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Royal Armouries Museum, Leeds, UK

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Contents

Chairman's introduction – Guy Wilson

Conference Programme

Articles

- Arms and armour of knights and Landsknechts in the collection of the Legermuseum, Delft, The Netherlands
Jan Piet Puype 9
- *War and warfare in Scandinavia 1563-1613 from a Danish point of view*
Ole Louis Frantzen 38
- *The 'Pumhart von Steyr' gun*
M Christian Ortner 47
- *Tudor naval gunnery: Range trials using replica ordnance*
Nicholas Hall 59
- *Gunfounding in England in the 1590s*
Ruth Rhynas Brown 65
- *The Taylor Collection of South Indian arms in the Fitzwilliam Museum*
Thom Richardson 71
- *A present for the Pope: Maintaining the armour of the Swiss Guard*
Wolfgang Muchitsch 92
- *The 'Russian' Benningh guns and their carriages*
Mathieu Willemsen 115
- *New research on the great pavise in the collection of the Royal Military Museum in Brussels*
Piet De Gryse and Christina Currie 120
- *Representations of executioners in Northern France and the Low Countries in the late Middle Ages*
Ilse Bogaerts 149
- *The Model 1921 Thompson Sub Machine gun in The Irish War of Independence (1919–21)*
Labhras Joye 166
- *Defence in depth: The Welsh castles of Edward I*
Robert C Woosnam-Savage 176

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New research on the great pavise in the collection of the Royal Military Museum in Brussels

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Introduction

The Arms and Armour collection at the Royal Military Museum in Brussels comprises some 25 different shields.(1) This is admittedly quite a modest number but through the different types present, the collection nevertheless gives an interesting overview of the shields most commonly used between the 14th and the 17th centuries. The Museum for instance possesses three good examples of late 15th century infantry shields, known as pavises. Two of them are characterised by their prominent central ridge and their striking figurative painted decoration. They vary between 100 and 120 cm in height, which is usual for this type of shield.(2) These particular pavises were designed to be propped up in groups in order to form a wall of shields, thus protecting the archers or crossbowmen. The shields would in this way provide the necessary protection against distance weapons whilst the soldiers knelt behind them in order to span the bows. Men-at-arms normally wore the pavises on their backs, but special soldiers - the pavisiers - men whose sole job it was to carry the shields, sometimes also performed this task.(3) When firearms started to replace bows, the pavise became less useful. They nevertheless continued to be used by foot soldiers up to the end of the 15th century.

The inventory of the Brussels collection also lists some standard round, embossed and engraved steel shields. They can mostly be dated back to the middle and late 16th century.(4) None of them are of particularly high quality, nor did armourers of great renown produce them in famous workshops nor did armourers of great renown make them. Their importance is mainly documentary. On the other hand, the collection includes a small square metal targe with a raised sword-breaking bar dating back to the second quarter of the 16th century (inv. 10192/ III-7). It is a typical example of the small targes used for sword-play, as depicted in Achille Marozzo's fencing book *Opera Nova*. Other similar targes are to be found at the Wallace collection,(5) the Hermitage in St Petersburg and the Czartoriski Collection in Krakow. Important also and quite rare are two round

wooden Venetian shields, covered in leather, painted with gilded decoration and both dating from the end of the 15th century.(6) Another noteworthy Italian shield is a small wooden targe, painted and gilded, representing Christ holding a small banner, probably from the middle of the 16th century.(7)

We will now focus on what undoubtedly can be regarded as an exceptional shield. The storm shield or storm pavise, as we will call this large shield, is unusual not only due to its dimensions, but also because of its rarity. It was examined and investigated by a multidisciplinary team from the Royal Institute of Cultural Heritage in Brussels.(8) This article will concentrate mostly on the results of the technical analysis executed in specialised laboratories.

An exceptional pavise

The pavise forming the focus of this study first attracts attention because of its exceptional dimensions (figs 1 & 2).



Figure 1 Front of the storm pavise, Royal Military Museum, Brussels, inv. 20011. © KIK-IRPA



*Figure 2 Back view of the storm pavise, Royal Military Museum, Brussels, inv. 20011.
© KIK-IRPA*

Compared to the 'traditional' infantry pavises used for protection while kneeling and usually 120 cm in height, this pavise offers protection of another magnitude. We are dealing here with a large body shield, rectangular in shape, but with rounded corners and a sharp convex curvature. The measurements are the following (fig. 3): a height of 179.5 cm without spikes and 188.5 cm with the spikes, a top width of 113 cm and 74 cm at the bottom; the pavise is about 3.5 cm thick.

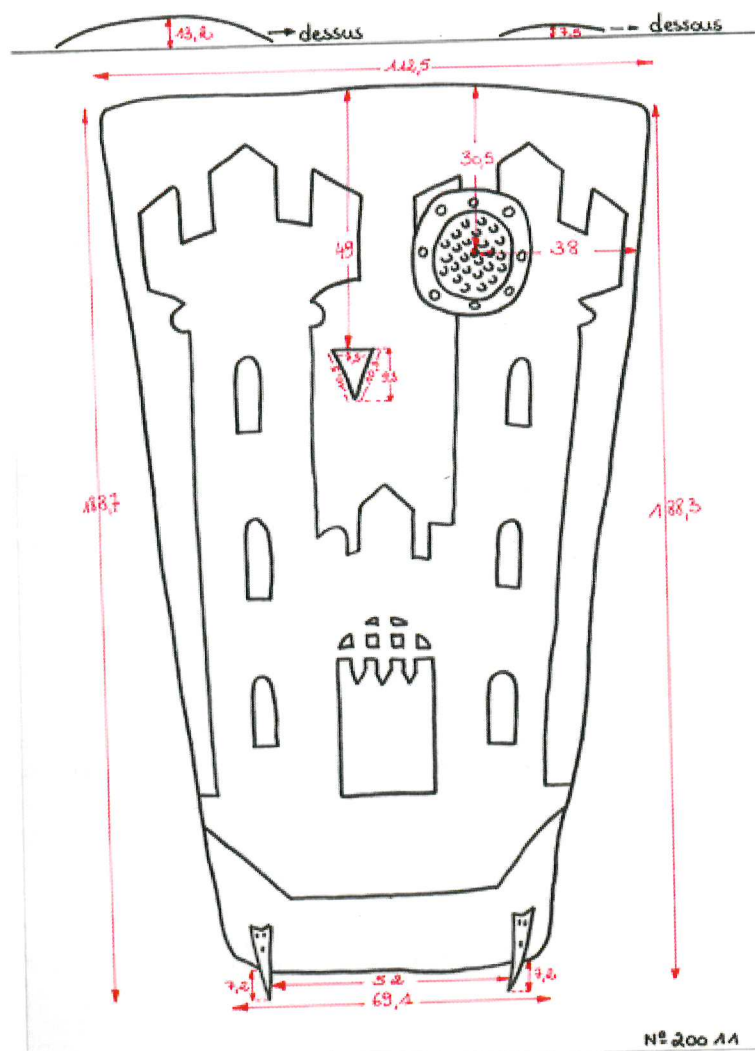


Figure 3 Detailed drawing of the Brussels storm pavise (by S. Meunier). © KLM-MRA

The dimensions clearly indicate that this is not a traditional infantry shield to be worn on the back or carried by hand, but rather that it was used most probably in groups during assaults for upright protection against arrows, bolts, stones and the like. In German, this kind of shield is called *Sturmwand*, thus referring to the use during assaults, or *Setzschild* when recalling the way in which it was propped up in front of the lines in order to protect soldiers.(9) In both cases it is clear that the same type of big shield is referred to. Here, it will be referred to as a 'great pavise' or 'storm pavise'.(10) That the shield was used for upright protection is made clear by two features: a circular grille on the left of the shield (seen from behind the shield) and a triangular opening somewhat downwards and slightly more to the middle. This opening was more than likely used for resting a crossbow or primitive handgun in order to shoot or fire. The grille is 24cm in diameter, comprises 28 small and irregularly placed holes and is held into place on the outside by means of eight forged-iron rivets. The centre of the grille is

situated some 30 cm from the top, that is to say about 158 cm from the ground up (when the pavise is propped upright). The triangular opening, the tip of which curiously points downwards, is situated at 135 cm above the ground and measures 9.5 by 7.5 cm (h x w). The pavise rests on two forged-iron spikes: each is held in place by forged-iron nails on both front (3) and back (2). These spikes were meant to secure the shield into the ground. In order to keep it upright the shield was also to be propped up by an iron bar on the rear face. This bar is missing, but the rear face has, to the left of the triangular hole, a metal eyelet. However, it is not clear whether or not this eyelet is original.

The great pavise was bought in 1854, when the important Peucker collection was put up for auction (fig. 4).

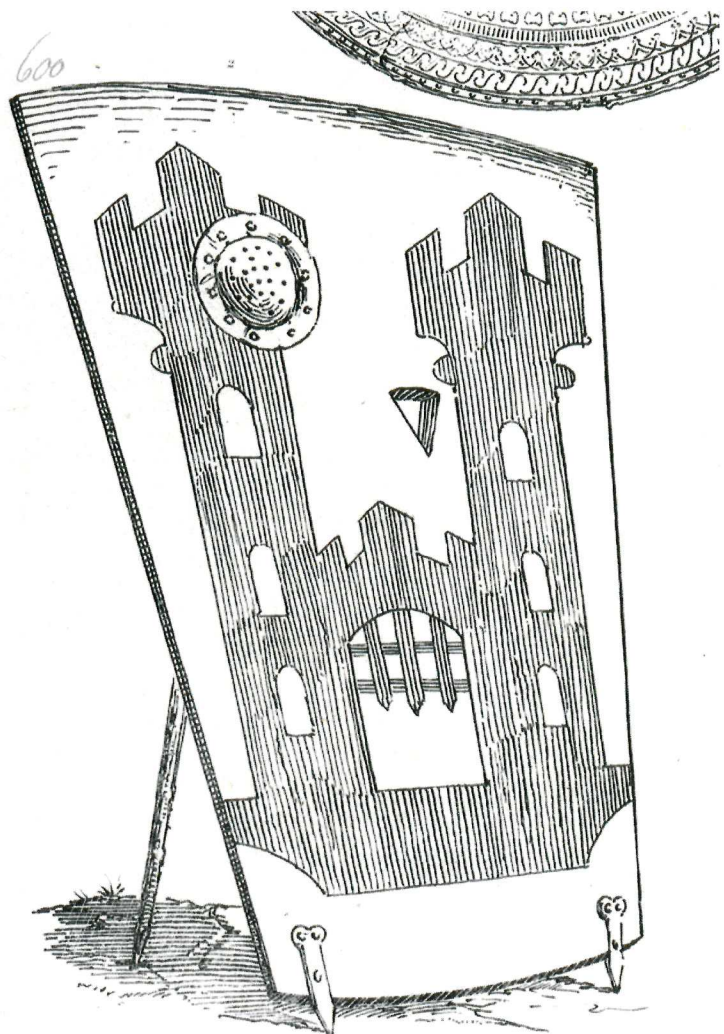


Figure 4 Picture of the storm pavise as it appeared in the catalogue of the Peucker/Leroy auction in Brussels in 1854. Note that the grille is placed on the wrong side of the shield and that iron bar to support the shield was also an invention of the illustrator of the catalogue.

The sale is also known as the Leroy auction, named for the auctioneer leading the public sale in Brussels on August 28, 1854. The storm pavise (number 122 in the sale) was bought for 600 franks, quite a remarkable sum of money. The 'Peucker/Leroy' auction offered a total of 55 shields (lot numbers 114 through 169). Some of them are now to be found at the Wallace Collection (London), the Germanisches National Museum (Nürnberg) and the Philadelphia Museum of Art (the former von Kienbush collection in Philadelphia, USA). The Museum not only bought the storm pavise, but also acquired a number of other objects.

Analysis of and research into the storm pavise

The aim of the study was to ascertain how the pavise was constructed and which materials were used. It was hoped to establish an approximate dating, to determine the origin of the leather covering and to investigate the paint and ground layer structure in order to deduce the probable original appearance of the painted design. For this purpose a multidisciplinary team under the leadership of Dr Christina Currie was set up at the KIK-IRPA.

Results of X-ray examination and naked eye observations

The pavise is made of multiple thin layers of wood with a thin outer layer of horizontal oak planks about 0.8 cm thick (figs 5a & 5b).

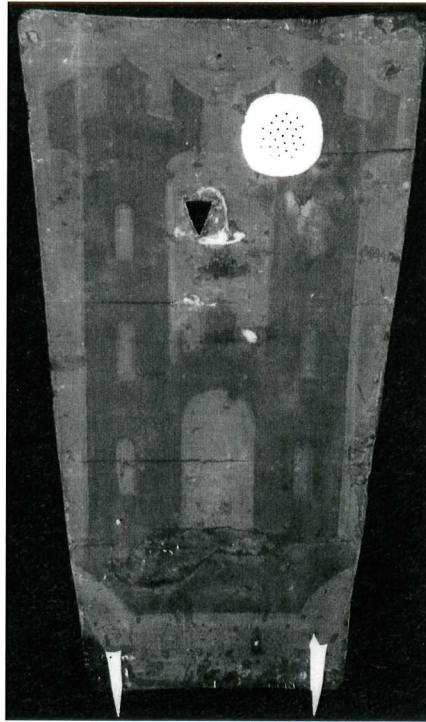


Figure 5a X-ray of the front showing the vertical joints as fuzzy white lines (left and right of the sharp x-ray band; for detail see ill. 12a). © KIK-IRPA

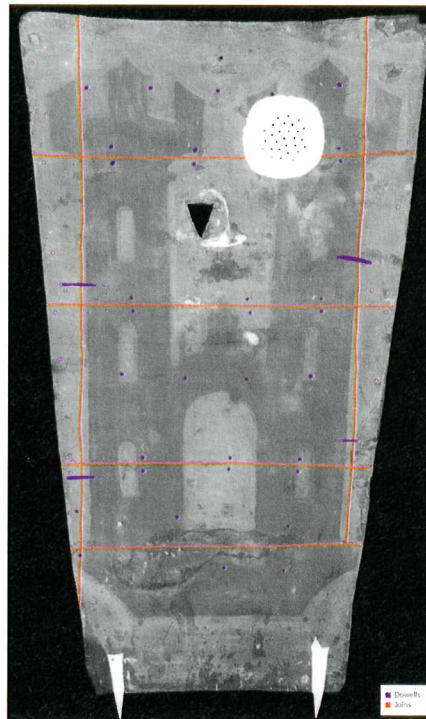


Figure 5b X-ray of the front showing joints and dowels. © KIK-IRPA

These are placed on an inner layer of vertical boards of lighter resinous wood with a thickness of approximately 2.8 cm. The laminate structure of thin planks on the outer side and thick boards on the inner side is clearly visible in a close-up picture of the triangular hole in the middle of the pavise (fig. 6).



Figure 6 Triangular hole showing the laminate structure of the shield with thin planks for the outer side and thick planks on the inner side. © C. Currie

Four slightly curved horizontal planks were counted, for which the X-ray clearly shows the wood structure of widely spaced rings. There are no horizontal boards at the very bottom as no tree rings are visible here.

There are at least three - and most likely more - vertical planks in resinous wood. The X-ray clearly shows two joins. They appear as more or less straight white vertical lines, visible to the left and right of the castle design. The X-ray also reveals long, sweeping, vertical-diagonal wood grain marks, which could indicate the use of a plane to smooth down the boards prior to lamination. (13)

The wood of the horizontal planks is both denser and darker than the one used for the vertical boards. The wood is oak and most probably local oak, the quicker growth of which leads to wide planks with wide annual rings, unlike the high-quality oak from the Baltic, which is narrower and has closely-spaced rings. (14)

The laminate structure of oak and resinous planks appears to be held together by sets of perpendicular pegs or dowels, perceptible from the front in raking light and in the X-ray. They are placed at right angles to the joins of both the horizontal and vertical planks. (15) There are three pairs of dowels per join for the three upper horizontal joins. None are visible in the lowermost part but as there does not seem to be a horizontal plank in this area, this would be logical. Some single dowels can be spotted at the centres of the horizontal boards (fig. 5b).

The wooden support is in relatively good condition considering the age of the

pavise. In most places the laminate structure is solid. However, there has been some delamination along the edges near certain horizontal joins and in one of the upper corners, the latter repaired through the insertion of a number of small iron nails.

The metal grille is in good condition but the forged iron spike to the left at the bottom is loose owing to the loss of a nail from the front and one from the reverse (see fig. 6).

The leather covering

A thick skin layer covers both back and front of the pavise. It is not entirely certain that the skin has been completely tanned to become leather. It appears that the skin was wrapped around the edges on the front side first, followed by the pieces of skin/leather on the reverse. The covering on the back is made up of two principal pieces of leather, joined somewhere beneath the grille. At the bottom right on the front a small loss in the covering reveals the wood of the underlying vertical planks. It can be clearly seen that the wood was intentionally scored in a diagonal direction, in all likelihood to improve adhesion of the skin (fig. 7).

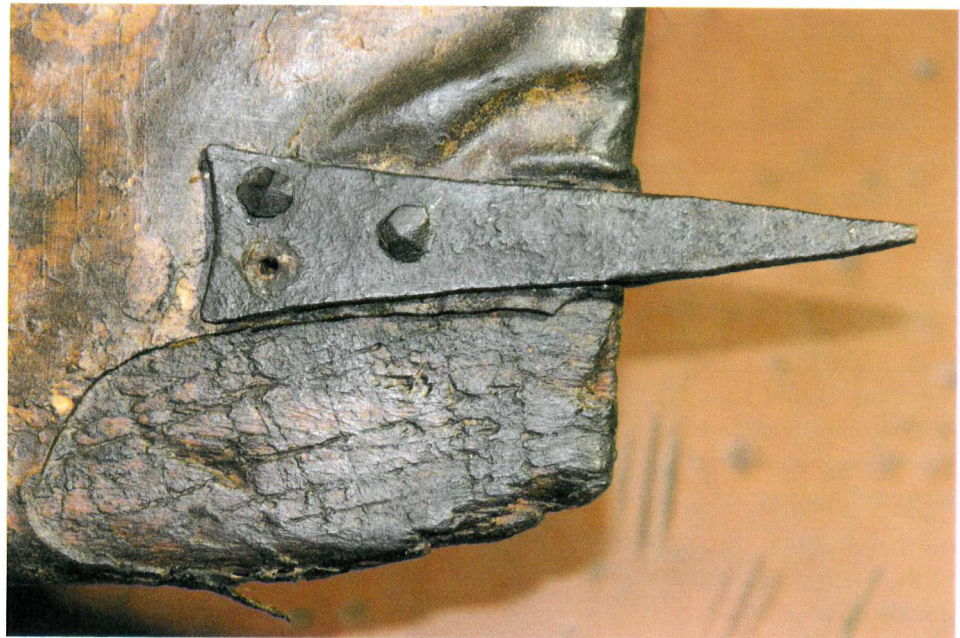


Figure 7 Lower left corner of the pavise showing the scoring of the wood. © C. Currie

Other examples show that often the skin was applied directly on to the wooden frame, even when the skin was still warm. When drying, the skin slightly shrunk and tightened. This process resulted in a supplementary reinforcement of the shield, with the tight skin hardening the surface. This made for an increased resistance against arrow and bolt impacts.(16)

Some minor and major repairs to the covering both on the inner and outer faces of the shield have been carried out. Two larger repairs catch the eye, one near the

bottom on the outer side where the old leather is missing and a new piece of thick leather has been added, the other along the left side, straddling the 3rd and 4th horizontal planks from the top. X-rays also reveal that some important repairs were carried out around the triangular opening in the middle of the shield. (figs 8a & b)



Figure 8a A detail of the large repair of the leather covering at the lower centre (outer side). © C. Currie



Figure 8b X-ray of the same area. © KIK-IRPA

Some newer ruptures in the leather around the horizontal joins are visible. These are attributable to the slight opening up of the horizontal joins between the planks and the forces exerted by the laminate structure. These relatively new ruptures indicate that this problem is most probably still ongoing.

Various projectile impacts are visible over the whole outer surface. This is not unusual for this type of shield.(17) Most of the impacts date back to the time of use. They vary in size and shape and can be interpreted as impacts from crossbow bolts. Most of them are either cross-shaped or v-shaped, the shape of most war-bolt heads. They not only damaged the leather, but also penetrated the first layer of planks often causing paint loss and the formation of a typical crack pattern around the point of impact, sometimes even resulting in the wood splitting (figs 9a, 9b, 10 & 11).



Figure 9a Cross-shaped impact damage to upper left of the grille. © C. Currie



Figure 9b X-ray from an impact, showing case of paint loss and circular crack pattern in the remaining paint around the impact. © KIK-IRPA



Figure 10 Cross-shaped impact damage in leather in the 3rd plank from top just above drawbridge. © C. Currie



Figure 11 Unrepaired impact damage from a pointed object. © C. Currie

The paint layers

The outer side of the pavise is decorated with a coat of arms. This was applied on a white ground layer mainly consisting of chalk (fig. 12).

Sample location	Cross section		Layer	Composition
	Visible light	UV		
C68.121: Lower window, left tower			9: Varnish 8: Beige 7: White 6: Dirt deposit/crack 5: Beige 4: Organic layer 3: White 2: White ground 1: Skin/leather	Brown earth, rich in calcium Lead white Organic Organic Lead white Chalk

Figure 12 Cross-section 1 © KIK-IRPA

The design shows a city gate with a portcullis between two relatively tall turrets crowned with battlements. The two battlemented turrets each have three window openings. The city gate is painted black and is placed against a light background. See for more details the cross section in fig. 12. The inner side of the shield presents a stained or tinted dark reddish colour. The current black paint of the fortress is not original and although the design of the coat of arms is original, it was simplified during repainting, removing some of its detail and its three-dimensional effects (figs 13a & b).



Figure 13a X-ray. Window showing a lead white paint spilling over the reserves for the fort. © KIK-IRPA



Figure 13b The same window having lost its three dimensional effects. © C. Currie

A cross-section from the dark gate reveals that the coat of arms (the city gate) was originally blue (fig. 14).



Sample location	Cross section		Layer	Composition
	Visible light	UV		
C68.122: Merlon, right tower			6: Varnish 5: Blue 4: Blue-greenish with red grains 3: Ground 2: Red 1: Leather/skin	The layers on top of varnish layer 6 (on the right side of the image) are considered as later interventions Azurite, barium sulphate Azurite, (green) quartz/earth, iron oxide Chalk (multiple layers) Iron oxide

Figure 14 Cross-section 2 © KIK-IRPA

Two blue layers can be observed directly above the ground layer in the cross-section. Both layers mainly consist of azurite, a copper based pigment. (18)

The coat of arms was previously identified as that of the city of Prague, but this was rectified in the 1960s when the coat of arms was correctly attributed to the city of Ravensburg in Württemberg (Germany). (19) The fact that the original paint of the gate was found to be blue reinforces and confirms this identification, as blue heraldically speaking, is the correct colour for the Ravensburg coat of arms.

The X-ray also shows that the light background was painted first, leaving room for the coat of arms. Cross-sections from the background show that the background paint mainly consists of lead white (figs 12 & 14). This background layer can also be detected in the turret window spaces. The coat of arms was painted in a layer that hardly shows up on the X-ray, leaving reserves for the shadow of the windows. The X-ray reveals that the window openings were rendered in a more detailed and three-dimensional manner than is apparent today. No reserves were left for the portcullis, perhaps because this would have been too complicated and too detailed to realise. The turrets were relatively recently repainted a uniform black, thus covering up a 19th-century inventory mark (figs 15a & 15b).



Figure 15a Old inventory number only visible in X-ray, upper left. © KIK-IRPA



Figure 15b Location of the old inventory number now concealed by the black repaint of the fort. © C. Currie

In the X-ray this marks reads 1¹ and it clearly refers to the numbering of the 1864 catalogue, which for the first time presented the pavise as an object belonging to

the Brussels Arms and Armour collection.(20) The catalogue entry J 1 reads: 'Grand pavois de bois d'environ cinq pieds de haut recouvert de peau et représentant la herse d'un château fort. C'est un spécimen remarquable des boucliers qui étaient destinés à garantir les archers ou les arbalétriers en rase campagne ou à l'attaque des forteresses; un vide et des créneaux permettaient à l'arbalétrier de placer son arme et d'ajuster.'

Overall, the paint layer is in stable condition and shows no signs of flaking. However, extensive, probable total, repainting of the coat of arms took place relatively recently. There are significant retouched losses to the paint along the bottom edge of the pavise. Losses elsewhere are due to impact damage and usage.

The leather on both sides appears to have been consolidated and protected with wax and/or varnish coatings.

Dendrochronology and radiocarbon dating

Dendrochronology was initially considered but decided against in view of practical and conservation considerations.(21) The wood is almost entirely covered in leather, which could not be safely removed. Moreover, the resinous wood on the top and bottom presents a rough and uneven surface that would require significant smoothing down in order to expose a suitable surface area for tree ring analysis.

In order to carry out radiocarbon dating, a sample was taken from the bottom rim of the shield through a gap in the leather covering. The analysis gave the results as laid out in the diagram, with 94.5% probable dating within the period 1290-1410 (see fig. 16).(22)

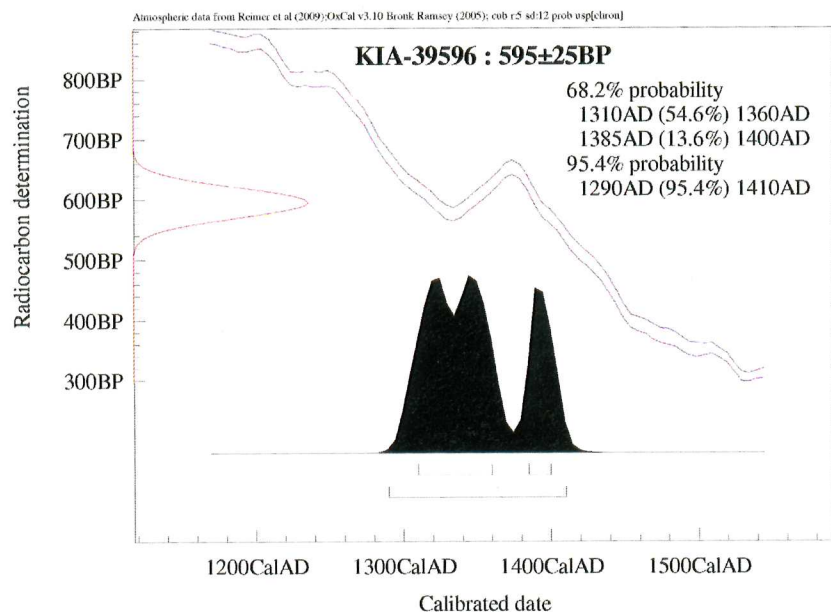


Figure 16 Diagram of the radiocarbon determination. © KIK-IRPA

The sample therefore most probably dates from the 14th century. However, this dating serves only as a starting point for the dating of the pavise itself. Since the edge of the plank was mostly concealed by the skin covering, the position of the sample relative to the tree ring sequence – nearer to the heart or the bark – could not be assessed. Since each ring represents a year of age, this means an unknown number of years have to be added to the radiocarbon results on the sample. Another variable related to this is the age of the tree at felling. The pavise itself could therefore date considerably after the ^{14}C date of the sample.

Protein analysis of the leather covering²³

In the framework of a currently conducted PhD thesis on protein analysis of collagen in animal skins four micro samples were taken from the edges of the leather. The surface of all samples showed a thick and sticky brown mass, which could not be identified. Subsequently and in as far as this proved possible, the leather was separated from both this sticky mass and the various paint layers using a stereoscope. Complete separation could not be attained. Consequently, it is necessary to take into account possible interference on the analysis results.

The analysis showed large quantities of collagen, with an identical protein composition for the four samples. When compared to special reference databases, bovine collagen prominently appears. All samples showed some kind of keratin naturally present in skin, especially in the epidermis and in hair. Although the report does not state this clearly, this could possibly point to the use of non-tanned skin, which in turn coincides with the aforementioned custom of directly stretching the skin over the shield.⁽²⁴⁾ As we initially believed that the leather possibly came from pigs, supplementary analyses were conducted in order to confirm or infirm this theory. Tests revealed that the use of pigskin was less probable, but not completely impossible. The provisional conclusion of this research, which is still experimental, clearly points in the direction of bovine leather, although the presence of closely related leather variants (amongst which pigskin) cannot be completely excluded.

Storm pavises in other collections

Human-sized great pavises are quite exceptional relics and only a few collections contain them.

The Art and History Museum in Geneva possesses a man-sized shield, described as a '*grand pavois d'arbalétrier*' or a '*pavois de siège*'. The shield measures 192 cm by 89 and weighs in at 26 kg. It is dated about 1415 (fig. 17).

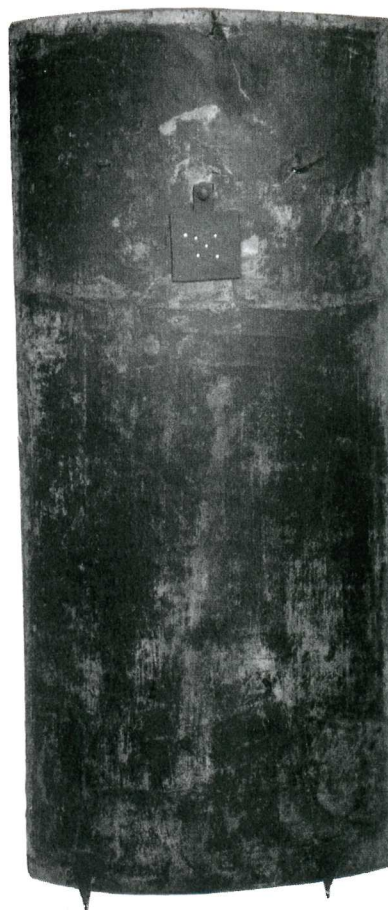


Figure 17 Storm pavise. Musée d'art et d'histoire, Genève, inv. n° 247. © Musée d'art et d'histoire, Genève.

It is made of pine or spruce and, as described above, covered in stretched animal skin. The outer side is decorated. Just as for the Brussels pavise, it rests on two iron spikes and also has, at a height of 135 cm, a view-finder. This is not entirely circular, but rather square and covered by a tiny metal plate with small holes. The inner side of the storm pavise still presents the grip used for carrying the shield around.(25) The Geneva storm shield very much resembles the series of ten large storm shields at the Historical Museum in Bern and definitely belongs to this typological group.(26) Bern undoubtedly possesses the largest ensemble of standing shields and both the dimensions and the appearance of the Bern shields recall those of the Geneva shield. Their heights vary between 192 and 197 cm, and their widths range from 88 to 97 cm. The pieces weigh between 24.7 and 29.2 kg, with an average of 27.6 kg. All are made of pine or spruce and all are covered in leather. Nine out of the ten storm shields are not decorated. Only one is painted black.(27) Both the ten Bern pavises and the Geneva pavise present a square view-finder, covered by a metal plate with round holes.

These storm pavises also rest on two forged-iron spikes and have one or two grips on the inside. The leather used could be pigskin.(28) Wegeli's dating is quite

vague: 14th–15th century. But he refers to an early inventory of the former *Zeughaus* in Bern in which twelve “grosse Belagerungsschilde aus dem 14. Jahrhundert” are listed(!). We are therefore once again in the presence of 14th-century shields, just as might be the case of the Brussels example.(29)

The Germanisches National Museum in Nürnberg also possesses a storm pavise (fig. 18).



Figure 18 Storm pavise, Germanisches Nationalmuseum Nürnberg, inv. W 970. © Germanisches Nationalmuseum Nürnberg

It is on display at the *Kaiserburg*(30). This storm pavise also indubitably belongs to

the Bern group. Although the shield is somewhat smaller (162 cm) it closely resembles the Bern and Geneva examples. The pavise is covered in leather, which still clearly shows the remnants of paint. Arrow or bolt impacts are easily visible as well. It also has a square viewing aperture, but the metal grille that would have covered the hole is lost. The iron spikes at the bottom, used to secure the pavise into the ground, are missing, but this loss, coupled to the reduced dimension, could indicate that the lower part of the pavise was cut down over the course of time. (31)

The Schweizerisches Landesmuseum in Zürich also has a storm pavise made of pine and covered in what is supposed to be pigskin (inv. KZ 382, fig. 19).



Figure 19 Storm pavise, Schweizerisches Landesmuseum, Zürich, inv. KZ 382. © Schweizerisches Landesmuseum, Zürich

The front presents the painting on linen of a two-headed eagle. To the left and right, underneath the eagle, there is the Zürich coat of arms. The shield lacks a viewing aperture, as is the case in the Bern group, but it does have a triangular opening (although the triangle points upwards) just as in the Brussels pavise. The shield measures 195.5 by 82.5 cm, originates from the Zürich city arsenal and dates back to about 1430.(32)

Another Sturmwannd is to be found in the collection of the Basel Historical Museum.(33) Erfurt (Germany) city hall also used to have various large shields, but these are now scattered over several collections. The majority of these big pavises which are dated 14th century are currently at the Anger-Museum in Erfurt,(34) but there is also one at the Historisches Museum in Dresden, two more are at the Metropolitan Museum of Art in New York (35) and two others are at the Deutsches Historisches Museum in Berlin (figs 20 & 21).(36)



Figure 20 Storm pavise with the armouries of the city of Erfurt, dated between 1286 and 1348, Deutsches Historisches Museum, Berlin, inv. 5342 © DHM, Berlin

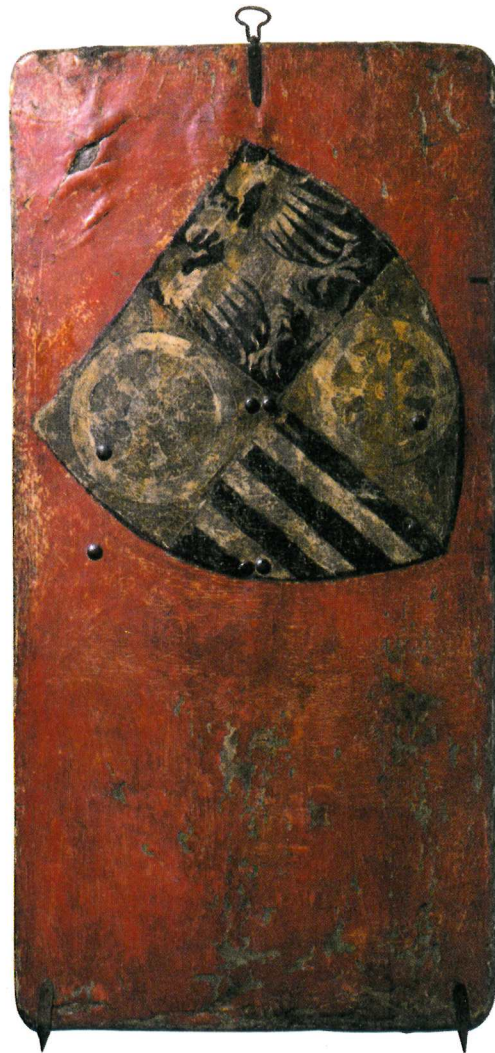


Figure 21 Storm pavise with the arms of the city of Erfurt, dated between 1348 and 1385, Deutsches Historisches Museum, Berlin, inv. 5343 © DHM, Berlin

Large pavises are also found in the collection of the Bayerisches Kunstmuseum (Munich).

Conclusion

The detailed study of the Brussels Military Museum storm pavise, conducted by an interdisciplinary team of the Royal Institute for Cultural Heritage uncovered remarkable new findings. The X-rays reveal that the man-sized shield is composed of horizontal oak boards, which are fixed onto resinous wood (probably pine or spruce) by means of wooden dowels. Contrary to what is generally believed, protein analysis suggests the shield is probably not covered in pigskin, but rather

in bovine leather. This leather cover was probably applied to the wooden support while the skin was still relatively fresh and warm. The leather would then have dried and shrunk, which made for additional sturdiness, thus strengthening the pavise. The black appearance of the city gate with portcullis and turrets proved to be a recent modification; paint layer analysis shows that the motif was originally blue, which concords with the heraldic colour of the Ravensburg coat of arms. Finally, radiocarbon analysis of a sample of the pavise gives a 94.5% probable dating within the period 1290–1410. This provides a starting point for the dating of the pavise itself to which an unknown number of missing tree rings must be added. Nevertheless this examination confirms the general idea that these kinds of shields can be situated between the beginning of the 14th and the middle of the 15th century. When compared to other existing examples where chronology is based on secondary arguments, a dating from the second part of the 14th century can be put forward for the Brussels storm shield.

Notes

1. E. De Prelle de la Nieppe, *Catalogue des armes et armures du musée de la Porte de Hal. Précédé d'une notice historique et archéologique sur la Porte de Hal par J. Van Malderghem*, Brussels, 1902, p. 136-138. In series III of the inventory 13 shields are listed (not including the 'oriental' ones) but since publication new acquisitions have completed the collection.

2. Respectively inv. 20012 (III-2), 11215 (III-3), 10190 (III-4). The most complete work on the subject is V. Denkstein, *Pavises of the Bohemian type, contribution to the history of the Hussite military tradition, its dissemination and influence in the 15th century*, in: *Acta Musei Nationalis Pragae*, 16 (1962), no. 4-5, pp.185-225 (English text starting at p. 207); 18 (1964), no. 3-4, pp. 107-194 (in English from p. 148); 19 (1965), no. 1-4, p. 117-202. For a summarised introduction, see also: V. Denkstein, *The Bohemian Pavise in Turin Armeria Reale Collections*, in: *Armi Antiche*, 1966, p. 37-49. Most of the arms and armour collections worldwide possess pavises but the biggest and the most important collection is to be found at the Vienna City museum. Almost the entire collection was put into storage some years ago and only a handful of pavises are on display in the new galleries. Fortunately the collection was inventoried and almost completely published. See: *Das Wiener Bürgerliche Zeughaus. Rüstungen und Waffen aus 5 Jahrhunderten. Sonderausstellung des Historischen Museums der Stadt Wien*, 14 Mai bis 30 Oktober 1977, Schloss Schallaberg bei Melk, 1977, catalogue numbers 131-195. See also: *Wehrhafte Stadt. Das Wiener Bürgerliche Zeughaus im 15. und 16. Jahrhundert. Sonderausstellung* 15 Mai bis 21 September 1986, Historisches Museum der Stadt Wien, 1986, numbers 1/33 till 1/100; all entries are illustrated.

3. V. Denkstein, *art. cit.*, part II p. 149-156: It is generally accepted that the term 'pavise' is derived from the Italian town of Pavia, where shields of this type were probably first made. 'Pavise' in that case means 'shield coming from Pavia'.

4. E. De Prelle de la Nieppe 1902, *op. cit.*, nos III-10 to 13 (inv. 10195 to 10198) and completed by other specimens (nos 10199-10203); most are of minor quality.

5. J. Mann, *Wallace Collection Catalogues. European arms and armour*, London, 1962 and A.V.B. Norman, *Wallace collection catalogues. European arms and armour. Supplement*. London, 1986. no. A 318 with a picture in the addendum pl. 221, first inventoried as a 'buckler', in the addendum of 1986 changed into a 'square targe'.

⁶ Respectively nos. 10193 (III-8) and 10194 (III-9). For similar shields see: N. Di Carpegna, *Antiche armi dal sec. IX al XVIII già collezione Odescalchi. Special Exhibition in the Palazzo Venezia*, Rome, 1969, no. 179 (illustrated).

7. Inv. 10191 (III-5). The word targe comes from the Arabic 'darake' from which the Italian word "targa" is derived. Via the French 'targe' the word spread all over Europe. Originally it referred to a small triangular shield. W. Boenheim, *Handbuch der Waffenkunde. Das Waffenwesen in seiner historischen Entwicklung vom Beginn des Mittelalters bis zum Ende des 18 Jahrhunderts*, Leipzig 1890, p. 177. Normally a targe is smaller in dimensions than a pavise (and therefore it is sometimes referred to as a 'small pavise').

8. Abbreviated in the text as it is known in Belgium 'KIK-IRPA' standing for (the Dutch) Koninklijk Instituut voor het Kunstpatrimonium and (the French) Institut royal du Patrimoine artistique.

9. V. Schmidgen, *Kriegswesen im späten Mittelalter. Technik, Taktik, Theorie*, Weinheim, 1990, p. 149-150.

10. We avoid the word 'mantelet', which does not refer to a shield, but rather to a heavy wooden screen made of beams or assembled thick boards used for the protection of a group of besiegers. These 'mantelets' were often placed on two wheels in order to facilitate moving them about when the soldiers assaulted the fortification and pivoted in the middle. In the 15th century similar constructions were used to cover early guns so that they could be manipulated when out of sight and protected. See: J. Bradbury, *The Medieval siege*, Woodbridge: The Boydell Press, 1992, p. 274. as well as ill. on p. 72 showing miners working under the cover of a 'mantelet'. Although the author devotes an entire chapter to medieval siege weapons, the 'mantelets' and the pavises are only briefly mentioned. See also the French and English Wikipedia (www.fr.wikipedia.org/wiki/Mantelet and www.en.wikipedia.org/wiki/mantelet).

11. *Catalogue illustré d'armes anciennes européennes et orientales, ... ayant appartenu à une des plus riches et des plus belles collections de Berlin, ... sous la direction de M. Henri Le Roy*, Brussels, 1854. The catalogue indeed concerns the sale of general baron de Peucker's collection, an important German collector. See Cripps-Day, *A record of armour sales 1881-1924*, London, 1925, p. 200.

12. Colour photographs by Marleen Sterckx and Christina Currie, X-radiography by Catherine Fondaire, paint layer analysis by Steven Saverwyns, analysis of leather by protein analysis by Wim Fremout, radiocarbon dating by Mark Van Strydonck and Matthieu Boudin. The KIK-IRPA file number is 2009.10197.

13. Denkstein mentions a 16th-century source indicating that willow tree wood was often used for pavises, 'because of its stickiness and sinewy character'; V. Denkstein, *art. cit.* (part III), p. 141-142.

14. We would like to thank dr. Pascale Fraiture, dendrochronologist at IRPA, for this observation.
15. Compare this with what Denkstein wrote about the construction of Bohemian pavises (these are the smaller ones, up to 120 cm): Bohemian pavises are, as a rule, made of three wooden panels, countersunk into each other without the use of nails or iron clamps, and connected only by gluing and pegging: V. Denkstein, *art. cit.* (part II), p. 209.
16. A. Geibig, *Die Pavesen der Veste Coburg, Text of a conference held at a meeting of the Gesellschaft für Historische waffen und Kostümkunde, October 1998*. A word of thanks to dr. A. Geibig, curator at the Veste Coburg, for putting the text at my disposal. See also: C. Bosson, *Le grand pavois d'arbalétrier*, in: *Musée de Genève*, September 1960, n° 8, p. 13-15. Inv. nr. 247. A word of gratitude also to colleague J. Godoy for the information about this object. Traces of the impact of bolts, arrows and even slashes of swords are clearly visible on most surviving pavises. See also *infra*.
17. Several other examples could be mentioned. See amongst others V. Denkstein *op. cit.* but also the catalogue about the Vienna pavise collection (see footnote 2).
18. Unpublished report by Steven Saverwyns, 22 June 2009.
19. J. Mann, *op. cit.*, nr. A 307, in which he discusses a smaller pavise with an identical coat of arms (city tower with portcullis) that he identifies as the coat of arms of Prague. This pavise was also bought in Brussels in 1854. (Cripps-Day, *op. cit.*, p. 196). Thanks to the detailed study by Denkstein the attribution could be corrected and connected to the city of Ravensburg. V. Denkstein, *art. cit.*, p. 223, and A.V.B. Norman, *op. cit.*, p. 92. Similar pavises are to be found at the Deutsches Historisches Museum (Berlin) inv. W. 760 (see: www.dhm.de/datenbank), the Germanischen National Museum, Nürnberg (inv. W1279) and the Kretzschmar von Kienbush collection Philadelphia, USA (inv. 284). The Musée national du Moyen Age. Hôtel de Cluny in Paris appears to possess a similar pavise. A shield with the same design and dated ca. 1490 was recently put up for sale by Peter Finer, item ref. 909, see www.peterfiner.com.
20. Cfr. *supra*. T. Juste, *Catalogue des collections composant le Musée royal d'Antiquités, d'armures et d'artillerie (Bruxelles) procédé d'une notice historique*, Brussels, 1864, p. 16.
21. Pascale Fraiture, dendrochronologist at IRPA-KIK kindly examined the pavise for its potential regarding dendrochronology.
22. Unpublished report by Mark Van Strydonck 7 August 2009. The sample was prepared and the result analyzed at the KIK-IRPA (Van Strydonck M, van der Borg K. *The construction of a preparation line for AMS-targets at the Royal Institute for Cultural Heritage Brussels*, in: *Bulletin van het Koninklijk Instituut voor het Kunstpatrimonium* 23, 1990-91, pp. 228-234) and measurements were performed at the Leibniz-Labor für Altersbestimmung und Isotopenforschung (Nadeau M-J, Grootes P M, Schliecher M, Hasselberg P, Rieck A, Bitterling M, *Sample throughput and data quality at the Leibniz-Labor AMS facility*, in: *Radiocarbon*, 40, 1998, pp. 239-245).

23. Unpublished report by Wim Fremout, 26 August 2009.
24. Tanning largely removes all hairs. On the covering of the shield with animal skin, see *infra*.
25. C. Bosson, *art. cit.* p. 13-15. Inv. nr. 247.
26. R. Wegeli, *Inventar der Waffensammlung des Bernischen historischen Museums in Bern. I. Schützwaffen*, Bern, 1920, p. 14-18 (nos. 26 tot en met 35) and the introduction to the catalogue (p. 4-6), with a word of gratitude to colleague P. Pouilly (Musée militaire vaudois. Le Château de Morges). The Bern collection actually comprises 35 pavises, of which 10 are large "Setzschilden".
27. R. Wegeli, *op. cit.*, nr. 26 (= inv. 268a). The Bern collection also has three medium pavises (ranging from 145 to 152 cm in height), which are painted in red and black, just like the Bern coat of arms. See R. Wegeli, *op. cit.* nos. 6, 7 and 13.
28. Further research is necessary. Just as in the Brussels case, the size of the shields means that that bovine leather should also be considered as a possibility.
29. Mentioned in R. Wegeli, *op. cit.* p. 18 (footnote 1). In his introduction Wegeli refers also to a city account of 1387 in which a craftsman is paid for the making of a 'setzeschild'. R. Wegeli, *op. cit.*, p. 4 (footnote).
30. J. Willers, *Germanisches National Museum, Nürnberg. Kaiserburg-Museum. Führer durch die Schausammlung*, Nürnberg, 2001. Inv. W 970. I would like to thank dr. J. Willers for showing me around in the National Germanisches Museum and the Kaisersburg in June 2007.
31. The fact that pavises were shortened over time need not surprise us. An important part of the Vienna infantry pavise collections underwent the same treatment.
32. H. Schneider, *Aus dem Schweizerischen landesmuseum. I. Schützwaffen aus sieben Jahrhunderten*, Bern, 1968. See also: http://webcollection.nationalmuseum.ch/de/sammlungen/militaria_waffen/. Described in the inventory as: "Sturmwand. Setzschild für Armbrustschützen".
33. W. Scheewind, *Historisches Museum Basel. Die Waffensammlung. Eine Wegleitung*, Basel, 1958, p. 21.
34. B. Dean, *Ancient shields from Erfurt*, in *The Bulletin of the Metropolitan Museum of Art*, vol. 18, r. 1 (1923), p. 11-13, with an old drawing of the council chamber of the city hall of Erfurt showing the shields still hanging on the walls. Several of these can be dated from the details of their heraldry to a period as early as 1385-87.
35. Confirmed in a mail by curator D. J. Larocca (12 September 2007). Inventory numbers are 22.164.1 and 22.144.
36. See the collection data-base on the DHM website: www.dhm.de/datenbank: <<http://www.dhm.de/datenbank>> W 5342 (dim. 168 x 82 cm, 23 kg, dated between 1286 and 1348 and Inv. W 5343 (dim. 178.5 x 90 cm, 25 kg, dated between 1348 and 1385).