AND INTENTIONAL DESTRUCTION

The state of preservation of the mail shirt is extraordinarily good, especially considering its age. It does have holes and tears, which are not so much the result of deterioration or battle damage, but of intentional destruction. In fact, many of the objects at Vimose show signs of ritual destruction before having been deposited in the bog. This was a fairly common practice in the war booty sacrifices in Southern Scandinavia (Lau, 2010: 137-140). There is a vivid description of this custom in the early 5<sup>th</sup> century AD by the author Paulus Orosius<sup>7</sup>:

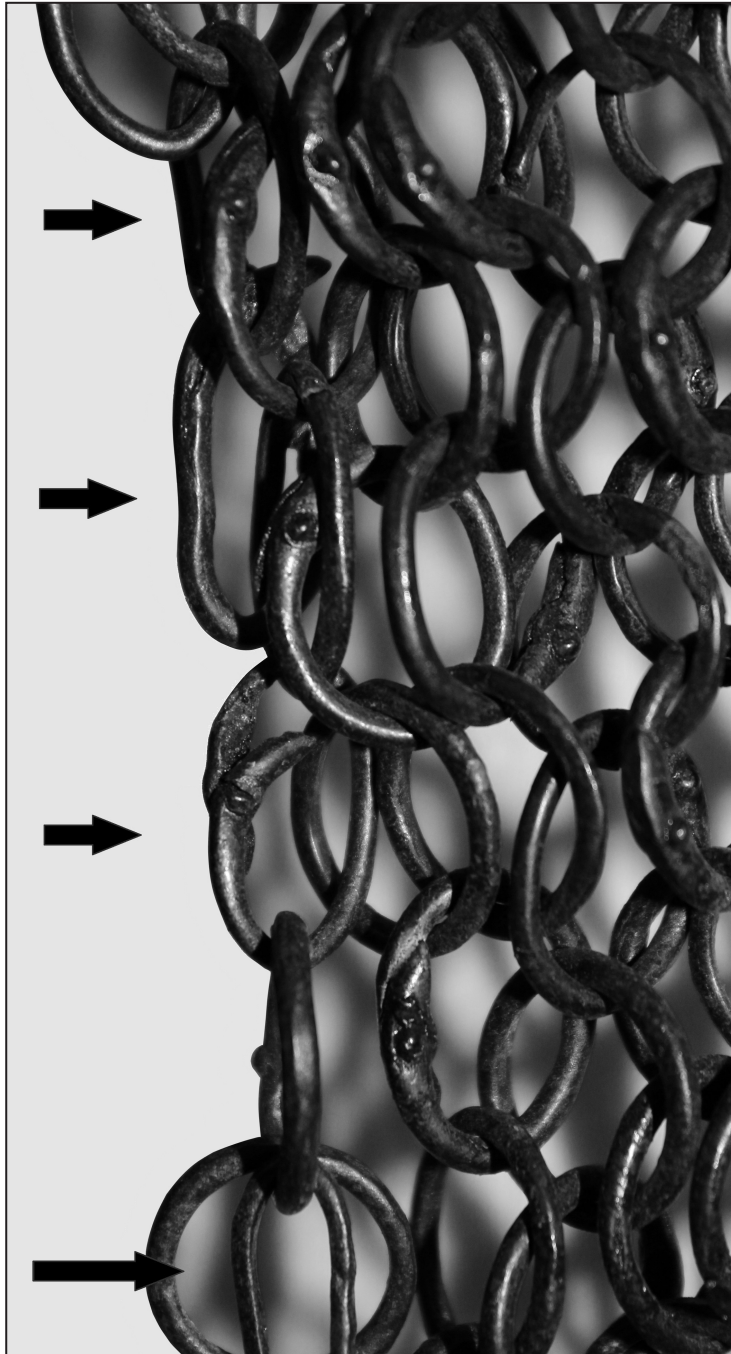
*‘When the enemy had conquered the camps and an enormous booty, they destroyed with new and fresh fury everything that had fallen into their position. Dresses were ripped, mail armour torn to pieces and horse armour destroyed, gold and silver thrown into the river’.*

Despite the damage, the original appearance of the Vimose coat of mail has been retained (Fig. 1 & Fig. 13) thanks to the fact that the destructive acts were mainly constrained to three areas. These resulted in a large hole underneath the head opening at one side of the garment, and two large rips running from the bottom (almost) all the way up to the armpit region at the sides. The shirt measures just over a meter in length, reaching down at knee level, and the sleeves are approximately 35 cm long, covering most of the upper arms. Given the length, the shirt must have had splits at the hem; otherwise the wearer would not have been able to walk comfortably<sup>8</sup>. The manner in which the mail coat was damaged also strongly suggests the

<sup>7</sup> Paulus Orosius’ *Historiae Adversum Paganos [History Against the Pagans]* V (16, 5-6). Translation from Lund Hansen (2007: 109). Orosius describes in this section the events after a successful battle of the Cimbri, Teutones and other Germanic people against the Romans in 111 BC.

<sup>8</sup> At Thorsberg, Germany, a fragment of the lower hem of a coat of mail clearly shows the presence of such splits (Matešić, 2011, vol. I: 246, cat. nr. M1142).

presence of the hem splits, which must have been used as a starting point to rip the shirt apart. Many of the rings along the two large tears are heavily distorted (Fig. 2), indicating that the shirt was pulled apart by sheer brute force, perhaps thrusting a foot while pulling at the splits with both hands.



*Figure 2.* Arrows point to some of the distorted rings as the result of the coat of mail being ripped apart (photograph M.A. Wijnhoven).

#### 4. CONSTRUCTION: SHAPING AND FITTING

Before addressing the construction of the Vimose shirt, our current knowledge about mail armour construction in Europe should be briefly discussed first<sup>9</sup>. So far, this knowledge has been based exclusively on examinations of medieval and more recent specimens, nevertheless, it is important to mention it as a background for a study of the Vimose piece and to highlight the relevance of the novel information that we can infer from it.

Whereas plate armour needs to be carefully sculptured to fit the human body, the flexible nature of mail fabric adapts easily to the figure of a person. For this reason, it may seem that the construction of the mail shirt did not require much technique, and that a one-size-fits-all mail rectangle would have worked in every case. The examination of medieval and younger coats of mail, however, has demonstrated that European mail from that time was meticulously designed to balance protection, weight, and mobility<sup>10</sup>. This balance was accomplished through the application of various constructional techniques<sup>11</sup>.

One of these involved shifting the rings' heaviness, or gauge, throughout the garment. The heaviest rings were placed at the trunk of the body, which is the most vital, while lighter rings were employed for the sleeves, the bottom part covering the legs and sometimes even the back of the shirt<sup>12</sup>. The use of different thicknesses of links within a single garment offered a well-thought balance between heavy protection, where most needed, and reducing the weight, where possible. Usually the inner diameter of the rings remained the same throughout the garment. This meant that although different gauges were used within a single mail coat, the mail weave would not expand or reduce unwantedly. Inner diameter variations in a single garment at times did occur, albeit to a much lesser extent in shirts than in other mail items such as standards, bishop mantles, and tippets, all designed to protect the throat and upper part of the body<sup>13</sup>. In fact, size variations in mail shirts were most common at the collar, where a smaller ring size was employed to provide greater stiffness. However not all coats of mail had a collar, many consisted of a simple square or rounded opening for the head, sometimes elaborated with a decorative band of contrasting rings made from another metal, different size and/or shape.

While the variation of ring sizes could be a means to deliberately give shape to a mail garment by expanding or reducing its fabric, this was usually done with other techniques. In order to understand these, it is essential to be familiar with how the mail fabric was made up. Apart from a handful of exceptions, through the centuries all mail in Europe was woven in a 4-in-1 pattern. The rings were placed in rows and each individual link was connected to four others, that is, two rings in the row above and two rings in the row below (Fig. 3).

Since mail is woven in rows, its fabric has directionality. In a coat of mail the rows run horizontally on the body and sleeves (arms extended horizontally). At the armpits the direction

<sup>9</sup> Outside Europe, mail armour has been used extensively in several regions, especially in the Middle East and India. However, there have been fewer studies of armour from these parts. E.M. Burgess (1960: 152) did note that oriental mail was different from western mail of comparable age, for example, that its construction made little use of shaping techniques such as increasing or decreasing of the mail fabric.

<sup>10</sup> The account books of merchant Francesco di Marco Datini demonstrate that mail shirts were also made to order (Frangioni, 1978: 485-492). There even were samples of different types of rings the purchaser could choose from.

<sup>11</sup> The techniques described in this paragraph, with the exception of the use of different gauges of rings, were first explained in Burgess (1957b: 197-200). Examples of mail with these characteristics can be found in his work (Burgess, 1957; 1958; Burgess & Robinson, 1956; Reid & Burgess, 1960) and that of others, such as Laking (1920); Scalini (1996); Schmid (2003); and Trapp (1995 [1929]).

<sup>12</sup> A single coat of mail could include up to four types of rings of different thickness. Examples are featured in Burgess (1958: 197-198); Reid & Burgess (1960: 51); and Schmid (2003: 4-5).

<sup>13</sup> Laking (1920: Fig. 508, 522-525, 530-531) features multiple mail garments for the neck and upper body, like the ones mentioned.

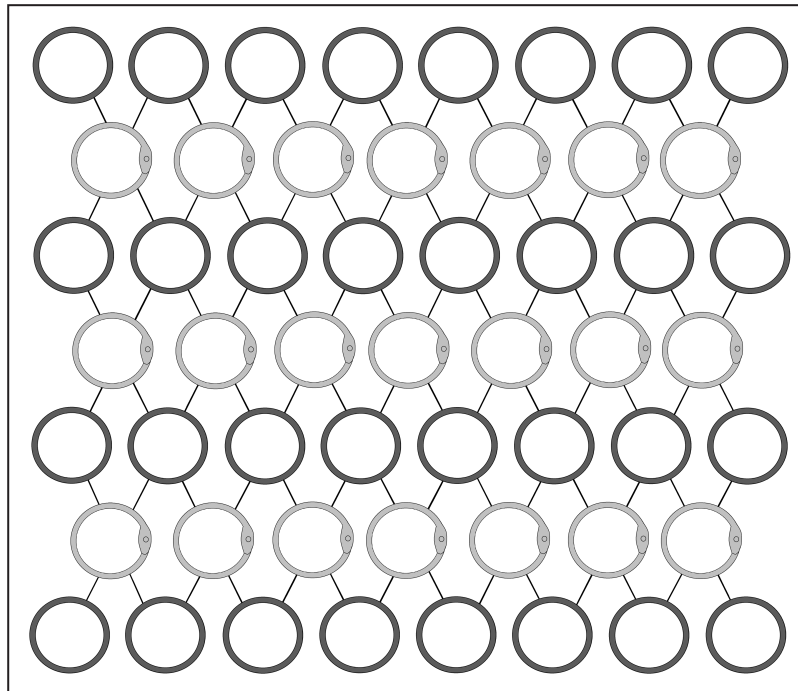


Figure 3. Representation of the 4-in-1 weave pattern with lines indicating which rings interconnect (drawing M.A. Wijnhoven).

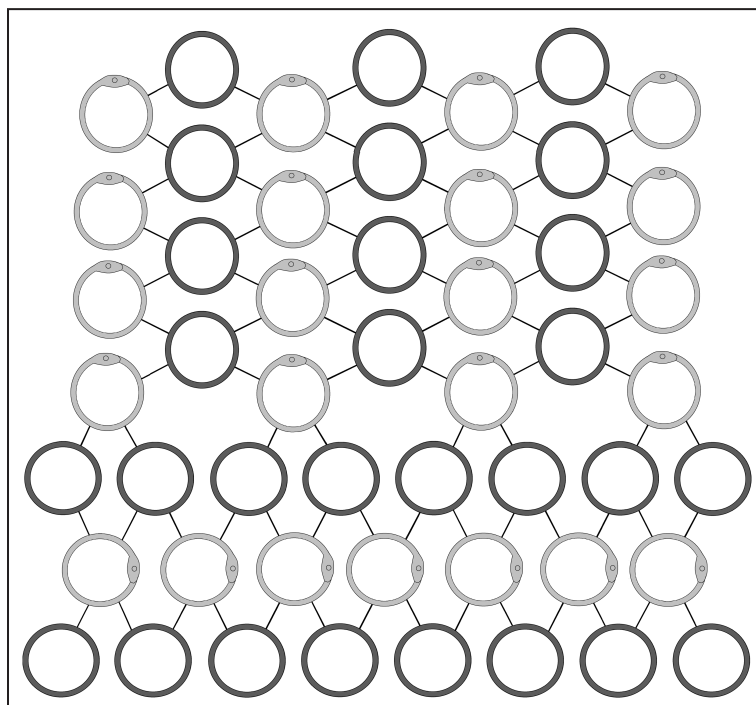


Figure 4. Representation of two sections of mail meeting at a 90 degree angle (drawing M.A. Wijnhoven).



of the body intersects the underside of the sleeve at a 90 degree angle (Fig. 4). By joining the sections of mail fabric at angles, a garment can acquire a three dimensional shape.

A far more complex shaping technique is to increase or decrease the number of rings following a preconceived plan, as it is done in knitting. This was achieved through the use of “idle links” that pass through only three rings (two above and one below or *vice versa*), instead of four. This would result, respectively, in a decrease or increase of the fabric below the idle link (Fig. 5). The coat of mail was tailored in such a way that extra rings were inserted into the area of the shoulder blades, giving additional room for movement to the arms and shoulders. Often, the fabric at the trunk of the body was decreased to reduce the weight of the garment, only to be expanded from the hips down to allow greater mobility for the legs and the lower torso.

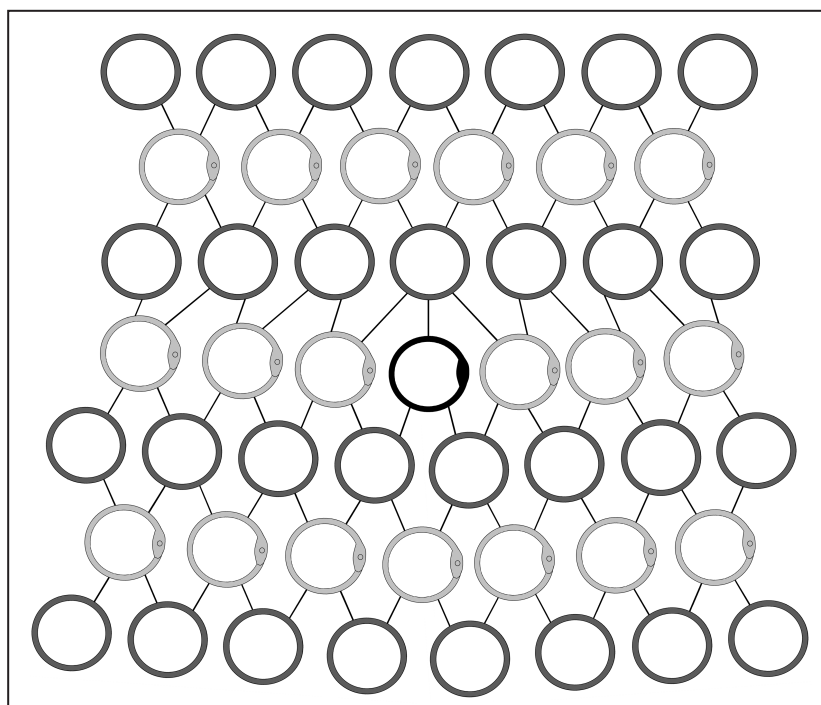


Figure 5. Representation of the use of an idle link to change the number of rings within a row (drawing M.A. Wijnhoven).

The use of idle rings allowed not only to change the number of rings in a single row, but also to modify the number of rows themselves (Fig. 6)<sup>14</sup>. Row reductions are usually found in the sleeves, tapering towards the end to reduce the weight. As stated above, the rows run horizontally in the sleeves (arms horizontally), therefore reducing the number of rings would not cause tapering, but reducing the rows would. Generally, the reduced rows were located on the inside of the sleeve, and sometimes in the body of the mail coat, where they were used to extend the length of the back while keeping the hem perfectly aligned. The extra length on the back of the shirt gave room to bend more easily.

<sup>14</sup> There are two techniques for reducing the amount of ring rows. One leaves a small hole, the other a small knot (see Burgess, 1953b: 198-199, Fig. 5 & 6). In this article only the first technique has been illustrated.

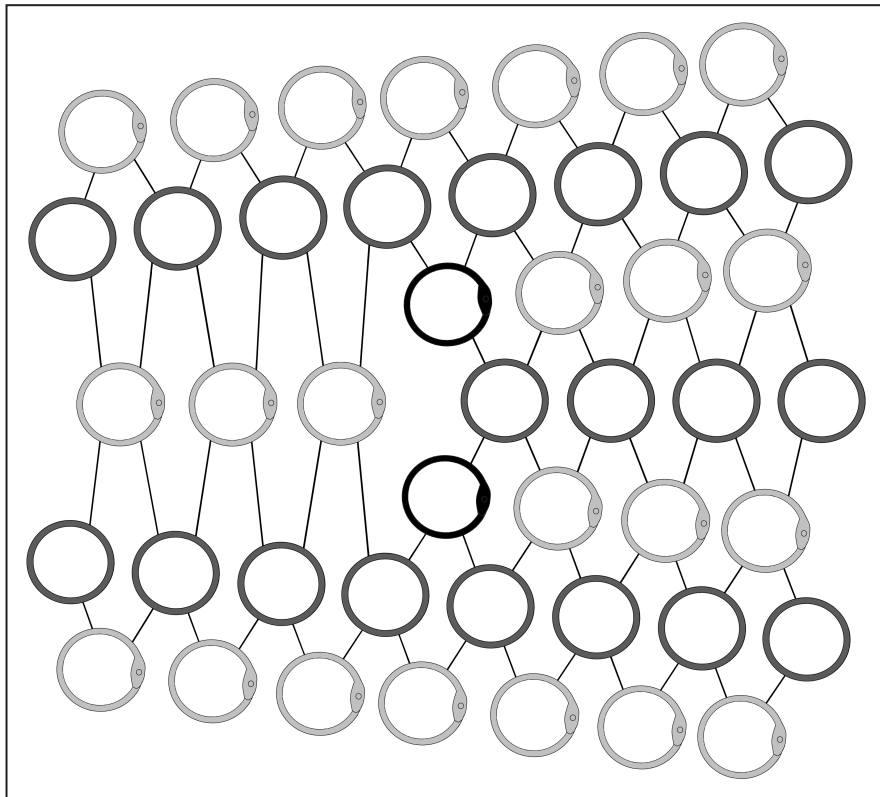


Figure 6. Representation of the use of idle links to change the number of rows (drawing M.A. Wijnhoven).

The purposeful placement of idle links throughout the garment, suggests that the mail-maker would have started at the top of the shirt and worked his way down. It is unlikely that the mail maker used drawn patterns. He rather worked from memory, applying different constructional techniques where necessary throughout the garment. This may in part explain the large variation among mail shirts from the Late Middle Ages and later. In these periods, the constructional techniques described above were used often, although not always, in a single piece. It remains unknown when these techniques were introduced into the craft of mail-making.

## 5. VIMOSE CONSTRUCTION

Conforming to the European mail tradition, the Vimose shirt is woven in a 4-in-1 pattern. It is comprised by rings of two kinds: ‘solid’ and ‘riveted’, which are arranged in alternating rows throughout the mail fabric (Fig. 7). The solid kind was produced by punching rings from sheet metal. Some of them still show burrs as traces of their manufacture. After being punched from a sheet, the solid links were reworked by filing down the sharp corners of the outer edges, resulting in a softly pronounced D-shaped cross-section. Filing strokes can still be observed on many of the rings. The solid links are quite sturdy and large. Their outer diameter measures on average 12.4 mm; and in cross-section they are approximately 1.5 mm thick by 1.3 mm wide.



Figure 7. Close-up of riveted and solid rings from the Vimose coat (photograph M.A. Wijnhoven).

The riveted rings, in contrast, were made by coiling metal wire around a rod, and cutting the coil into individual rings. The ends of these were then overlapped, flattened and pierced. After weaving the riveted rings through the solid ones, they were subsequently closed by a small rivet that was placed inside the hole of the overlap. As is typical in pre-medieval mail, the direction of the overlap of the riveted rings is left over right. The overlap must always be large enough to allow for a hole with a rivet, but in the Vimose coat these are exceptionally long, measuring approximately 8 mm. Like the solid rings, the riveted ones are also fairly large and sturdy. The outside diameter is 12.3 mm on average (measured from the overlap) and 13.2 mm (measured from side to side with the overlap at the top). The wire for the rings has a round cross-section of 1.6 mm. Because only the riveted rings could be woven, to make up the fabric the mail maker would have assembled the ring rows in pairs composed of a row of riveted rings with its underlying row of solid rings. As a result, the edges of the shirt (bottom hem, opening for the head and hem of the sleeves) all end with solid links.

In contrast to medieval and later mail, no variation in ring size or gauge has been introduced in the garment. This means that the thickness and diameter of all the riveted and solid links are constant throughout the entire piece.

The trunk of the Vimose coat is rectangular. From the neck opening, one side includes 117 rows to the bottom of the shirt, the other side only counts 115 rows. Despite the two large rips running at each side of the coat, the width of the body could be established. The circumference just below the armpits is comprised by 145 rings, with one armpit being intact and the other torn. Inspection of the torn armpit showed that only one ring of each row was missing, making a total circumference of 146 rings in undamaged condition. The body does not contain any idle links for shaping the garment, and has the same width at the top, centre and bottom.

The absence of idle links to widen the lower part of the shirt and allow for additional freedom of leg movement, strongly suggests that it originally had two splits (see above) at the bottom sides. The fact that one side of the shirt is 2 rows longer than the other also points to the presence of such splits.

It is unclear which side of the Vimose coat is the front and which is the back. In medieval and later mail, the location of idle links can help to determine which side is which, but no idle links are present at the trunk of the Vimose shirt. Given human anatomy, medieval mail often has the head opening located more towards the chest than to the back, and it generally is of square or round shape. Unfortunately, the position of the neck opening in the Vimose shirt does not reveal anything, as it is placed in the middle of the top part and it simply is a large horizontal split (Fig. 8), created by leaving out 25 riveted rings from one single row in the mail fabric<sup>15</sup>. No collar or decorative band surrounds the opening either<sup>16</sup>. The distance from the head split to the armpit is 30 rows on one side and 29 at the other, illustrating that the head opening is located at the top of the shirt, although not exactly at the centre. Left to right, one end measures 44 rings from the slit to the hem of the sleeve, while the other only counts 42 rings. This may be the result of small damage at one extreme of the slit, but it is also possible that it never was completely symmetrical.

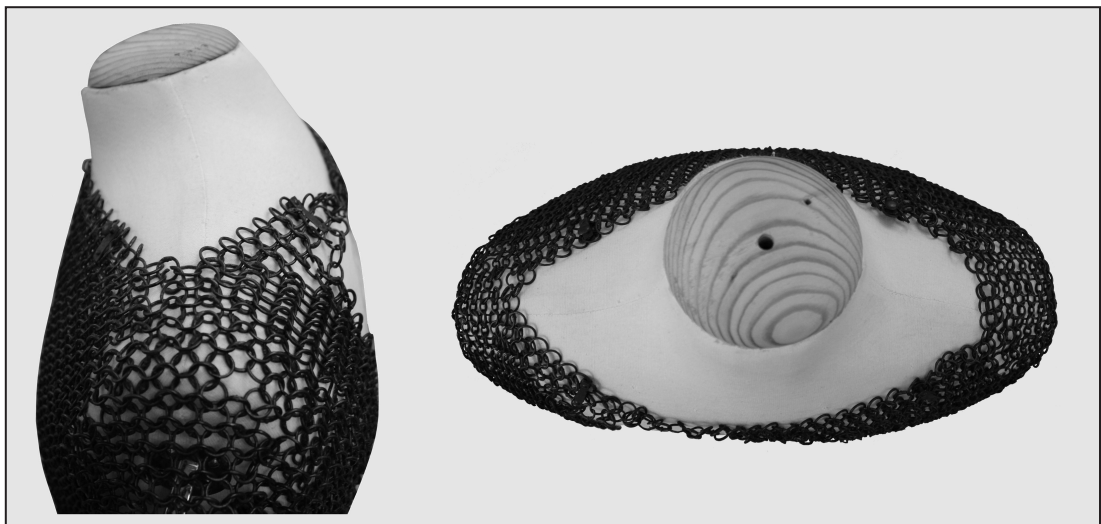


Figure 8. Slit-like neck opening of the Vimose coat (photograph M.A. Wijnhoven).

The slit is large enough to allow easy access for the head, so much so that part of the neckline and upper shoulders would be left unprotected. In addition, its size would have made it cumbersome when moving around, dragging the heavy coat of mail towards one side instead of keeping it neatly positioned on both shoulders. To prevent this movement and shoulder exposure, the Vimose garment has an ingenious closing mechanism for the head opening, made

<sup>15</sup> The slit is nowadays larger than it would have been originally due to damage to one side.

<sup>16</sup> Some authors have erroneously suggested that the coat of mail from Vimose had a trim of copper alloy rings (e.g. Bishop & Coulston, 2006: 170; James, 2004: 116). However, it consists entirely of iron rings. It is possible that Vimose has been mistaken for Thorsberg. Engelhardt excavated and published the materials from both sites. He did recover copper alloy trimmings in Thorsberg, but not in Vimose (Engelhardt, 1963: 26; 1866: 46).



of four small applications, two at each side of the slit (Fig. 9 & 10). On the side where the coat is 115 rows in length, the fixtures are plain rectangular iron plates (25 x 6.3 mm and 25.8 x 6.1 mm), fastened to the mail by two rivets (diameter rivet heads 3.4 mm). These were held in place by a single rectangular washer similar in size to the plates. As indicated by a space of several millimetres between the plate and the mail fabric, the applications would have been used to fix two straps of leather, now missing. To close the head opening, the straps would be fastened onto the two fixtures on the opposite side. These fixtures are similar in shape (22.6 x 7.3 mm and 22.1 x 7.6 mm), but additionally contain a button (diameter 9.0 and 9.2 mm). The opening for the head could be easily adjusted by pulling the buttons through a hole in the leather straps<sup>17</sup> (Fig 10, top), and it even could have been customized if various holes were placed at a regular distances along the leather straps, as in a belt.



Figure 9. Fixtures for regulating the neck opening (photograph M.A. Wijnhoven).

<sup>17</sup> The distance between the two plate applications is 15 riveted rings; that between the two fixtures with buttons is 18 riveted rings, reducing the opening for the head by a third.

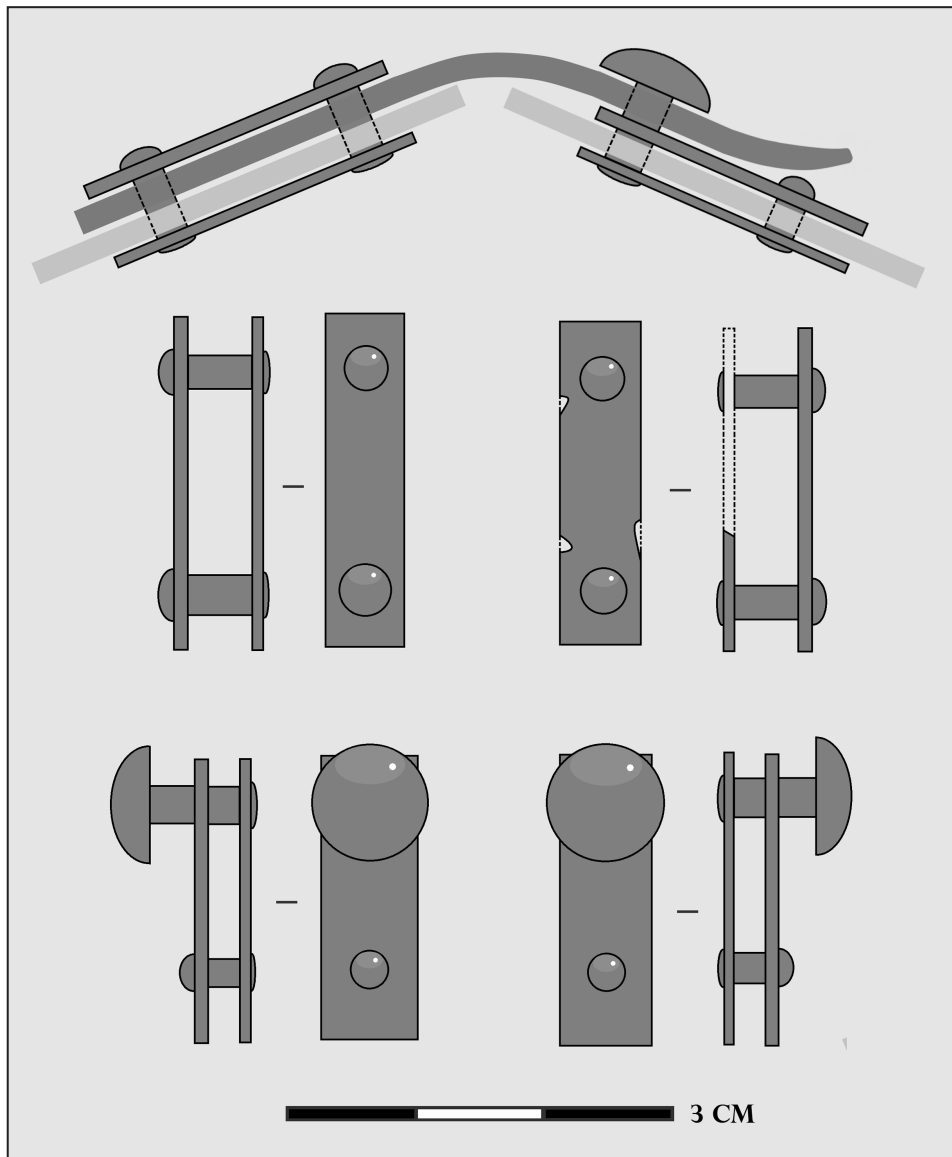


Figure 10. Fixtures of the Vimose coat of mail. Top illustrates how they function with a leather strap still in place (drawing M.A. Wijnhoven).

The sleeves are created as a continuation of the horizontal ring rows of the body. Counting from the armpit, one sleeve is formed by 20 extra rings per row extending from the body. The length of the other sleeve is difficult to determine because the armpit is no longer intact, but with 19 rings from the sleeve's hem to the torn armpit, it was probably the same. The sleeves taper towards the ends. The tapering was accomplished by reducing the number of ring rows from 60 at the armpit to 50 at the hem. At the underside of the sleeves the rows are reduced two at the time, employing the technique that is illustrated in Fig. 5. Each sleeve contains five of these reductions (Fig. 11). This technique for tapering has been observed in many medieval and younger coats of mail, and it is remarkable that it can now be identified in the Vimose coat as well.

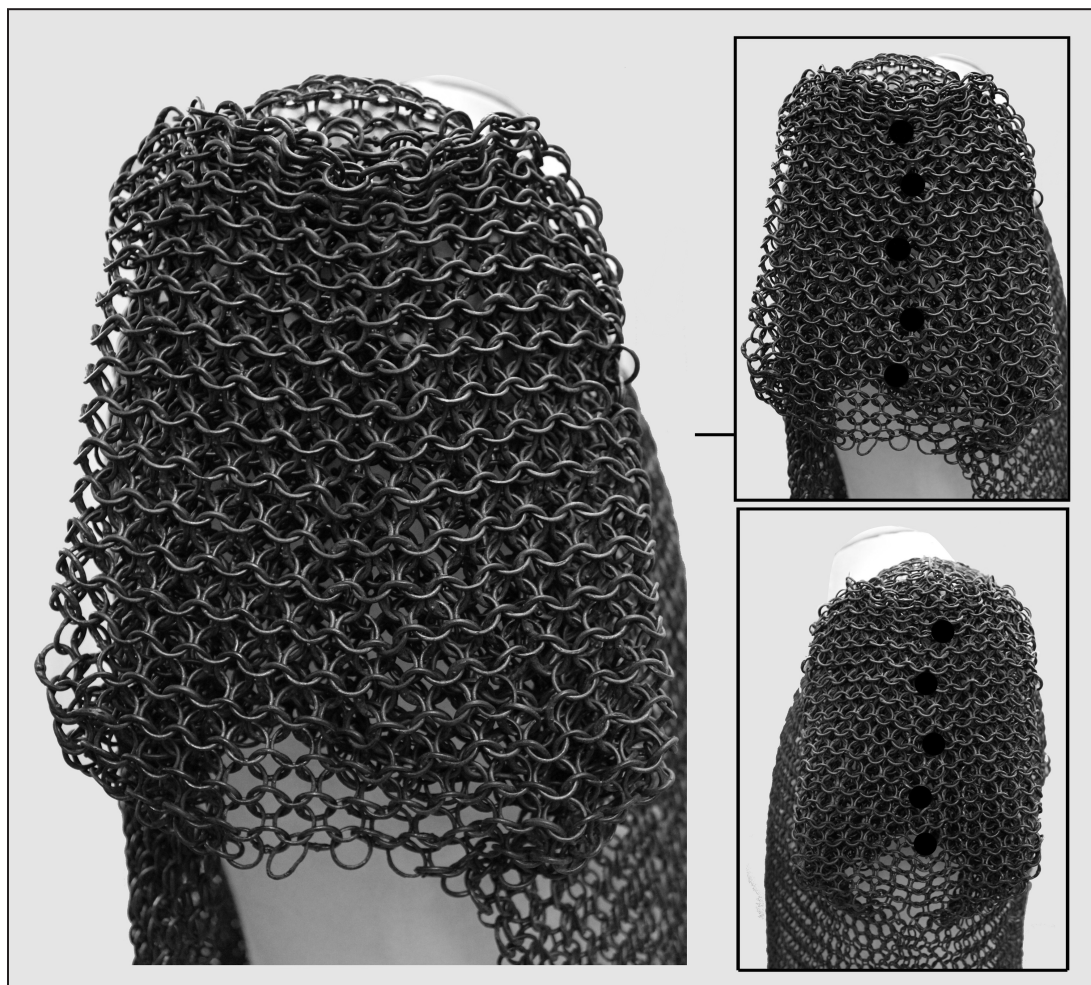


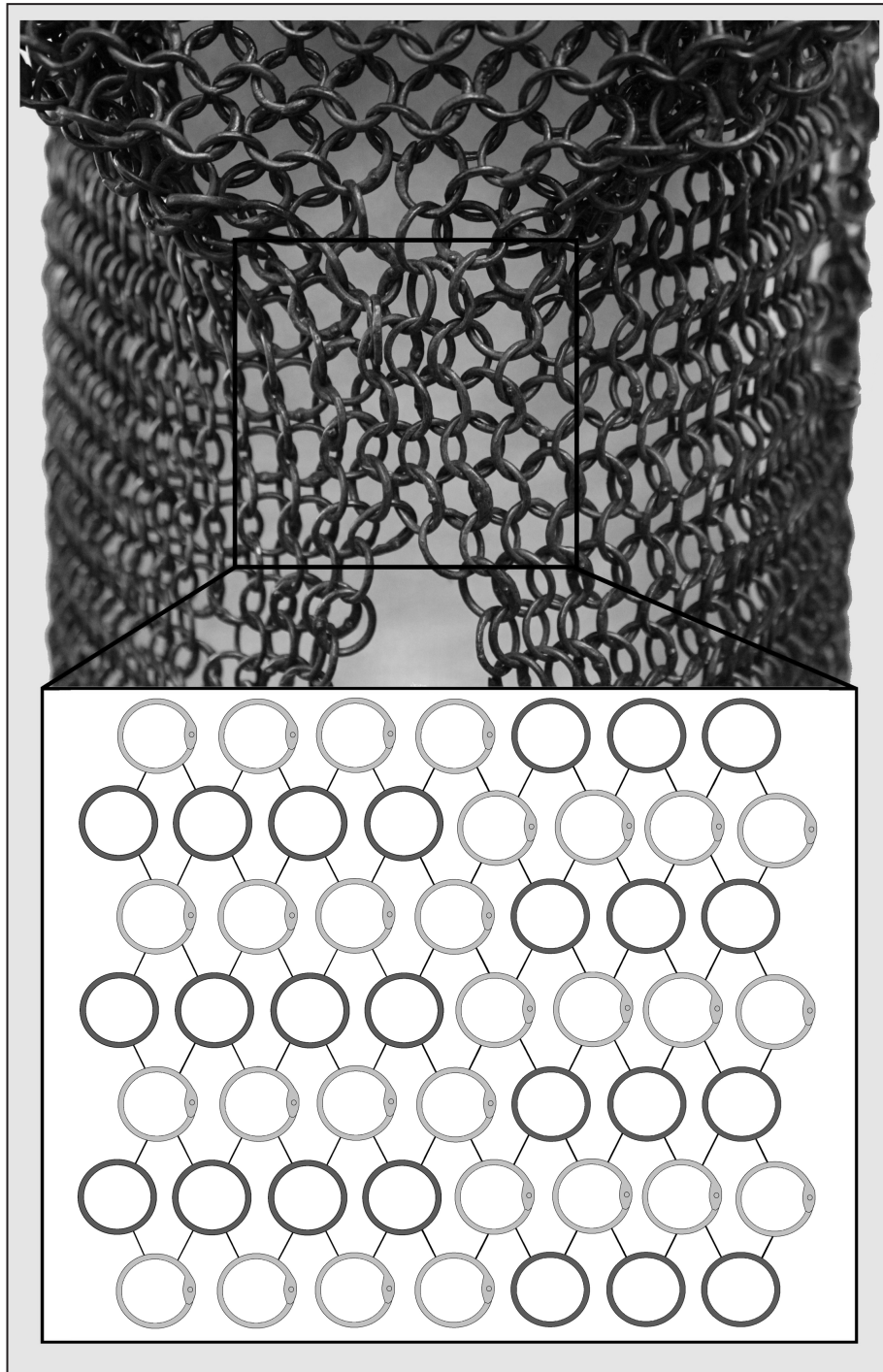
Figure 11. Sleeves turned upward to expose the row reductions at the underside; reductions are marked with dots. (photograph M.A. Wijnhoven).

Whereas in medieval specimens the armpit forms a 90 degree angle between the body row and the underside of the sleeve (as in Fig. 4), that is not the case in Vimose. The purpose of that technique was to give the sleeve a three-dimensional shape at the pivoting point. Instead, the armpit area of the Vimose coat is ‘flat’, created simply by connecting the front and back of the trunk and seaming up the undersides of the sleeves (Fig. 12). Moreover, the area underneath the intact armpit gives an essential clue about the manner in which the Vimose coat was constructed. As mentioned previously, the shirt consists of alternating rows of riveted and solid rings, which fits the pattern of most early mail up to the Late Medieval Period<sup>18</sup>. Nevertheless at Vimose, each row of rings suddenly shifts from riveted to solid (and *vice versa*) in a vertical line underneath the armpit (Fig 12). That is, each single row on the circumference of the trunk consists of riveted rings on one side of the garment and of solid links on the other. This is very

<sup>18</sup> Mail with alternating rows of riveted and solid rings has always been the rule, although exceptions do exist. Only from the late 14<sup>th</sup> century onwards does all-riveted mail become much more dominant in Europe (Burgess, 1958: 201-203).



different from medieval and later mail coats in which each single row only contains one type of ring for the entire circumference (Burgess, 1958: 202).



*Figure 12.* The rows shift from solid to riveted rings and *vice versa* underneath the armpit (photograph and drawing M.A. Wijnhoven).



The difference in construction is that the latter were made by adding rings ‘in the round’, while Vimose was made ‘in the flat’. This means that the Vimose coat was constructed as one single large flat panel that included both sides of the garment and its sleeves (Fig. 13). Only as a last step in its manufacture the large flat sheet of mail would have been folded at the centre, thereby creating a front and a back, and closed at the sides of the trunk and undersides of the sleeves, forming a true coat of mail<sup>19</sup>.

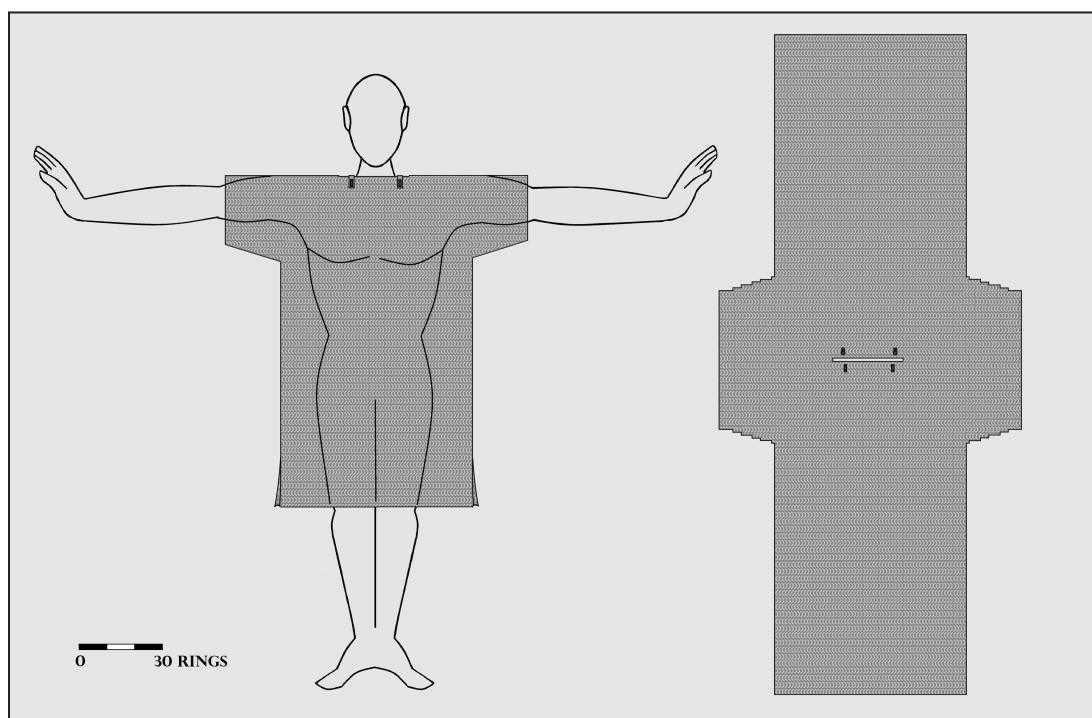


Figure 13. Proportion Vimose coat to human body and constructional lay-out (drawing M.A. Wijnhoven).

## 6. THE IRON TUNIC

The construction of the mail coat from Vimose closely resembles that of a tunic, one of the most widespread types of clothing during the Roman Period<sup>20</sup>. The tunic was not only the garment of choice within the Roman Empire, but also for many peoples on its borders and beyond, including those of the Barbaricum (Pausch, 2003: 56-59).

<sup>19</sup> The rings in a 4-in-1 weaving pattern do not lay entirely flat but slope towards the right or left (see Fig. 7). In this pattern all the rings within a single row always slope in the same direction, with the row above and below going in the opposite direction. When a rectangular section of mail is folded (and it concerns alternating rows of riveted and solid links) the slope of the solid and riveted rows will become different on each side. This means that the row of riveted rings on one side can no longer be connected to a row of riveted rings on the other side, but only to rows with similar slope, which are the rows with solid rings. The phenomenon of ‘row slope’ thus allows us to verify with certainty that the Vimose coat of mail was first constructed as one large sheet of mail, only folded in the end.

<sup>20</sup> For further information on the construction of the Roman tunic see: Croom, 2010: 16-18; Pausch, 2003: 71-76; Pritchard, 2006: 49-59; and Sumner, 2009: 33, 60.

One of the most striking similarities between the Vimose coat and the tunic is the two-dimensional approach to its construction. In antiquity, and particularly among the Romans, clothing such as tunics and cloaks were almost always ‘woven to shape’ (Granger-Taylor, 1982). This means that instead of creating garments by cutting smaller pieces of textile from a larger cloth and sewing them together, the entire garment was created in one single piece on the loom<sup>21</sup>. A tunic that was woven to shape did not require much ‘post-loom’ work, since there was no cutting and only minimal sewing. Just like the Vimose coat of mail, these tunics were folded and closed at the sides during their last stage of manufacture.

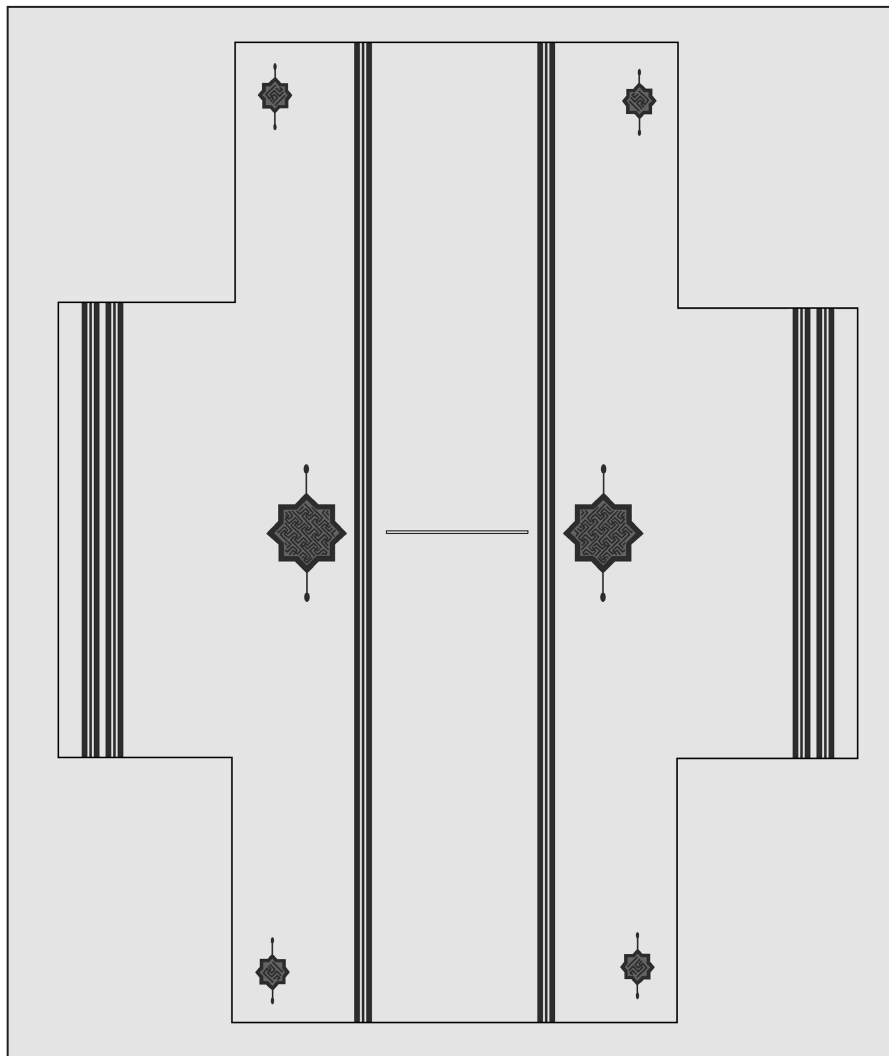


Figure 14. Reconstruction of original lay-out of a 3<sup>rd</sup>-4<sup>th</sup> century AD cross-shaped tunic from Egypt in the collection of the Whitworth Art Gallery (drawing M.A. Wijnhoven, adapted from Pritchard 2006, Fig. 4.3a)

<sup>21</sup> This approach had several advantages: no textile was wasted in the manufacture of the tunic, little subsequent needlework was involved, and the selvages of the cloth provided more resistance against the fraying of the fabric than a sewn hem.

Not only does the mail coat from Vimose have the same two-dimensionality as woven-to-shape garments, but its construction also mirrors a well-known type of tunic: the so-called ‘cross-shaped’ or ‘cruciform’ tunic (Fig. 14)<sup>22</sup>. These tunics were highly popular in Roman times, especially in the Mediterranean and Near East. As its name indicates, this tunic resembled a cross when finished on the loom, two of the extremities forming front and back, the other two making up the sleeves. In weaving a cross-shaped tunic a narrow section was first woven at the middle, producing the first sleeve. The full width of the loom was then used to create the body. The neck opening was formed as a vertical slit with closed edges in the process of weaving; the threads being turned back at the middle and returning towards the outer edges. Finally, the second sleeve was woven by copying the measurements of the first sleeve. At a final stage the tunic was taken from the loom, folded and sewn along the sides and the undersides of the sleeves (Hald, 1949: 67-69).

The cross-shaped tunic was a very wide garment which left lots of room on the upper body (Fig. 15) and could have wide sleeves. Because of its voluminous nature, it was worn belted. The male cruciform tunic usually reached down to the knees. Often, the bottom part of the sides was left open, creating two splits that allowed sufficient movement of the legs.

The resemblance between the cross-shaped tunic and the Vimose coat of mail is no coincidence. It is very probable that in antiquity the coat of mail was not seen merely as a piece of armour, but as a tunic in its own right, albeit one that offered protection to its wearer. There is some literary support for this suggestion. Varro, who wrote in the 1<sup>st</sup> century BC, speaks of *ex anulīs ferrea tunica*, or the ‘iron tunic made of rings’, to refer to the mail coat when he is explaining the etymological origin of the word for cuirass (*lorica*)<sup>23</sup>. This author, then, confirms that the mail coat was perceived as a tunic.

There is further archaeological support for a correspondence between clothing and mail armour. At the site of Dura-Europos, in Syria, a complete coat of mail was found in a collapsed countermine related to the Sassanid siege of the Roman garrison town during the mid-3<sup>rd</sup> century AD (James, 1990, Vol. I: 39-40, 136-137; Vol. II: Pl. 2.2A-B; 2004: 116-117, Fig. 52-55). Although complete when deposited, the Dura-Europos mail coat has sustained post-depositional damage and is no longer flexible. Therefore, its exact form difficult to determine, but it is clear that it followed a ‘pullover’ pattern that reached approximately to the top of the thighs. It had fairly long sleeves that extended at least below the elbows, and perhaps up to the wrists. The lower hem of the coat was trimmed with three rows of copper alloy rings. There was a 10.5 cm split at each side of the hem, to facilitate movement. As in Vimose, the neck opening consisted of a simple slit in the mail. In this case, however, the slit was trimmed with three rows of copper alloy rings and did not have any fixtures to regulate the aperture. Finally, copper alloy rings were also used on the upper chest area to create a decorative trident pattern of similar design to the ‘heraldic’ devices seen on depictions of early Sassanian warriors’ armour (ibid., 2004: 116).

Unfortunately, the current condition of the Dura-Europos coat of mail does not allow us to say with certainty how it was constructed. Nonetheless, the presence of (long) sleeves, the splits at the sides, and especially the slit-like neck opening strongly suggest that, like the Vimose one, it was constructed as a cross-shaped tunic<sup>24</sup>. The rich decoration of the Dura-Euro-

<sup>22</sup> Extant cruciform tunics are e. g. discussed and illustrated in: De Moor *et al.*, 2010; Pritchard, *op. cit.*; and Verhecken-Lammers, (2010).

<sup>23</sup> Varro, *De lingua latina*, V.24.

<sup>24</sup> James (2004: 116) was the first to link this coat of mail with an item of clothing by emphasizing its similarities with the Parthian kaftan. However, the construction of the kaftan differs from that of the cross-shaped tunic. The most salient difference is that the kaftan is not woven-to-shape, but cut to pattern, allowing it to be more form-fitting to the body than

pos coat may well be a reflection of the cultural background of its owner. During that period Persian<sup>25</sup> clothing was especially known for its abundant decoration (Staufer, 2000: 33).

There are, however, some differences between the two coats of mail. The Vimose one does not contain any decorative copper alloy rings, whereas the neck opening of the Dura-Europos one has no fixtures for adjusting its size. Of course their dimensions are also different, the Vimose coat being much longer, but having shorter sleeves. Despite these differences, both artefacts perfectly serve to illustrate the intimate relationship between the coat of mail and textile clothes such as the tunic.

## 7. IN SEARCH OF AGE AND PROVENANCE

The absence of a find context does not facilitate the dating of the Vimose coat of mail. Its provenance is equally hard to establish, as is for most mail armour in the Barbaricum which at times has been considered of Roman origin (e.g. import, war booty or exchange gift), and at times as a local Germanic product<sup>26</sup>. Without context, the only inferences we can make must be from the object itself. The following section will address age and provenance by zooming in on some of the most relevant characteristics of the coat of mail.

The weapon deposits at Vimose span between the start of our era and circa AD 600. We can expect the coat of mail to belong to one of these deposits. This is confirmed by a very simple trait found on the riveted rings, which is the direction of the overlap. From at least the 6<sup>th</sup> century onwards the ends of the overlap were positioned right over left; while in prior centuries, these were placed left over right (Wijnhoven, 2009: 34). Since the Vimose coat consists of rings with a left over right overlap, it must be earlier than the 6<sup>th</sup> century AD.

Another indication of age is given by iconography. From its earliest beginnings, the mail coat has been represented as a sleeveless garment with a flap ('doubler') on each shoulder that was brought down to the chest. Here the doublers were attached to the front of the mail coat by a metal fastener. In the representational record, this design is observed time and again until the start of the 2<sup>nd</sup> century AD. From this time onwards a very different type of mail coat is represented. The new design no longer makes use of doublers, but has sleeves and resembles a modern T-shirt. The introduction of this new type of mail coat is also confirmed by the archaeological record. Without doublers, there was no need for fasteners to attach them to the chest. Finds of chest fasteners are abundant until the 2<sup>nd</sup> century AD but from that point in time they disappear quickly from the archaeological record. Since the Vimose coat has sleeves and no doublers, it must date from after the 1<sup>st</sup> century AD. We may be tempted to try and continue narrowing down the age or try to establish provenance by comparing the Vimose design to that of representations, but the quality of the iconographic material is not reliable enough to do so<sup>27</sup>.

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the tunic (Staufer, 2000: 33-35). The cut-to-pattern approach also means that the kaftan can have a rounded neck-line (ibid.: Fig. 34), instead of the slit-like aperture typical of woven-to-shape clothing. Given that the Dura-Europos coat of mail has a slit-like neck opening, it is more likely that its construction was inspired by the cruciform tunic rather than by the Parthian kaftan.

<sup>25</sup> The Sassanid army was constituted by individuals of different cultural backgrounds (James, 1990, I: 18), hence the use of the term Persian.

<sup>26</sup> E.g. Engström 1992: 29-30); Hansen, 2003: 78, 82; Pauli Jensen, 2003: 234; 2008: 217; and Raddatz, 1959-1961: 52-54.

<sup>27</sup> For one, representations come almost exclusively from a Roman context for the 1<sup>st</sup> century AD onwards. More importantly, such depictions are usually simply too inaccurate to allow for detailed comparisons. For example, the 2<sup>nd</sup>



Fortunately representations of mail coats are not the only source that provides clues. Given the similarities between the construction of the cruciform tunic and the Vimose coat, it is likely that the age and provenance of one can shed some light on the other. The earliest archaeological evidence for the cruciform tunic comes from Palmyra, Syria, and dates to 1<sup>st</sup> and 2<sup>nd</sup> century AD (Schmid-Colinet, 2000, 1-4; Staufer, 2000: 32-36). Archaeological remains of cross-shaped tunics are found in Egypt from the 3<sup>rd</sup> century onwards (Fig. 14). Not surprisingly, this country has rendered a very large number of finds that span until well after the Arab invasion and demonstrate the popularity of this garment in Egypt (Pritchard, 2006). For the western part of the Roman Empire, sleeved tunics are depicted from the late 2<sup>nd</sup> century onwards (Hald, 1980: 338). It is not entirely certain whether these representations are meant to depict cruciform tunics or not, because again the iconographic medium does not offer good information about construction. Identifiable remains of cruciform tunics have not been preserved in this region. It is clear that woven to shape garments, of which these were part, started to diminish during the end of the Western Roman Empire and finally ceased to exist in Europe around the 7<sup>th</sup> or 8<sup>th</sup> century (Granger-Taylor, 1982: 22). Data on the cruciform tunic thus confirms the date range already established.

Concerning the provenance or cultural affiliation of the cruciform tunic, there is evidence from various regions. However, one has to keep in mind that textiles only survive under exceptional environmental circumstances. This means that the overwhelming majority of the archaeological evidence for the construction of tunics comes from the dry Near East (mostly Egypt and Syria) or from wet environments in Northern Europe<sup>28</sup>. As noted earlier, there is much evidence for the cross-shaped tunic in the Near East as part of Roman Empire, but there is also one find from the North of the Roman border. At a bog in Reepsholt (North-western Germany) a cruciform tunic was unearthed (Fig. 15). This find, originally ascribed to the 1<sup>st</sup> or 2<sup>nd</sup> century AD (Potratz, 1942: 25-26), has subsequently been reassigned to the 1<sup>st</sup>- 4<sup>th</sup> century AD by various scholars (e.g. Hald, 1980: 336; Vedeler & Jørgenson, 2013: 798). Hanns Potratz (1942: 18-19) concluded that the tunic must have been a local product because an analysis of the wool fibres corresponded with that of a modern local breed of sheep. While later research has not challenged this specific argument, it is currently conceded that the Reepsholt tunic is of local manufacture but following the Roman fashion (Fuhrmann, 1942: 363-364; Hald, 1980: 336-338; Nockert, 1991: 120). The main argument is that, while it shows various local characteristics<sup>29</sup>, cruciform tunics have not been found anywhere else in the Barbaricum, but are common in the Roman Empire. In brief, the cultural affiliation of the cross-shaped tunic appears to lie in the Roman Empire. Probably originating in Syria, its use seems to have spread rapidly over the Empire, reaching areas beyond its borders as attested by the Reepsholt find. The similarities between the Vimose coat and the cruciform tunic thus point to a Roman provenance, at least for its constructional design.

The four iron fixtures at the Vimose neck opening also render viable clues about age and provenance. There have been quite a lot of similar finds although - with one exception - none related to mail armour. In fact, Przybyła (2010: 125-162) has defined the small metal plates with upstanding hooks as a separate type of closing mechanism common in the Barbaricum. In total she offers a catalogue of 41 examples of which almost all come from the Elbe region

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century shows such a high degree of standardisation in the representation of the mail coat, that very little conclusions can be drawn from this material.

<sup>28</sup> E.g. Hald, 1980; Möller-Wiering, 2011; Schlabow, 1976; and Wild, 1982.

<sup>29</sup> The seams are a type called 'Thorsberg seam', which is common in Northern Europe (Möller-Wiering, 2011: 109); the tunic is made of a coarser and darker wool than Roman examples (Hald, 1946: 95); and the manner in which the yarn in the garment is spun resembles Danish specimens that date between the 2nd and 4th century AD (Hald, 1980: 336).

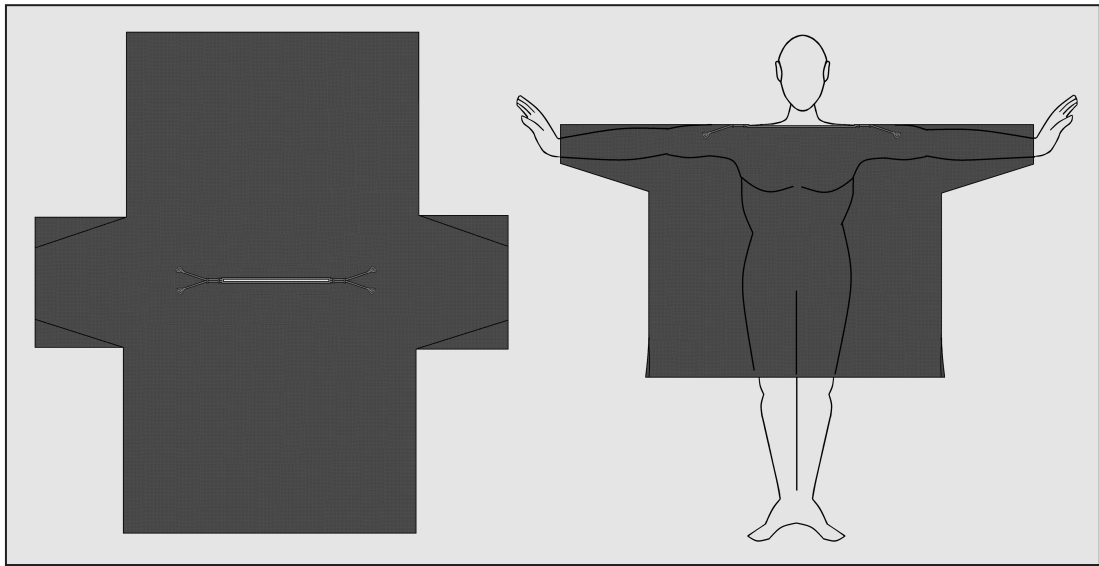


Figure 15. Constructional lay-out of the Reepsholt tunic and proportion to the human body (drawing M.A. Wijnhoven, adapted from Schlabow 1976, Fig. 158).

of North-Eastern Germany and Denmark. These span between the 1<sup>st</sup> and early 3<sup>rd</sup> century AD (B1-C1b Phase). It seems that most were used as sword belt fittings, although other uses cannot be excluded, such as part of a horse harness or a waist belt. The Vimose coat of mail illustrates another use and it is possible that some of the isolated finds come from mail armour<sup>30</sup>. Closing mechanisms in the shape of small metal plates with an upstanding hook are not exclusive to the Barbaricum and are also found in Roman contexts, making the provenance of this type of fixture uncertain (ibid.: 162).

The only other coat of mail with similar fixtures comes from a cremation grave at Brokaer, Denmark (Jouttijarvi, 1995; Rasmussen, 1995: 58-80). The grave included a rich array of items such as a ring-pommel sword, spurs, a golden finger ring, two ornamented silver beakers, two drinking horns, various Roman bronze vessels and one of silver. The presence of such objects allowed it to be dated to the second half of the 2<sup>nd</sup> century AD (transition B2 to C1). The fixtures are of the same plain design and size (ca. 30 by 7 mm) as those from Vimose, except that their ends are rounded instead of square (Fig. 16), and none has buttons. The latter must have been present on two of them, but are probably now missing due to their fragmentary condition.

At a first glance, Brokaer seems to be the only find with similar fixtures, but this may not be the case. The sites of Thorsberg and Hagenow (Germany) have yielded a number of fixtures that clearly were part of mail coats but whose actual function has remained unknown and, according to some authors, would always remain a mystery (Hansen, 2003: 85; Waurick, 1982: 113; Przybyła, 2010: 161). However, with the new insight that the Vimose coat was constructed like a tunic with a slit at the neck that could be opened and closed by means of fixtures, we can now say what these artefacts are and what they were used for.

The mail fixtures from Thorsberg can be divided into three categories. The first concerns a highly ornate type of fastener of which two pairs have been discovered. They are made of a

<sup>30</sup> The same is true for some of the so-called button-and-loop fasteners which are found mainly on military sites in the Roman provinces. These have been interpreted as fasteners of a military cape (*paenula*), as horse harnesses, and as sword belt fittings (Wild, 1970), but some of them may actually have come from mail coats.

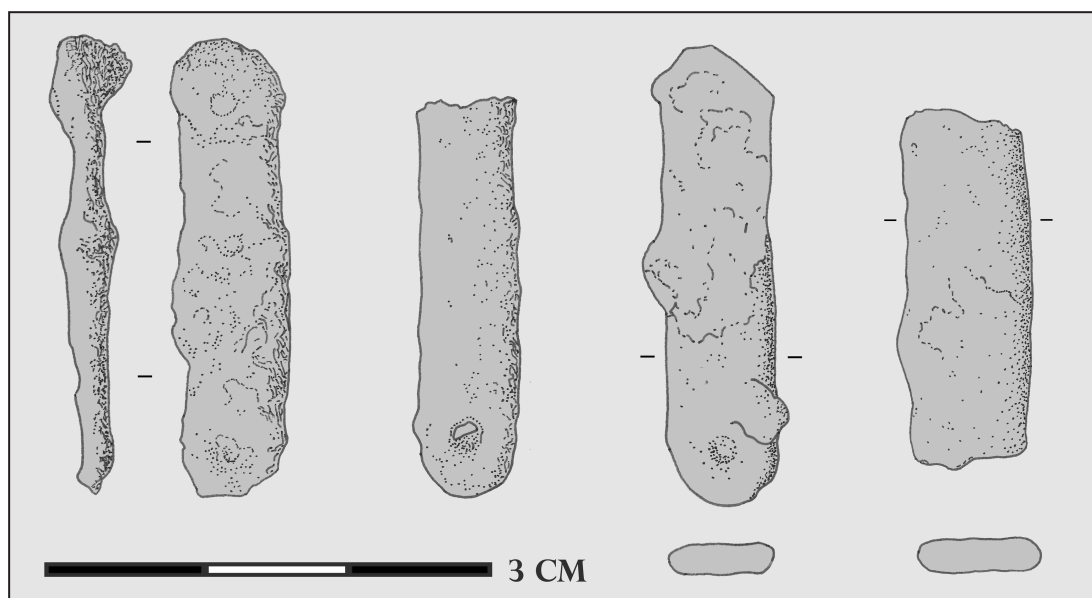


Figure 16. Fixtures from Brokaer, Denmark (drawing M.A. Wijnhoven, after Rasmussen 1995, Fig. 29).

copper alloy base-plate covered in embossed silver sheet and further enhanced with gild and decorative beaded silver wire (Fig. 17)<sup>31</sup>. Each fastener from a set consists of two separate roundels that were permanently attached to the mail coat by rivets and elaborate washers. The roundels connect to each other through a hook and eye construction. One of their most revealing features is the presence of hinges that give the three segments (the two roundels and their connecting part) extra movement. The use of hinges allows the fasteners to accommodate the round of the shoulder perfectly. There is little doubt that these fixtures, just as at Vimose, regulated the slit-like neck opening of a mail coat<sup>32</sup>. These hinged fasteners probably date to the first half of the 3<sup>rd</sup> century (C1b) as the majority of military equipment from Thorsberg (Matešić, 2008: 94). More specifically, the larger set of the two can be given a date between AD 220 and 240<sup>33</sup>. Similar fasteners have been found outside Thorsberg in two graves at Hagenow. Graves II/1899 and 9/1995 both contained a coat of mail with fasteners of this type (Voß, 1998; 2000; 2007; 2008)<sup>34</sup> and date to the start of the 2<sup>nd</sup> century AD (B2). They also included a rich assembly of artefacts among which the complete warrior panoply of a horseman. The grave goods were a mix of items of Germanic and Roman(ised Germanic) origin.

<sup>31</sup> Catalogue numbers M1172-5 (Matešić, 2011) or 407.3-4 & 408-9 (Raddatz, 1987).

<sup>32</sup> Independently Matešić (2011, Vol. I: 260) reaches the conclusion that this type of fastener was used at the top of the shoulder. She bases this on two observations: 1) when unearthed, the larger set of fasteners was still attached to a fragment of mail that corresponded to the top of the mail coat; and 2) the direction of the attached mail weave indicated that the fixtures had been used vertically and not horizontally on the coat of mail. She, however, suggests that the coat of mail to which the fasteners belonged to was entirely open at the shoulders.

<sup>33</sup> Part of the larger set of fasteners was found in a ceramic vessel together with a decorative disk. The disk has been dated between AD 220 and 240 (Carnap-Bornheim, 1997: 80). Since the vessel can be considered as a single deposit, a similar date can be given to the large fasteners.

<sup>34</sup> Catalogue numbers II-04-9/1.16 and II-04-9/1.33 (Voß, 1998). The fasteners from cremation II/1899 are now lost; a water colour drawing still exists (ibid. Pl. 57). A photograph of the fasteners from grave 9/1995 can be found in Voß (ibid.: Pl. 62).

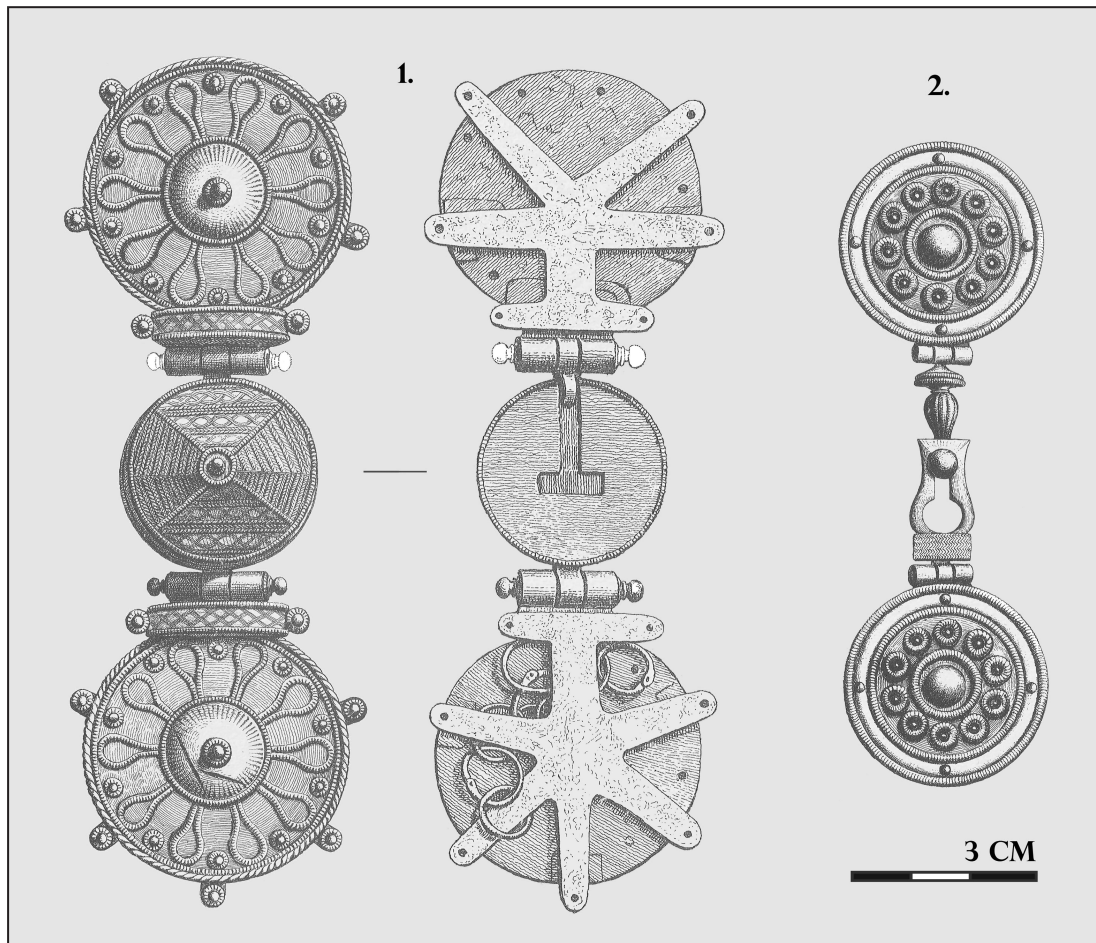


Figure 17. Ornate fasteners with hinges from Thorsberg (from Engelhardt 1863, Pl. 6-7).

The second type of mail fixtures found at Thorsberg is simpler, but probably served the same function as the first. Each fastener consists of two small metal plates, one ending in an eye, the other in a hook, by which they connect to each other. One of the fixtures still had mail rings attached. In total, Thorsberg rendered three sets and a separate example<sup>35</sup>. Two sets are made of iron covered in white metal (Fig. 18, 1-4). Both have a round shaped hook and a corresponding pear-shaped eyelet. It is feasible that these once formed part of the same coat of mail; each placed on one side of a slit-like neck opening. The other set and single plate are made of copper alloy (Fig. 18, 5-7). The eyelet is rectangular, while the corresponding hooks are T-shaped. Given the similarities between this set and the single plate, it probably also came from one coat of mail. The interpretation that the two sets of hook and eye plates served a similar function as the fixtures found on the Vimose coat is reaffirmed by two characteristics. First, instead of being flat, the plates show a subtle curvature. And second, all the hooks are positioned at a slight angle, making them close best when not positioned flat, but following the round of the shoulder. Unfortunately, these finds cannot be dated very accurately, probably they belong to one of the weapon deposits between AD 150 and 300 (B2-C2).

<sup>35</sup> Catalogue numbers M1178-81 (Matešić, 2011) or 413.2, 414, 418-9 (Raddatz, 1987).



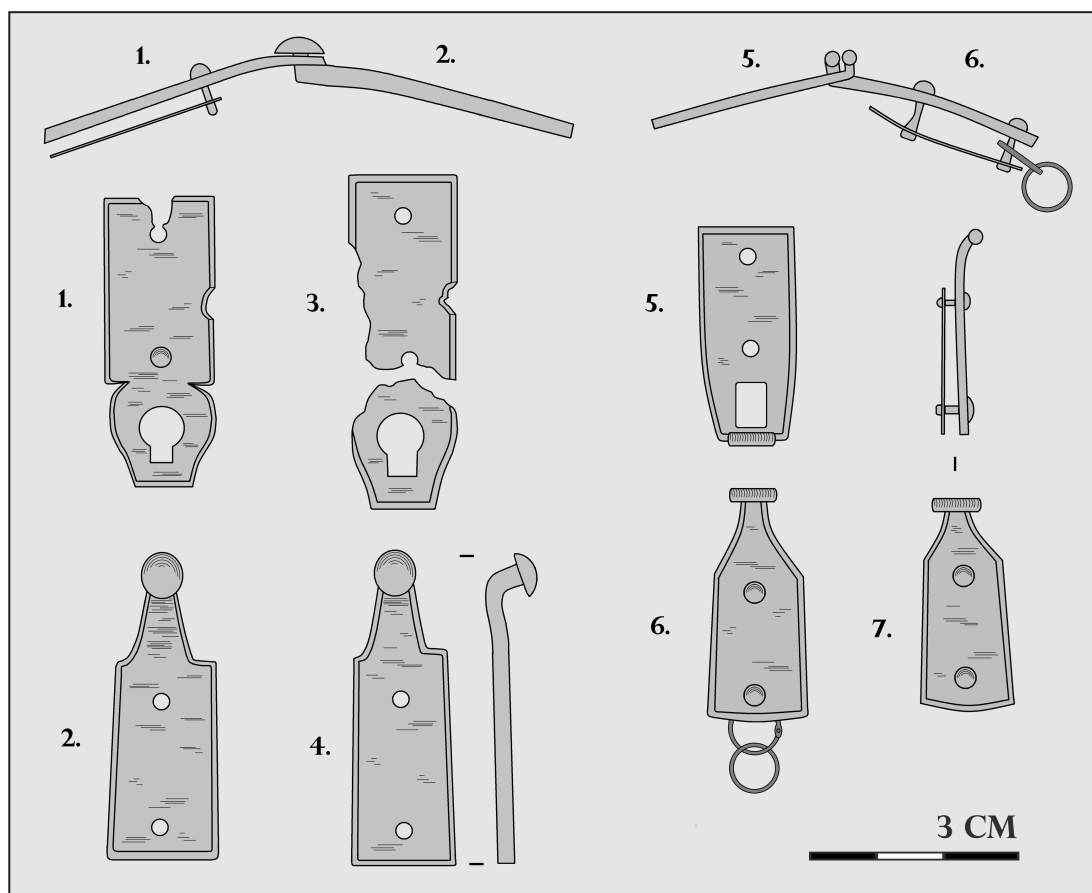


Figure 18. Thorsberg hook and eyelet fasteners (drawing M.A. Wijnhoven, adapted from Raddatz 1987, Pl. 34).

The function of the last type of fixtures from Thorsberg remains uncertain. Two of these have been recovered (Fig. 19, 1-2); one with mail rings still attached<sup>36</sup>. They are made up by a round copper alloy base plate with circular protrusions, where rivets attach the fixture by means of a washer to the mail coat. One of the objects has a hole at its centre, but both are covered by a (gilded) silver sheet embossed with decorations. At Vimose, two similar objects have been discovered (Fig. 19, 3-4) and, according to the excavating archaeologist, were also part of a mail coat (Engelhardt, 1869: 12)<sup>37</sup>. Possibly, this type of fixture was also somehow employed to adjust the neck opening of the mail coat.

The mail fixtures from Brokaer, Thorsberg and Hagenow demonstrate that the slit-like neck opening, as observed at the Vimose mail coat, was not unique. Given the Roman origin of the cross-shaped tunic, in addition to its presence on the coat from Dura-Europos, one would also expect this feature on Roman coats of mail. Although likely, the poor preservation of mail is, unfortunately, unable to provide evidence in favour or against this expectation. Just as at Dura-Europos, mail-related fixtures employed to regulate a slit-style opening are currently lacking from the Roman Empire. So far, the distribution of these fixtures is restricted to the area

<sup>36</sup> Catalogue numbers M1176-7 (Matešić, 2011) or 411-2 (Raddatz, 1987).

<sup>37</sup> National Museum Copenhagen, inventory numbers 24224-5.

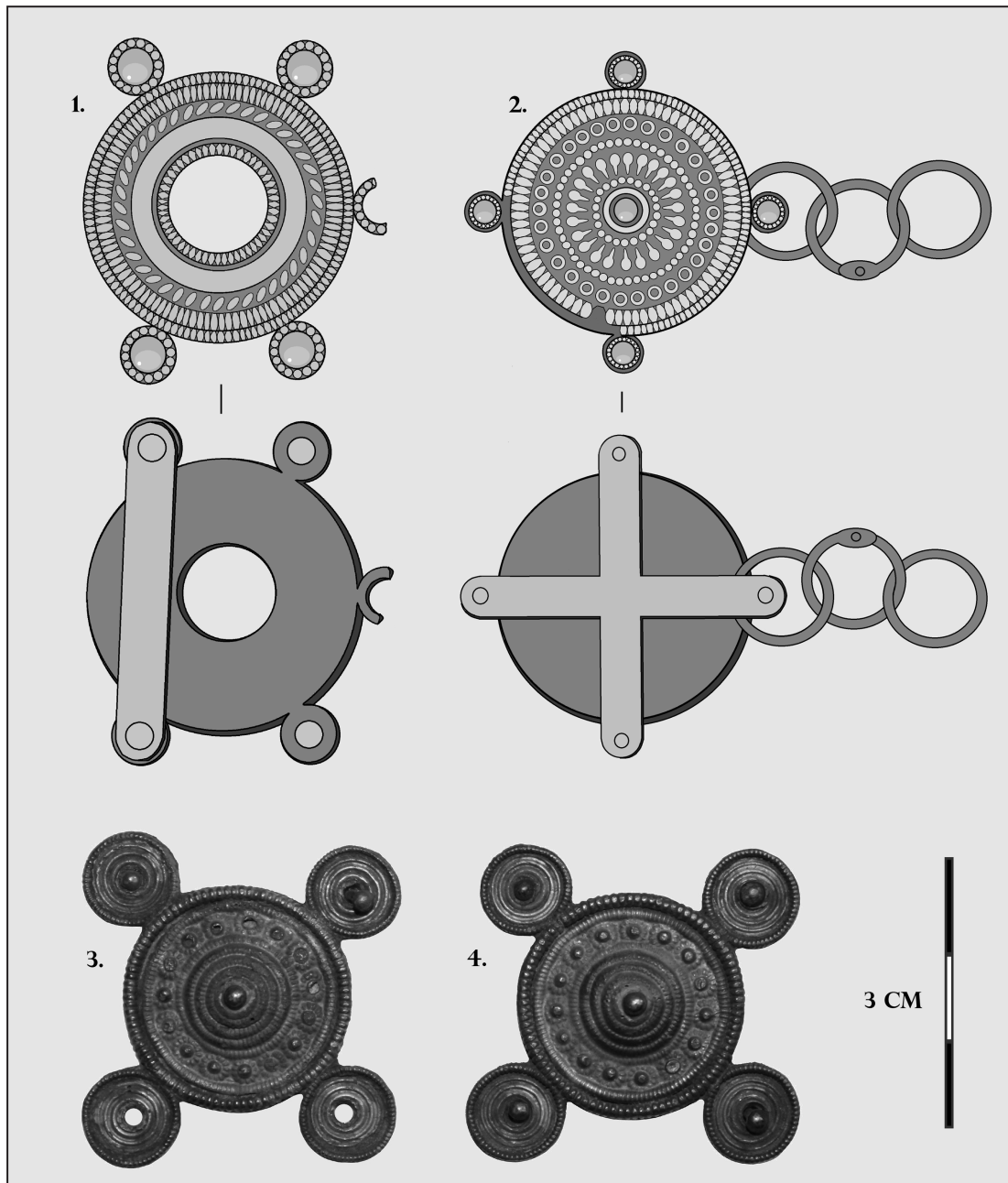


Figure 19. Fixtures from Thorsberg (1-2) and Vimose (3-4) (drawing and photograph M.A. Wijnhoven).

of Northern Germany and Denmark. It appears, then, to be a local phenomenon that persisted from at least the start of the 2<sup>nd</sup> century up to the middle of the 3<sup>rd</sup> century AD. This may seem at odds with the earlier statement that the constructional design of the Vimose coat points to a Roman provenance. But, like many artefacts from Northern Germany and Denmark, the Vimose mail must be understood as a blend of two traditions. Interestingly, all sites discussed in this paper rendered artefacts of both Germanic and Roman origin, reaffirming the dialogue

between two traditions. Part of this dialogue includes imitation and modification of Roman artefacts in Northern Europe; processes which recently received more scholarly attention (Pauli Jensen, 2013)<sup>38</sup>. The mix of elements in the Vimose coat points to a local Germanic manufacture, but whose construction was inspired by the Roman tunic. The local origin of the Vimose coat is supported by the typical shape of the riveted rings, especially the exceedingly long overlap, large diameter, and gauge of the riveted rings, which bear no resemblance to Roman examples of mail<sup>39</sup>.

The age of the Vimose coat was earlier designated between the 2<sup>nd</sup> and the 5<sup>th</sup> century AD. The neck opening fixtures now allow it to be narrowed down to the 2<sup>nd</sup> - early 3<sup>rd</sup> century (B2-C1b) and, given the similarity with the Brokaer fixtures, a date of the 2<sup>nd</sup> half of the 2<sup>nd</sup> century may be suspected.

## 8. CONCLUSIONS

The Vimose coat gives us an exceptional glimpse into the construction of a mail garment of a much earlier period than usual. Evidently, this is just but a glance, from a single artefact. Variation —not only through time and space, but also between contemporary groups— must have existed. Despite these reservations, the Vimose coat greatly enriches our knowledge of mail armour.

It has demonstrated that mail armour was in fact also manufactured locally. Finds of mail throughout the Barbaricum can therefore no longer be solely explained as of Roman origin. The local production of mail was however not isolated from outside influences and the Vimose coat should be understood as a blend of traditions. Moreover, the coat has also allowed the exact function to be identified of a group of mail related fixtures, previously thought impossible to determine.

Perhaps the most remarkable observation is that, while the Vimose coat and its medieval counterparts may look similar, their construction is very different. The construction of the Vimose coat was not planned to maximize the weight to protection ratio. Instead, it seems to have been modelled after a non-military textile garment, the tunic. This does not mean that weight and protection issues were not important. In fact, we can observe certain adaptations towards this purpose in the Vimose shirt. For example, compared to the wide and voluminous nature of the cross-shaped tunic, the mail shirt was kept slim. Also, the large slit for the neck became adjustable with the aid of small metal fixtures and leather straps. Lastly, the sleeves were tapered by reducing the number of rows, thereby avoiding an excess of material on the upper arms.

The row reductions at the arms further demonstrate that at least one of the techniques to shape mail was already understood and applied at an early date. The absence in the Vimose piece of other shaping techniques could be explained as a later date of introduction, but could likewise be the result of its ‘cross-shaped tunic approach’ rather than unawareness. For now, the moment of emergence of these techniques remains unresolved, and probably stays so until new exceptionally preserved finds will come to light.

<sup>38</sup> For example, this was the subject of the 18<sup>th</sup> Roman Military Equipment Conference held at Copenhagen in 2013.

<sup>39</sup> Only a slag inclusion analysis of the iron rings would be able to conclusively determine the region of origin of the iron ore.

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## BIBLIOGRAPHY

- Bishop, M.C. & Coulston, J.C.N. (2006): *Roman Military Equipment: From the Punic Wars to the Fall of Rome* (2<sup>nd</sup> edition). Oxford, Oxbow Books.
- Burgess, E.M. (1953a): "The Mail-Maker's Technique", *The Antiquaries Journal* XXXIII: 48-55.
- Burgess, E.M. (1953b): "Further Research into the Construction of Mail Garments", *The Antiquaries Journal* XXXIII: 193-202.
- Burgess, E.M. (1957): "The Mail Shirt from Sinigaglia", *The Antiquaries Journal* XXXVII: 199-205.
- Burgess, E.M. (1958): "A Mail Shirt from the Hearst Collection", *The Antiquaries Journal* XXXVIII: 197-204.
- Burgess, E.M. (1960): "A Reply to Cyril Stanley Smith on Mail Making Methods", *Technology and Culture* 1 (2): 151-155.
- Burgess, E.M. & Robinson, H.R. (1956): "A 14<sup>th</sup> Century Mail Hood in the Scottish Museum, Edinburgh", *Journal of Arms and Armour* II: 59-63.
- Carnap-Bornheim, C. von (1997): "Neue Forschungen zu den beiden Zierscheiben aus dem Thorberger Moorfund". *Germania* 75 (1): 69-99.
- Carnap-Bornheim, C. von (2004): "Römische Militaria aus dem Thorsberger Moor: Fundzusammensetzung, Kontext, Interpretation". In M. Erdrich & C. von Carnap-Bornheim (eds.), *Corpus der römischen Funde im europäischen Barbaricum*, Deutschland 5, Bonn, Dr. Rudolf Habelt GmbH: 15-24.
- Checksfield, N., Edge, D. & Williams, A. (2012): "Examination and Assessment of the Wenceslaus Mail Hauberk", *Acta Militaria Mediaevalia* VIII: 229-242.
- Croom, A. (2010): *Roman Clothing and Fashion*. Stroud, Amberley Books.
- Engelhardt, C. (1863): *Thorsbjerg Mosefund*. Copenhagen, Thieles Bogtrykkert.
- Engelhardt, C. (1866): *Denmark in the Iron Age*. London, Williams and Norgate.
- Engelhardt, C. (1869): *Vimose Fundet*. Copenhagen, Thieles Bogtrykkert.
- Engström, J. (1992): "Skandinaviskt krigsväsen under mellersta järnåldern", *Meddelande från Armémuseum* 52:14-72.
- Frangioni, L. (1978): "Una cotta di maglia milanese a Firenze sulla fine del Trecento". In *Studi in memoria di Federigo Melis* Vol. II, Firenze, Giannini Editore: 479-495.
- Fuhrmann, I. (1942): "Zum Moorgewand von Reepsholt", *Prähistorische Zeitschrift* 32-33: 339-365.
- Granger-Taylor, H. (1982): "Weaving Clothes to Shape in the Ancient World: The Tunic and the Toga of the Arringatore", *Textile History* 13 (I): 3-25.
- Hald, M. (1946): "Ancient Textile Techniques in Egypt and Scandinavia: A Comparative Study", *Acta Archaeologica* 17: 49-98.
- Hald, M. (1980): *Ancient Danish Textiles from Bogs and Burials: A Comparative Study of Costume and Iron Age Textiles*. Copenhagen, National Museum of Denmark.
- Hansen, L. (2003): *Die Panzerung der Kelten: Eine Diachrone und Interkulturelle Untersuchung eisenzeitlicher Rüstungen*. Kiel, Hansadruck.
- James, S. (1990): *The Arms and Armour from Dura-Europos, Syria: Weaponry Recovered from the Roman Garrison Town and the Sassanid Siegeworks during the Excavations, 1922-37* Vol. I-II. PhD Thesis, University College London.
- James, S. (2004): *Excavations at Dura-Europos 1928-1937: Final Report VII: The Arms and Armour and other Military Equipment*. London, The British Museum Press.
- Jouttijarvi, A. (1995): "Technische Untersuchung der kaiserzeitliche Ringbrünne von Brokaer". *Acta Archaeologica* 66: 102-105.



- Jouttijärvi, A. (1996): "Early Iron - The Manufacture of Chain-Mail". In H. Lyngstrøm (ed.), *Netvaerk for Tidlig Jernteknologi*, Copenhagen, Tutein & Koch: 53-60.
- Laking, G.F. (1920): "Chain Mail and Interlined Textile Defences". In *A Record of European Armour and Arms through Seven Centuries* Vol. II, London, Bell and Sons Ltd: 167-189.
- Lau, N. (2010): "Zum Ritus der Opferung von Kriegsbeute in der jüngeren römischen Kaiserzeit: Spuren ritueller Zerstörungen an Pferdgeschirren aus dem Thorsberger Moorfund". In A.W. Busch & H.-J. Schalles (eds.), *Waffen in Aktion: Akten der 16. Internationalen Roman Military Equipment Conference*. Mainz am Rhein, Verlag Philipp von Zabern: 137-152.
- Lund Hansen, U. (2007): "Barbarians in the North: The Greatest Concentration of Roman Weaponry in Europe". In T. Grane (ed.), *Beyond the Roman Frontier: Roman Influences on the Northern Barbaricum*. Rome, Quasar: 105-130.
- Matešić, S. (2008): "Militaria im Thorsberger Moorfund: Zeugnisse römisch-germanischer Kontakte". In A. Abegg-Wigg & A. Rau (eds.), *Aktuelle Forschungen zu Kriegsbeuteopfern und Fürstengräbern im Barbaricum*. Neumünster, Wachholtz Verlag: 85-104.
- Matešić, S. (2011): *Die militärischen Ausrüstungen aus dem Thorsberger Moor: Vergleichende Untersuchung zur römischen und germanischen Bewaffnung während der jüngeren römischen Kaiserzeit* Vol. I-II, Unpublished PhD Thesis, University of Cologne.
- Möller-Wiering, S. (2011): *War and Worship: Textiles from 3<sup>rd</sup> to 4<sup>th</sup>-Century AD Weapon Deposits in Denmark and Northern Germany*. Oxford, Oxbow Books.
- Moor, A. de, Berghé, I. vanden, Strydonck, M. van, Boudin, M. & Fluck, C. (2010): "Radiocarbon Dating and Dye Analysis of Roman Linen Tunics and Dalmatics with Purple Coloured Design", *Archaeological Textiles Newsletter* 51: 34-47.
- Nockert, M. (1991): *The Högom Find and Other Migration Period Textiles and Costumes in Scandinavia*. Umeå, University of Umeå.
- Pauli Jensen, X. (2003): "The Vimose Find". In L. Jørgensen, B. Storgaard & L. Gebauer Thomson (eds.), *The Spoils of Victory: The North in the Shadow of the Roman Empire*, Gylling, Narayana Press: 224-238.
- Pauli Jensen, X. (2007): "Preliminary Remarks on Roman Military Equipment from the War Booty Sacrifice of Vimose, Denmark". In T. Grane (ed.), *Beyond the Roman Frontier: Roman Influences on the Northern Barbaricum*. Rome, Quasar: 131-136.
- Pauli Jensen, X. (2008): *Våpen fra Vimose: Bearbejdning og tolkning af et gammelkendt fund*. Unpublished PhD Thesis.
- Pauli Jensen, X. (2009): "From Fertility Rituals to Weapon Sacrifices: The Case of the South Scandinavian Bog Finds". In U. Freeden, H. Friesinger & E. Wamers (eds.), *Glaube, Kult und Herrschaft: Phänomene des Religiösen im 1. Jahrtausend n. Chr. in Mittel- und Nordeuropa: Akten des 59. Internationalen Sachsensymposiums und der Grundprobleme der frühgeschichtlichen Entwicklung im Mitteldonauraum*, Bonn, Dr. Rudolf Habelt GmbH: 53-64.
- Pauli Jensen, X. (2011): "Friend or Foe: Alliances and Power Structures in Southern Scandinavia during the Roman Iron Age", *Lund Archaeological Review* 2011: 35-47.
- Pauli Jensen, X. (2013): "Imitation and Transformation - Roman Militaria in South Scandinavian Grave Finds". In M. Sanader, A. Rendić-Miočević, D. Tončini & I. Radman-Livaja (eds.), *XVII Roman Military Equipment Conference Zagreb 2010*, Zagreb, Arheološki muzej u Zagrebu: 177-183.
- Pausch, M. (2003): *Die römische Tunika: Ein Beitrag zur Peregrinisierung der antiken Kleidung*. Augsburg, Wißner-Verlag.
- Potratz, H. (1942): *Das Moorgewand von Reepsholt, Kr. Wittmund (Ostfriesland)*. Hildesheim, August Lax.
- Pritchard, F. (2006): *Clothing Culture: Dress in Egypt in the First Millennium AD; Clothing from Egypt in the Collection of the Whitworth Art Gallery*. Manchester, Whitworth Art Gallery.
- Przybyła, M.J. (2010): "Bemerkungen zu einigen lokalen Formen der Schwertgürtelschließen von sog. Balteus-Typ aus dem Barbaricum", *Recherches Archéologiques: Nouvelle Série* 2: 93-184.
- Raddatz, K. (1959-1961): "Ringknaufschwerter aus germanischen Kriegergräbern", *Offa* 17-18: 26-55.
- Raddatz, K. (1987): *Der Thorsberger Moorfund: Katalog: Teile von Waffen und Pferdegeschirr, sonstige Fundstücke aus Metall und Glas, Ton- und Holzgefäße, Steingeräte*. Neumünster, Karl Wachholtz Verlag.

- Rasmussen, B.M. (1995): "Brokaer: Ein Reichtumszentrum der römischen Kaiserzeit in Südwestjütland", *Acta Archaeologica* 66: 39-101.
- Reid, W. & Burgess, E.M. (1960): "A Habergeon of Westwale". *The Antiquaries Journal* XL: 46-57.
- Robinson, H.R. (1975): *The Armour of Imperial Rome*. London, Arms and Armour Press.
- Scalini, M. (1996): "The 'Textile' Protections and Various Other Items in the Armoury". In *The Armoury of the Castle of Churburg*. Udine, Magnus Edizioni SpA: 190-197.
- Schlabow, K. (1976): *Textilfunde der Eisenzeit in Norddeutschland*. Neumünster, Karl Wachholtz Verlag.
- Schmid, E.D. (2003). "Details from Articles of Mail in the Wallace Collection", *The Journal of the Mail Research Society* 1 (1): 2-20.
- Schmidt-Colinet, A. (2000): "Einleitung". In A. Schmidt-Colinet (ed.), *Die Textilien aus Palmyra*, Mainz am Rhein, Verlag Philipp von Zabern: 1-7.
- Stauffer, A. (2000): "Material und Technik", In A. Schmidt-Colinet (ed.), *Die Textilien aus Palmyra: Neue und Alte Funde*, Mainz am Rhein, Verlag Philipp von Zabern: 8-40.
- Sumner, G. (2009): *Roman Military Dress*. Gloucestershire, The History Press.
- Trapp, O. (1995 [1929]): "Mail and Brigandine". In *The Armoury of the Castle of Churburg*, J.G. Mann (transl.), Udine, Magnus Edizioni SpA: 3-14.
- Vedeler, M. & Jørgensen, L.B. (2013): "Out of the Norwegian Glaciers: Lendbreen - A Tunic from the Early First Millennium AD", *Antiquity* 87 (337): 788-801.
- Verheeken-Lammens, C. (2010): "Piecing Together a Roman Linen Tunic", *Archaeological Textiles Newsletter* 51: 31-33.
- Voß, H.-U. (1998): *Corpus der römischen Funde im europäischen Barbaricum*, Deutschland 3, Bonn, Dr. Rudolf Habelt GmbH.
- Voß, H.-U. (2000): "Das Fürstengrab 9/1995 von Hagenow in Mecklenburg-Vorpommern". In L. Wamser (ed.), *Die Römer zwischen Alpen und Nordmeer: Zivilisatorisches Erbe einer europäischen Militärmacht*, Mainz, Philipp von Zabern: 197-200.
- Voß, H.-U. (2007): "From the Baltic to the Danube: Early Roman Iron Age Warriors from Hagenow, Mecklenburg, and Their Relations with Barbarian and Roman Worlds", *Archaeologia Baltica* 8: 58-68.
- Voß, H.-U. (2008): "Zwischen Vannius-Reich und Vimose: Die elitären Krieger von Hagenow". In A. Abegg-Wigg & A. Rau (eds.), *Aktuelle Forschungen zu Kriegsbeuteopfern und Fürstengräbern im Barbaricum*, Neumünster, Wachholtz Verlag: 253-277.
- Waurick, G. (1982): "Die römische Kettenrüstung von Weiler-la-Tour", *Hémecht* 34: 111-130.
- Wijnhoven, M.A. (2009): "The Ouddorp Lorica: A Study of Roman Lorica Hamata Squamataque", *The Journal of the Mail Research Society* 2 (1): 30-65.
- Wild, J.P. (1970): "Button-and-Loop Fasteners in the Roman Provinces", *Britannia* 1: 137-155.

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