Genuine, Fake, Restored or Pastiche?

Two Renaissance Jewels in the Rijksmuseum Collection*

• SUZANNE VAN LEEUWEN, JOOSJE VAN BENNEKOM AND SARA CREANGE •

In 1978 more than a thousand designs by the German goldsmith Reinhold Vasters (1827-1909) were discovered in the records of the Victoria and Albert Museum in London (fig. 1).[1] Although the drawings, among them designs for Renaissance-style jewellery, were acquired in 1919, little interest had been shown in them since.

All Vasters's property was sold on his death and his drawings came into the possession of the London art dealer Murray Marks, who in 1912 brought them to the attention of Edward Strange, a curator at the V&A. He was not interested: 'They are designs for goldsmiths' work, many pieces of which, I understand, have been placed on the market as old work. A few of the designs are genuine old 16th century Italian work; and it is curious to note how Vasters has developed the themes thus supplied to him into compositions of similar nature.'[2] It would subsequently appear, however, that the drawings were more important than Strange thought. Almost sixty years later, drawings in hand, experts were able to identify many jewels and other objects in various collections that bore a striking resemblance to Vasters's designs. In the years that followed, examination of the techniques and materials used in these pieces unmasked more than one Renaissance jewel as a product of the nineteenth century.[3]

Detail of fig. 2

The greater insight into Vasters's methods brought to light the fact that a number of leading goldsmiths produced Renaissance jewels on a large scale in the nineteenth century. The most important of them were

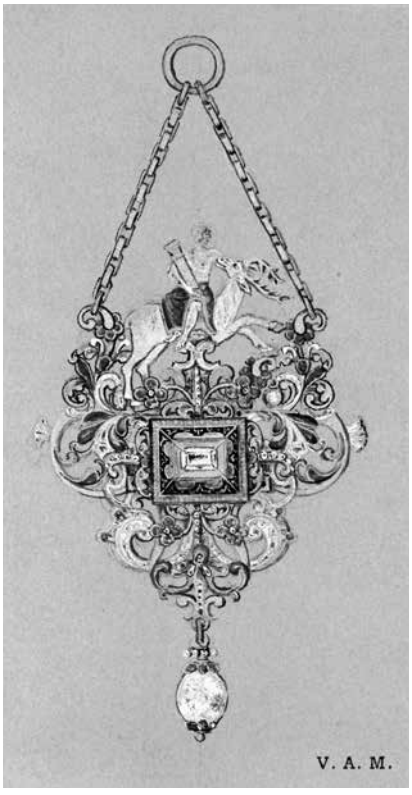


Fig. 1
REINHOLD VASTERS, *Design for a Pendant,* London, Victoria and Albert Museum, inv. no. E.2801-1919.

Fig. 2
Pendant of a Horseman on a Pedestal, Southern Germany?, part Renaissance and part nineteenth century. Gold, enamel, pearls, rubies, h. 13.5 cm. Amsterdam, Rijksmuseum, inv. no. BK-17049.

the Austrian Salomon Weininger (1822-1879) and the Frenchman Alfred André (1839-1919). Vasters, Weininger and André can all be linked to the Paris art dealer Frédérique Spitzer (1815-1890). As well as antique items, he also sold contemporary pieces made by famous goldsmiths. In this period a Neo-Renaissance jewel was not necessarily made and sold as a deliberate forgery. Although this is still a controversial issue, it does seem likely that Spitzer knowingly sold the contemporary items as Renaissance pieces.[4]

The rediscovery of Vasters's drawings prompted a new type of research into Renaissance jewels – a category of jewellery whose authenticity had never really been questioned until Vasters's designs came to light. An important

aid in these new investigations is the examination of materials and techniques using scientific methods that can help us establish the authenticity of objects much more objectively than in the past.

The Rijksmuseum's collection of Renaissance jewels has not yet been systematically subjected to this sort of research. It was, however, suspected that this collection may well also contain pieces of jewellery that do not date from the sixteenth and seventeenth centuries, but were made considerably later. These misgivings applied particularly to two pieces, *Pendant with a Horseman on a Pedestal* and *Pendant in the Shape of a Mermaid* (figs. 2, 3). By means of research into records and literature and through investigations of the materials and techniques, the authors have endeavoured to discover the true nature of these two jewels.[5]

Fig. 3
Pendant in the Shape of a Mermaid, Italy?, nineteenth century or later. Gold, enamel, pearls, rubies, emeralds, h. 12 cm. Amsterdam, Rijksmuseum, inv. no. BK-17062.

The Mannheimer Collection

One way of establishing the authenticity of an object is to research its provenance. How far back in time can we trace an object and how much can the provenance tell us about the period when it was made?

The two jewels, the horseman and the mermaid, come from the collection of the German banker Dr Fritz Mannheimer (1890-1939). When the collection entered the Rijksmuseum in 1952 the museum was instantly propelled into the top rank of European museums.[6] The Sculpture and Decorative Arts Departments, in particular, benefited from great quantities of silver, porcelain, furniture, textiles and objects in metal and precious metal. In 1920, after a successful career in international currency trading and stock dealing, Mannheimer was appointed director of the Amsterdam branch of Mendelssohn & Co. This renowned banking house in Berlin gave Mannheimer an unlimited credit facility, which he used for more than performing his duties as a banker. In 1921 he moved to the large house at number 20 Hobbemastraat that had been purchased by Mendelssohn & Co; it now houses the Rijksmuseum's offices (fig. 4). From then on, entirely at the bank's expense, Mannheimer amassed an enormous and very diverse art collection which he kept in this house. It was open to the public at set times, and in part because of the public nature of the collection, Mannheimer did not have to pay wealth tax on it. The extravagant furnishing of the house was not universally appreciated, however, and the locals soon nicknamed it 'Villa Protski'.[7]

In the nineteen-twenties and thirties Mannheimer's passion for collecting drove his debt to the bank ever higher, and in 1934 the other partners stepped in. The result was a complicated transaction in which the collection was sold to a company set up especially for the purpose – The Artistic & General Securities Company Limited – for something over 6.5 million guilders, the equivalent of 57.5 million euros today. The company then loaned the objects back to Mannheimer. In short, the collection was sold within a closed circle and remained in the

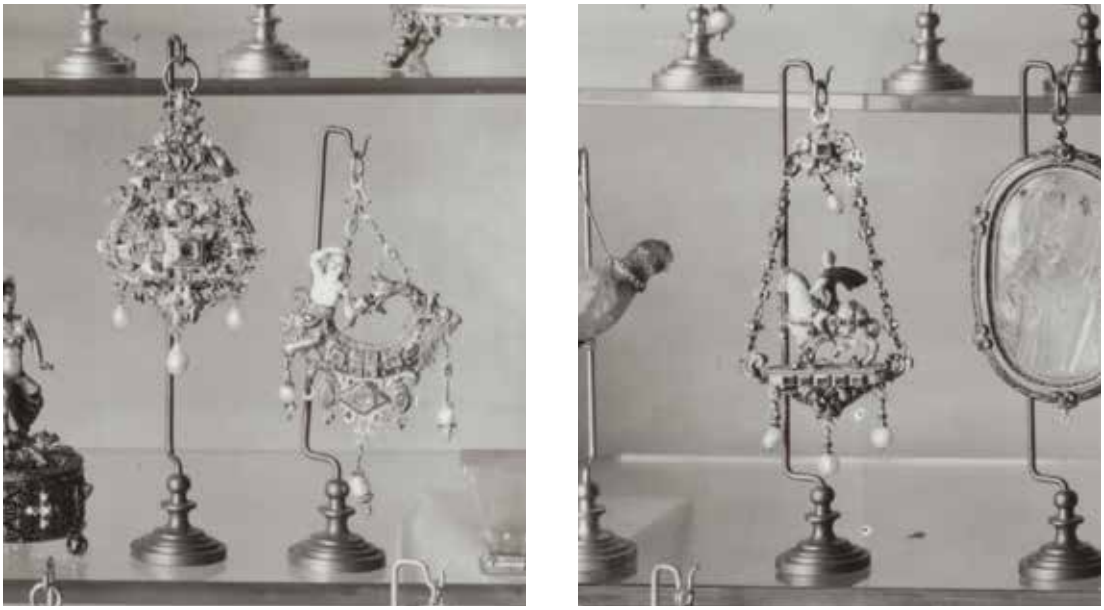
Fig. 4
HANNA ELKAN,
Mannheimer's House at number 20 Hobbemastraat ('Villa Protski'),
c. 1930.
Gelatin silver print,
119 x 116 mm.
Amsterdam,
Rijksmuseum, inv. no.
B-F-1963-426-1.

Fig. 5
Some of the Renaissance jewels on display in Mannheimer's house, before 1939. Haarlem, Noord-Hollands Archief, inv. no. NL-HlmNHA_476_2142_17_56.

Hobbemastraat house. Despite the bank's financial difficulties and the agreement that Mannheimer would stop buying art, the collection continued to grow steadily after 1934. On his death in 1939, Mannheimer was in debt to the bank to the tune of some 13 million guilders.[8]

After his death, a complete inventory of everything in the Hobbemastraat house was compiled on the instructions of Dr Frederik Schmidt Degener (1881-1941), the then director of the Rijksmuseum.[9] Room by room, the whole art collection was classified, described and valued.[10] This inventory, which can be consulted in the Noord-Hollands Archief (NHA) in Haarlem, contains a detailed description of every work of art in the house and a set of black-and-white photographs, some of which show the jewels in their original display case. In other photographs the pieces have been removed from the display and put into groups (figs. 5-7).

Fig. 6
A selection of the Renaissance jewels during the inventorying of Mannheimer's house, c. 1939. Amsterdam, Rijksmuseum, inv. no. HA-00247II.



Figs. 7a, b
Details of the selection of Renaissance jewels, showing the horseman and the mermaid (fig. 6).

When the German occupying forces entered Amsterdam in 1940, the collection in the Hobbemastraat soon attracted their attention. German art historians and advisers to both Adolf Hitler and Herman Goering were trying to build up prestigious collections for their principals as quickly as possible and were consequently on the lookout for larger collections that they could buy up lock, stock and barrel.[11] In 1941 the whole collection was acquired on Hitler's behalf through the *Dienststelle Mühlmann*. Part of the collection was destined for the museum of art that was planned for Linz in Austria and was to be Hitler's personal Louvre. The museum was never built, however, and the collection passed through several hands, including the monastery at Hohenfurth in the present-day Czech Republic, before ending up in the salt mines at Altaussee in Austria.[12] Towards the end of the war the Germans were so afraid that all the art they had looted would fall into the hands of the Allies that they placed crates of explosives in the mines so that everything could be destroyed if the worst came to the worst.[13]

At the end of the war, all the objects were recovered from Altaussee and taken to the Central Collection Point (CCP) in Munich. Every single object was inventoried by experts from all the plundered countries, and usually photographed as well (figs. 8, 9). It was the experts' job to establish the provenance of each piece and bring about its return.[14] Through the work of bodies concerned with the recuperation of Nazi-looted art – the Stichting Nederlands Kunstbezit, the Bureau Herstelbetalingen and Recuperatiegoederen and the Dienst voor 's Rijks Verspreide Kunstvoorwerpen – the Mannheimer Collection was returned to the Netherlands virtually intact at the beginning of 1946. In 1950 it was established that the collection could not be returned to its original owner, and in 1952 it was given to the Rijksmuseum on loan. The loan was transformed into a definitive transfer in 1960.[15]

The Provenance of the Jewels

Mannheimer used the bank's money to acquire Renaissance jewellery from very large and renowned collections

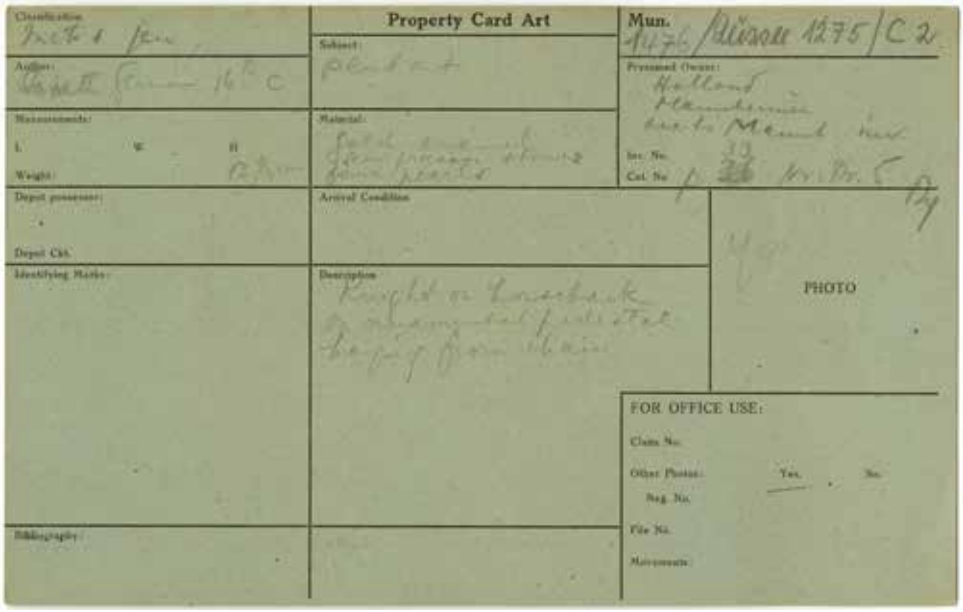

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Fig. 8
The front of the inventory note made at the Central Collecting Point in Munich, on which the pendant with the horseman is listed. Photo: Federal Office for Central Services and Unresolved Property Issues (BADV), Berlin.

through various auction houses and art dealers. The most important information about the provenance of the jewels is based on the unpublished catalogue that Mannheimer compiled between November 1935 and March 1936 in collaboration with the German art historian Otto von Falke.[16] Mannheimer proves to have purchased jewels from the collection of the Hermitage in St Petersburg, the Grünes Gewölbe in Dresden and the private collection of the Rothschild family, among others. Neither the horseman jewel nor the mermaid is linked to a particular collection in the catalogue. There is a good chance that Mannheimer bought these pieces in the art trade. Given Mannheimer's international contacts in both art and commerce, the search for the sellers has to extend beyond dealers in the Netherlands to include other European countries. Regrettably, it has so far proved impossible to trace these two jewels in older collections.

Hallmarks can also shed light on the provenance of objects. Unfortunately, no hallmarks have been found on the mermaid, but the marks on the

Fig. 9
Photograph taken at the Central Collecting Point in Munich showing the pendant with the horseman. Photo: Federal Office for Central Services and Unresolved Property Issues (BADV), Berlin.

Fig. 10
Two of the French re-assay marks in the shape of an owl (x 35) on the horseman pendant. Photograph taken with HIROX Digital Microscope KH7700.

horseman pendant make it clear that the piece has a French background. It bears seven gold assay marks, four of them struck in France (fig. 10). These are re-assay marks struck when the object entered the art trade, but sadly tell us nothing about the original maker, where the piece was made or the gold content. The four re-assay marks in the shape of an owl are found on each of the larger elements of the piece and were in use from 1893 onwards. The owl mark was used for various purposes: for watches, for jewellery from countries with which France did not have international contracts,[17] and for pieces that were legally sold in the art trade but had not been made in France.[18] In the case of the horseman pendant it is highly likely that the marks were struck so that the piece, originally unmarked, could be sold by a French art dealer.

As well as the French re-assay marks, there are three Dutch re-assay marks on the gold ring at the top of the chain. They are a *V* and two marks containing the figures 5 and 20 (fig. 11). The *V* mark was one of the state stamps or tax stamps for objects that had not been assayed for content. The mark is therefore no guarantee of content. This type of *V* was used on foreign pieces from 1 January 1906 to 1 September 1953. The marks containing the figures 5 and 20 are weight indications that were in use in the Netherlands from 1906 for gold and silver pieces with appendages, for example chains. These marks are a series of numbers running from 1 to 20. The numbers in the marks have to be multiplied by five to arrive at the gross weight in grams. More than one mark was struck on items that weighed more than a hundred grams, and in that case the sum of the figures had to be multiplied by five. In themselves these marks are no form of guarantee, this is only the case when they occur in combination with guarantee or tax marks. Until 1932 these marks indicated the gross weight of the object; from then on they gave the net weight of the precious metal.[19] The weight indication marks on the jewel correspond with the weight: the sum of the numbers five and twenty, multiplied by five, gives us the gross weight of the object – 125 grams.

On the basis of the seven assay marks we may safely say that the horseman pendant was traded in France in or after 1893 and ended up in a Dutch auction house or in the Dutch art trade at some time from 1906 onwards. This explains the absence of both French and Dutch guarantee marks on the jewel.[20] The Dutch marks tell us that the jewel must have been assayed before 1932, but this does not mean that Mannheimer must have bought the piece before then. Interesting as the information the marks provide may be, it does not, alas, answer the question as to the authenticity of the object.

Research into Manufacture, Materials and Technique

Fortunately, it is possible to augment the information about the provenance of the jewels with the findings of research into materials and techniques. This combination can often provide a conclusive answer to the question as to whether an object was made in a particular period. A Renaissance jewel is usually composed of gold,

Figs. 11a, b
Three Dutch re-assay marks on the horseman pendant: a V (right) and the figures 5 and 20 (left).

transparent and opaque enamel, precious stones and pearls. There are two famous contemporary sources about the techniques sixteenth-century goldsmiths used in working with these materials: *De la Pirotechnia* (1540), by the Italian metallurgist Vannoccio Biringuccio (1480-1539), and Benvenuto Cellini's *Trattato dell'Oreficeria* (1565).[21]

The first step was to create a good design. The goldsmith would then make a three-dimensional model in wax, plaster, wood or lead, and cast the individual elements of the jewel in gold in a two-piece sand mould. These would then be finished and enamelled. At the beginning of the sixteenth century enamel was a minor element of the decoration, but as the century progressed enamel became an increasingly essential feature of the jewel. The enamelling techniques most commonly used for Renaissance jewellery are *émaille cloisonné*, *ronde-bosse* and *champlevé*.[22] Once the enamel had been applied, the piece was assembled by soldering or mechanical links. In the last phase of the production process, the pearls were added and the precious stones set in pre-prepared mounts. Depending on the colour or the desired effect, the precious stones were set on plain or coloured metallic foil. This enabled the goldsmith to give the stone greater colour, depth and brilliance. The foil was placed in the base of the mount and the stone was then set and finished.[23]

Enamel

In recent years technical research into enamel has become an important factor in the question of the authenticity of Renaissance jewels. This research is based on the hypothesis that the composition of Renaissance enamels differs on a number of important points from nineteenth-century enamels.[24] Enamel is essentially glass in powder form coloured with various metal oxides. In the eighteenth and early nineteenth centuries a number of new opacifiers and metal oxide colours were introduced for the production of opaque and transparent enamel. It is consequently possible, with the aid of various analytical research methods, to distinguish between enamel from the Renaissance and nineteenth-century enamel (fig. 12).

The most striking differences are found in the presence of the elements arsenic, chromium and uranium, and in the quantity of lead. Arsenic, which is highly toxic, was used by women in the nineteenth century to make their skin whiter. Arsenic oxide (As_2O_3) was also used in this period to make white enamel opaque. Chromium was

Fig. 12
Composition of enamel during the Renaissance and in the nineteenth century, based on the information in various publications mentioned in this article.

COMPOSITION OF ENAMEL	RENAISSANCE		NINETEENTH CENTURY	
GENERAL COMPOSITION	Silicon dioxide (SiO_2)		Silicon dioxide (SiO_2)	
	Sodium oxide (Na_2O)	10-16%	Lead oxide (PbO)	20-30%
	Potassium oxide (K_2O)	2-3%	Calcium oxide (CaO)	< 2%
	Magnesium oxide (MgO)	< 1%	Magnesium oxide (MgO)	< 0.1%
	Aluminium oxide (Al_2O_3)	< 1%	Aluminium oxide (Al_2O_3)	< 0.3%
	Calcium oxide (CaO)	< 3%	Arsenic (Al_2O_3)	
	Lead oxide (PbO)	< 0.5%		
	Trace elements: phosphorus, sulphur, chlorine, barium, strontium			
TRANSPARENT GREEN	Colour: CuO	5-9%	Colour: CuO	
	Colour: FeO	4-7%	Colour: FeO	
	Trace elements: Sn, As, Zn and Ni		Colour: Cr_2O_3	0.5-1%
TRANSPARENT BLUE	Colour: CoO	0.5-1%	Colour: CoO	
	Colour: FeO	0.5-2%	Very little Ni, Fe and As	
	Colour: CuO	2-4%	No Bi	
	Trace elements: Ni, As and Bi			
TRANSPARENT RED	More K_2O than Na_2O		Colour: Sb	2-5%
	More CaO and MgO		Trace element: CuO	
	A little more Al_2O_3			
	Colour: CuO	< 1%		
	Trace elements Sn, Pb and Zn			
TRANSPARENT BLACK	Colour: MnO	4- > 10%		
	Colour: CoO			
	Colour: FeO			
	Trace elements: Ni, As and Bi			
TRANSPARENT YELLOW	Colour: FeO	> 12%	Colour: Uranium oxide (UO_3?)	
	Trace elements: Sn, As, Zn and Ni			
TRANSPARENT PURPLE	Colour: MnO		Colour MnO (lower percentage)	

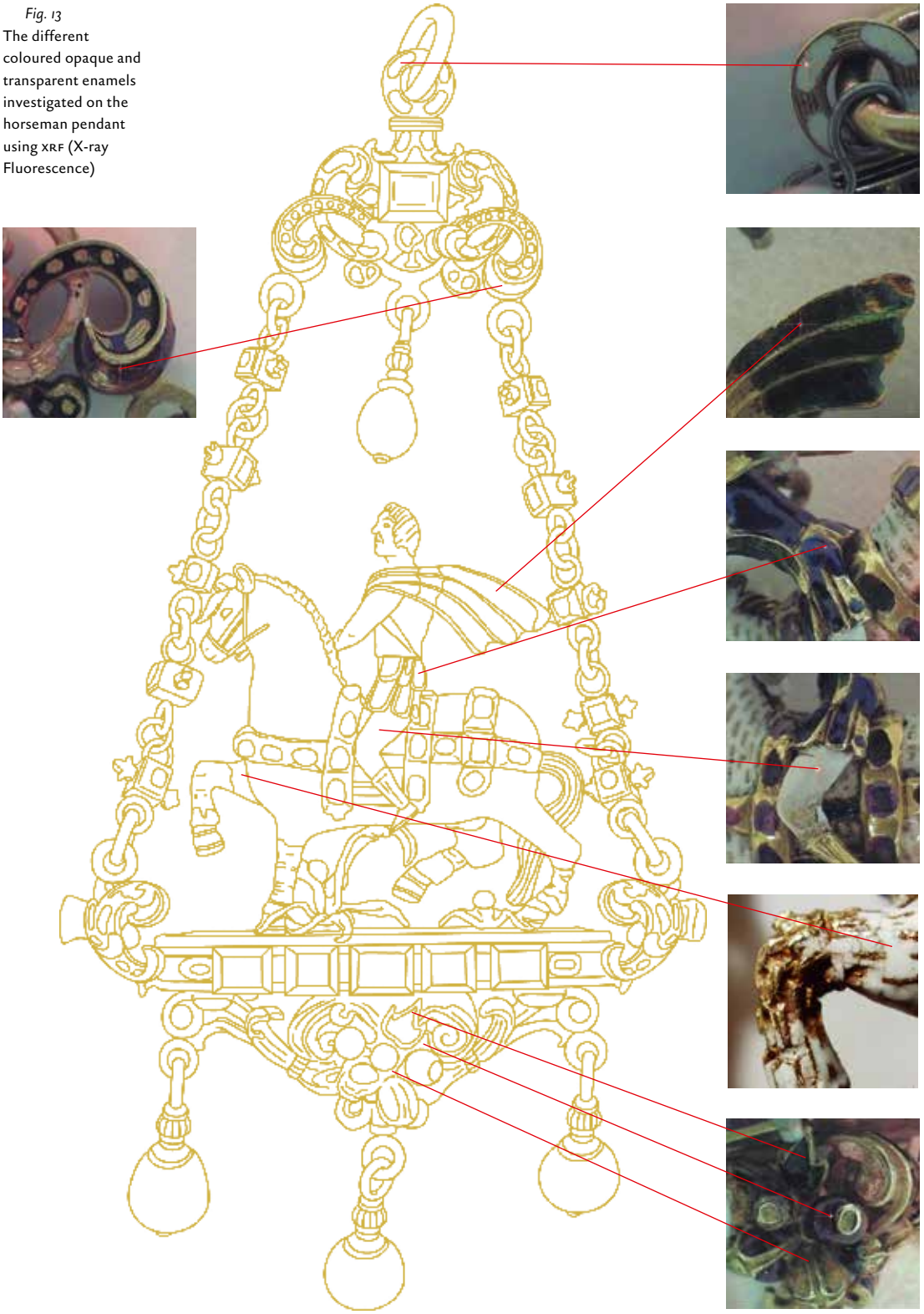
discovered at the end of the eighteenth century and increasingly used as a colorant in the first half of the nineteenth.[25] Although green enamel still contained copper oxide (CuO) and iron oxide (Fe2O3) as colouring agents in the nineteenth century, more and more chromium oxide (Cr2O3) was added to it. The metal oxide used to obtain yellow enamel also underwent a noticeable change in this period, with uranium oxide (UO3) increasingly replacing Fe2O3. The element uranium was discovered in 1789 and widely used as a colorant in glass, glazes and enamel between 1830 and 1940.[26]

COMPOSITION OF ENAMEL	RENAISSANCE	NINETEENTH CENTURY
OPAQUE WHITE	Opacifier: PbO 15-20% Opacifier: SnO_2 20- > 30% Low content MgO Low content CaO	Opacifier: PbO 20- > 50% Opacifier: As_2O_3 3-6%
OPAQUE BLUE	Opacifier: PbO 15-20% Opacifier: SnO_2 < 20% Low content MgO Low content CaO Colour: CuO 0.2-0.6% Colour: CoO 0.2-0.6%	Opacifier: PbO Opacifier: As_2O_3
OPAQUE GREEN	Opacifier: PbO 5- > 40% Opacifier: traces of Sb_2O_3 and SnO_2 Colour: CuO Low content MgO Low content CaO	Opacifier: PbO Opacifier: As_2O_3 Colour: Cr_2O_3 Colour: CuO Colour: FeO
OPAQUE YELLOW	Opacifier: PbO 40-50% Opacifier: traces of Sb_2O_3 and SnO_2 Low content MgO Low content CaO	Composition similar to Renaissance
OPAQUE TURQUOISE	Opacifier: SnO < 20% Colour: CuO 2-6% Colour: CoO (low %)	

Although a certain percentage of lead was always added to Renaissance enamel, the quantity of lead oxide (PbO) that was added in the nineteenth century was many times higher.[27] Both the horseman pendant and the mermaid are decorated with different coloured opaque and transparent enamels (fig. 13). Using X-ray fluorescence (XRF) it is possible to characterize the different elements that make up the enamel (see fig. 12 and 13).[28] Components that are inconsistent with Renaissance enamel recipes can be quickly identified.[29]

The investigation of the composition of the enamels on the two jewels produced a number of striking results. The presence of both Renaissance and nineteenth-century enamels was clearly established in several cases. In the horseman pendant it emerged that the only enamels that satisfy the criteria for the Renaissance are on the horseman himself and on his horse. The enamels on the chain and the pedestal are clearly nineteenth century in composition. For instance, a high concentration of uranium was found in the transparent yellow enamel on the underside of the pedestal. Unlike the white enamel on the horseman and the horse, the white enamel on the element

Fig. 13
The different coloured opaque and transparent enamels investigated on the horseman pendant using XRF (X-ray Fluorescence)



connecting the chains contains a considerable quantity of arsenic (fig. 14). Considering results of the enamel on the horseman pendant in conjunction with the condition of the piece and the way it was made, it seems highly probable that what we have here is a pastiche, in other words a composite jewel. A striking feature of the horseman pendant is that the enamel on the horseman and the horse is in poorer condition than the enamel on the other elements, a difference that could well be related to the age of the enamel. Several studies have revealed that Renaissance jewels were usually put together with mechanical means, unlike their nineteenth-century counterparts on which gold or other solder was much more widely used. Solder was used on every part of the jewel except for the horseman and the horse. The figurative element of

Fig. 14
The enamels investigated on the horseman using XRF (X-ray Fluorescence).

BK-17049 ENAMELS	FASTENING	HORSEMAN	HORSE	PEDESTAL
TRANSPARENT BLACK	—	—	—	—
TRANSPARENT GREEN	—	High % Cu and Fe	—	High % Pb and Cu
TRANSPARENT RED	High % Pb, possible traces of Sb, little to no Cu present	—	—	High % Pb, possible traces of Sb, little to no Cu present
TRANSPARENT YELLOW	—	—	—	High % Pb and U
TRANSPARENT BLUE	—	Comparable % Co, Fe, Cu. Bi also present	—	—
OPAQUE BLUE	—	—	—	—
OPAQUE WHITE	High % Pb and As	High % Pb and Sn	High % Pb and Sn	—
RESULT	Red enamel unclear, white enamel of 19th-century composition	Composition in accordance with Renaissance enamels	Composition in accordance with Renaissance enamels	Green and yellow enamel of 19th-century composition, red enamel unclear

BK-17062 ENAMELS	FASTENING	TORSO	LOWER BODY	TAIL FIN	MIRROR	OVAL ORNAMENT
TRANSPARENT GREEN	High % Pb and Cu, low % Fe and Cr	—	High % Pb and Cr	High % Pb and Cu, low % Cr	High % Pb and Cu, traces of Fe, Mn and Ti	High % Pb and Cu, low % Fe, Mn and Cr
TRANSPARENT RED	High % Pb, very low % Cu	—	—	—	High % Pb and Mn, low % Fe, traces of Cu and Sb	High % Pb, low % Zn and traces of Sb
TRANSPARENT BLUE	—	—	—	—	High % Pb, low % Cu, traces of Co, Fe and Mn	—
OPAQUE WHITE	High % Pb and As	High % Pb and As	—	—	—	High % Pb and As
RESULT	Red enamel unclear, green and white enamel of 19th-century composition	Enamel of 19th-century composition	Enamel of 19th-century composition	Enamel of 19th-century composition	Green enamel unclear, red and blue enamel of 19th-century composition	Enamel of 19th-century composition

Fig. 15
The enamels investigated on the mermaid using XRF (X-ray Fluorescence).

the horseman pendant therefore is more likely to date from the Renaissance, while the other parts appear to be later, nineteenth-century additions.

The enamels on the mermaid that were examined all proved to be nineteenth-century in composition (fig. 15). The relatively high concentration of lead in the enamels is striking; the lead concentration in the transparent enamels alone would be enough to justify the conclusion that this is nineteenth-century enamel, but other elements that were found also betray a nineteenth-century origin: there was chromium in all the transparent green enamels except for the mirror. The transparent red enamel is probably coloured with antimony (Sb) and this element was only used to colour enamel in that century. Two analyses of the opaque white enamel revealed a high level of lead and this, combined with the presence of arsenic, also points to a nineteenth-century origin.

Although the research into the material used in the enamel on the mermaid suggests it was made in the nineteenth century, it is more difficult to make a judgement about the age of the piece on the basis of the condition and manufacture of the jewel. The mermaid has virtually no wear, and this could indicate that she is relatively recent. However, all the parts have been joined mechanically; the use of gold or other solder is very limited. In Falke and Mannheimer's catalogue, this item is described as an eighteenth-century Sicilian piece. However, various studies have shown that jewels with marine figures were particularly popular in the nineteenth century. Many of the jewels unmasked in various collections feature mermaids and sea monsters. No mermaids of this kind were found among Vasters's drawings, but more research into this could be done into both Vasters's work and that of others, such as Alfred André.

Conclusion

There had long been doubts about the Renaissance credentials of the horse-

man pendant and the mermaid, and the technical research into the pieces proves that these doubts were not unfounded. The horseman pendant proves to be a composite of Renaissance and nineteenth-century parts, while the mermaid was made in its entirety in the nineteenth century or possibly even later.

This investigation has shown clearly just how important technical research into materials is for this category of objects. An interdisciplinary approach remains the goal, however. In the ideal case, when the results of technical research into materials can be combined with those of art historical and archive research, it would be possible to reconstruct the whole history of a jewel.

It is to be hoped that the research into these two jewels will serve as a springboard for research into the other Renaissance jewels in the Rijksmuseum collection. The first steps have been taken and it would seem that the collection has many more secrets to reveal. The Rijksmuseum could collaborate with other museum with ongoing research programmes, and thus contribute to international research into Renaissance jewels.

NOTES

* The research and restorations were made possible with the support of the Gieskes-Strijbis Fonds.

1 See among others M. Krautwurst, *Reinhold Vasters – ein niederrheinisher Goldschmied des 19. Jahrhunderts in der Tradition alter Meister. Sein Zeichnungskonvolut im Victoria & Albert Museum, London*, Trier 2003 (diss. Trier).

2 Quoted in C. Truman, 'Reinhold Vasters – the Last of the Goldsmiths?', *The Connoisseur* 201 (1979), p. 154.

3 See among others A. Somers Cocks et al. (ed.), *Princely Magnificence: Court Jewels of the Renaissance, 1500-1630*, exh. cat. London (Victoria and Albert Museum) 1980; A. Somers Cocks and C. Truman, *The Thyssen-Bornemisza Collection: Renaissance Jewels, Gold Boxes, and Objects de Vertu*, cat. Madrid (Museo Thyssen-Bornemisza) 1984; H. Tait, *Catalogue of the Waddesdon Bequest in the British Museum, Volume 1: The Jewels*, cat. London (British Museum) 1986; *Renaissance Jewelry in the Alsdorf Collection. Art Institute of Chicago Museum Studies* 25 (2000), no. 2; M. Weldon et al., 'Application of PIXE to the Study of Renaissance Style Enameled Gold Jewelry', *Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms* 109-10 (1996), pp. 653-57; T. Drayman-Weisser and M.T. Wypyski, 'Fabulous, Fantasy, or Fake?', *The Journal of the Walters Art Museum* 63 (2005), pp. 81-102.

4 See Y. Hackenbroch, 'Reinhold Vasters, Goldsmith', *Metropolitan Museum Journal* 19/20 (1984/85), pp. 166-77; R. Distelberger, *Western Decorative Arts, Part I: Medieval, Renaissance, and Historicizing Styles Including Metalwork, Enamels, and Ceramics*, cat. Washington (National Gallery of Art) 1993, pp. 282-87; Krautwurst, op. cit. (note 1), pp. 26-27; Drayman-Weisser and Wypyski, op. cit. (note 3), pp. 81-89.

5 The investigation on which this article is based was undertaken as part of a master's thesis in the conservation and restoration of cultural heritage at the University of Amsterdam: *Authentiek, vervalst, gerestaureerd of pastiche? Een onderzoek naar twee Renaissance juwelen uit de collectie Mannheimer in het Rijksmuseum Amsterdam* (October 2012). The Rijksmuseum made the two jewels available for literature and archive research into the creation of the collection of Renaissance jewellery and a non-destructive investigation of the materials and techniques.

6 G. van der Ham, *200 jaar Rijksmuseum. Geschiedenis van een nationaal symbool*, Amsterdam/Zwolle 2000, p. 322.

7 See among others M.D. Haga, 'Mannheimer, de onbekende verzamelaar', *Bulletin van het Rijksmuseum* 22 (1974), pp. 87-88; J.P.B. Jonker, 'Fritz Mannheimer (1890-1939)', *Biografisch woordenboek van Nederland*, The Hague 2002, p. 324.

8 Worth around 112 million euros. See further Haga, op. cit. (note 7), pp. 88-91.

9 Van der Ham, op. cit. (note 6), p. 281.

10 Haarlem, Noord-Hollands Archief, 476 Rijksmuseum and legal predecessors, 2140;

inventory of art objects in the house of Dr F. Mannheimer in Amsterdam, 1939.

11 Van der Ham, op. cit. (note 6), p. 280.

12 Haga, op. cit. (note 7), p. 92.

13 H. van Os, 'Otto Lanz en het verzamelen van vroege Italiaanse kunst in Nederland', *Bulletin van het Rijksmuseum* 24 (1978), p. 168.

14 Ibid.

15 Van der Ham, op. cit. (note 6), p. 321.

16 O. von Falke and F. Mannheimer, *Katalog der sammlung F[ritz] M[annheimer]*, *s.l.* November 1935-March 1936. Almost all the entries in the catalogue include a general description, the dimensions, the country of manufacture, a date or period of manufacture and, where applicable, the provenance in a private collection. The copy available in the Rijksmuseum Research Library has a great many handwritten notes in the margins. They indicate which pieces came to the Rijksmuseum, which were sold in 1952 and whose whereabouts are unclear, and which attributions (date, place of manufacture) were regarded as doubtful. In some cases typing errors are corrected. We do not know who was responsible for these notes.

17 '… et les bijoux provenant des pays non contractants, Brésil, Canada, Chine, Etats-Unis, Espagne, Esthonie, Finlande, Hongrie, Lettonie, Pérou, Pologne, U.R.S.S., etc.' See *Les Poincons de Garantie Internationaux pour l'or, le platine et le palladium*, Paris 1988, p. 174.

18 In combination with other marks it may have functioned as an indication of weight. The possibility that the owl marks on the horseman pendant indicate the weight could not be confirmed during this investigation.

19 L.B. Gans, *Goud- en zilvermerken van Voet*, Leiden 1992, p. 175.

20 Jewels sold in the art trade in this period were not normally taken to the assay office. Based on a conversation with jewel historian Martijn Akkerman.

20 V. Biringuccio, Cyril Stanley Smith and Martha Teach Gnudi (transl.), *The Pirotechnia of Vannoccio Biringuccio: The Classic Sixteenth-Century Treatise on Metals and Metallurgy*, New York 2005; B. Cellini and C.R. Ashbee (transl.), *The Treatises of Benvenuto Cellini on Goldsmithing and Sculpture*, *s.l.* 2010. Cellini was born in 1500 and died in Florence in 1571.

22 *Emaille cloisonné* is a technique in which the enamel is applied in small gold cells on a back plate. In *emaille en ronde-bosse* a three-dimensional figure or a figure in high relief is covered wholly or partly in enamel. In *emaille champlevé* voids are left in the gold background into which the enamel can flow.

23 Cellini and Ashbee, op. cit. (note 21), pp. 28-30.

24 Weldon, op. cit. (note 3), p. 653; M.T. Wypyski, 'Renaissance Enameled Jewelry and 19th Century Renaissance Revival: Characterization of Enamel Compositions. Renaissance Jewelry in the Alsdorf Collection', *Museum Studies* 24 (2000), p. 102; Drayman-Weiser and Wypyski, op. cit. (note 3), pp. 81-102; M.T. Wypyski, 'Chemical Analyses of Renaissance Enameled Jewelry', in *Glass and Ceramics Conservation 2007. Interim Meeting of the ICOM-CC Working Group August 27-30, 2007, Nova Gorica, Slovenia*, Nova Gorica 2007, pp. 46-59; P. Craddock, *Scientific Investigation of Copies, Fakes and Forgeries*, Oxford 2009, p. 239.

25 R. Newman, 'Chromium oxide greens', *Artist's Pigments: a Handbook of Their History and Characteristics*, London 1997, pp. 273-74.

26 D. Strahan, 'Uranium in Glass, Glazes and Enamels: History, Identification and Handling', *Studies in Conservation* 46 (2001), p. 181.

27 Drayman-Weisser and Wypyski, op. cit. (note 3), p. 90, and Wypyski 2007, op. cit. (note 24), pp. 52-55.

28 XRF is a research method in which a material is bombarded with high-energy X-rays so that the electrons in the atoms are excited. When the electrons return to their original place they emit a characteristic fluorescence and energy, and the elements that make up the material can be mapped on this basis. The energy generated by a specific element can be converted into a visual spectrum. The qualitative method is non-destructive and can be carried out quickly on an unprepared surface. The ARTAX-XRF from Bruker AXS available at the Rijksmuseum was used for this investigation.

29 XRF cannot provide a definitive answer as to the quantitative composition of the enamel, nor does it give any information about metal oxides that are present; distinguishing between the various enamels therefore has to be based on the elementary composition. Unfortunately it was not possible to analyze each individually enamelled component of the two jewels during this investigation. The author is aware that the results and conclusions in this article are based on a limited number of measurements. However, the places where the measurements were carried out were carefully selected and, in the author's opinion, form a sufficiently representative group to be able to pronounce on the composition of the enamel on the whole jewel.

Detail of fig. 3