Bart Devolder
Harvard University

Two 15th Century Italian Paintings on Fine-Weave Supports and their Relationship to Netherlandish Canvas Painting

Abstract
In the 15th century and earlier, artists used canvas supports more often than the material evidence that has come down to us might indicate. In order to paint on canvas, artists used several different techniques. One of these bears the historical name of Tüchlein. This technique was widely used in the Low Countries and to a lesser extent in other regions in Europe. With the help of technical analyses, the author examined the two Italian paintings from the Fogg Art Museum collection -one attributed to Giovanni Canavesio and the other to the Studio of Sandro Botticelli-, to determine how closely their structure and materials are to the Tüchlein technique.

1. Introduction

This short communication is the result of a research project conducted at the Straus Center or Conservation at the Harvard University Art Museums from September 2004 through June 2005. The goal of the project was to study the technique and materials of two Italian paintings on fine-weave supports in order to compare them with Northern paintings made using the Tüchlein technique.

The paintings examined are both from the Fogg Art Museum collection (Harvard University Art Museums): '*Salvator Mundi*' (c. 1490-1499, 57.15 x 34.93cm; 1930.2) by the Studio of Sandro Botticelli (*Fig.1*), and '*Saint Roche*' (1475-1500, 114.4 x 48.3cm; 1942.271), attributed to Giovanni Canavesio (*Fig.2*).

2. Etymology of the Word Tüchlein

To avoid misunderstandings and to set up a frame of reference, it is important to examine the historical usage of the term Tüchlein, as well as to give the precise definition that is being used for this research project. The term '*Tüchlein*' derives from a quotation in Albrecht Dürer's diary (Dubois 1997). He made this entry during his travels to the Low Countries in 1520-1521: In these quotations he mentions the word Tüchlein [*tuch* meaning 'cloth' and *lein* meaning 'small'] three times:

Figure 1: (Top left) Studio of Sandro Botticelli, Salvator Mundi
c. 1490-1499
57.15 x 34.93cm., actual
Fogg Art Museum, Friends of the Fogg Art Museum Fund, 1930.2

Figure 2: (Top right) Giovanni Canavesio, Saint Roch
1475-1500
114.4 cm. x 48.3 cm., actual
Fogg Art Museum, Gift of Edward W. Forbes, 1942.271

"*[…] I have sold a 'Madonna' picture painted on* ***small canvas"/ "****I have got 4 florins, 5 stivers for three* ***small canvases "/ "****I have given the little Portuguese factor, Signor Francisco, my* ***small canvas*** *with the small child […]"*[1] (Fry 1913).

Modern scholars have linked this term to Vasari's technical description of a self-portrait by Dürer[2], which Dürer gave to Raphael. This description mentions *a guazzo* as the medium that strictly translated means gouache [painting with opaque pigments ground in water, and mixed with gum and honey (Onions 1934)]. Dubois et al. (1997) interprets it as 'distemper' [glutinous substance soluble in water; e.g. animal glue, plant gum and egg]. In addition the description mentions painting on a linen canvas in transparent

colors without white, the image equally visible on both sides and the highlights obtained by using the color of the, (possibly bleached), canvas (Dubois et al. 1997).

From that point on, for the majority of modern scholars, the word *Tüchlein* came to represent a specific technique, although the term was probably used by Dürer to identify only his supports. Unfortunately the term has been used indiscriminately by art historians to describe canvas paintings made before, during and after Dürer's life and painted using many different types of procedures and materials. Scholars such as Marijnissen (1987), Wolfthal (1989), Dubois & Klaassen (2000) have argued for a distinction between the different materials and procedures used to make early Netherlandish canvas paintings.

Taking the above in consideration, the proper definition of the Tüchlein technique is:

1. - finely woven linen support with glue size layer and unprimed;
2. - aqueous binding medium (gum/glue);
3. - no varnish.

3. Comparison Between Italy and the Low Countries

Descriptions of 15th–century canvas paintings have been made which emphasize the differences in materials and procedures used north and South of the Alps. It has been generally assumed that canvas paintings from South of the Alps tend to have an egg binding medium, a gesso preparation layer, and often a final varnish layer. These three differences change the paintings' visual properties and give them a very different appearance from canvas paintings from the North (Villers 2000)**.**

Andrea Mantegna (c.1431-1506), and to a lesser extent Giovanni Bellini (c.1430-1516)**,** are generally assumed to be the only Italian artists who painted both in the Tüchlein technique and in the Italian technique (Villers 1995). Dunkerton (1993) mentions that it is possible that Mantegna saw the Bouts triptych[3], (painted in the Tüchlein technique), in Venice. Such an encounter could have inspired Mantegna to experiment with a similar technique. It is important to note that the Bouts triptych is only one of many examples mentioned in written sources listing Netherlandish canvas paintings in 15th century Italian collections (Nuttal 2004).

Artists in the Low Countries were well aware of the fact that their art was 'fashionable' in Italy and they therefore made many paintings for export. In addition to panel paintings, they exported canvas paintings, rolled on dowels and shipped in crates (Dunkerton 1993). In order to allow the paintings to be rolled they used the Tüchlein technique [a gesso priming layer tends to crack during rolling]. Beside the well-known

fact that Italian artists came into contact with Netherlandish paintings, they also met artists travelling from the Low Countries (for example: Dürer in Venice, 1506) (Nuttal 2004). Italian painters also travelled to the Low Countries to study Netherlandish painting procedures, though most documented study trips were to study oil painting techniques (Nuttal 2004).

With regard to the two paintings examined for this study, we know that Botticelli painted on canvas in an Italian technique (e.g. '*The Birth of Venus*' c.1485, tempera on canvas; 172.5 x 278.5 cm, Galleria degli Uffizi, Florence) but so far we are not aware of any Tüchleins. From Giovanni Canavesio, as far as the author knows, no paintings on canvas –of any kind- are known to exist.

4. Technical Examination

In order to determine if the paintings from the Fogg Art Museum collection are painted in the Tüchlein technique, the canvases were studied layer by layer, looking at the support, the presence or absence of a priming or glue size layer, the medium used and the presence or absence of a varnish[4].

4.1. '*Salvator Mundi*', Studio of Sandro Botticelli

The '*Salvator Mundi*' painting attributed to the 'Studio of Sandro Botticelli' (*Fig.1*) entered the Fogg Art Museum collection in 1930 as a Botticelli. Over the years the attribution has changed to 'copy of Botticelli', then to 'School of Botticelli' and now to 'Studio of Botticelli'. Two similar paintings by Botticelli, painted in egg tempera on panel**,** are known: one in Detroit and one in Carrara[5] (Kanter, et al. 1997).

As mentioned earlier, it is known from inventories that the Italian nobility collected Netherlandish artwork. For example**,** the inventories of the Medici family and Tomasso Portinari mention Flemish linen canvas paintings (Nuttal 2004). The Italian nobility were attracted by the different way of representing themes, both sacred and profane, as well as by the painting style and technique. The Netherlandish type of the '*Head of Christ*', with its realistic representation of blood and wounds became a very popular devotional object in Italy (Nuttal 2004). In order to meet the demand for these images Italian painters started to make paintings inspired by examples from the Low Countries**.** In her book '*From Flanders to Florence*', Nuttal mentions the Fogg collections `*Salvator Mundi*` painting:

> *'[…] Although possibly not executed in a strictly Netherlandish technique, [it] might be seen as alluding generically to Netherlandish panni dipinti* […]' and also '*The choice of a cloth support was perhaps intended to enhance its 'Netherlandish' character*' (Nuttal 2004)

4.1.1. Support

The support of the painting is a canvas with a fine plain weave of 18 threads per cm. A prominent flaw in the weave runs through the center of the canvas. The canvas texture plays an important role in the appearance of the painting.

Two fiber samples were taken and studied with transmitted light microscopy in order to identify the type of fiber (*Fig.3*). The fibers do not twist and they show nodes -a clear indication of linen (Gettens & Stout 1963). The fibers are Z-spun. It is important to mention that the painting has no less than four lining canvasses, which could affect the analytical analysis. There appears to be no ground on the painting and cross-sections give further evidence that no ground exists. Examination of the samples under ultra violet light made the glue size layer applied on the canvas surface visible as a highly fluorescent layer.

Figure 3: Linen fiber sample, Salvator Mundi
Transmitted light microscopy, X 40

4.1.2. Paint Layers & Pigments

In order to examine the paint layers and pigments**,** x-ray fluorescence (XRF) was first conducted on the painting. All of the identified pigments corresponded to the palette used in 15th century Italy. Later eight pigment samples were taken. These samples were mounted in resin blocks and studied using polarized light microscopy (PLM), under both visible and ultra violet light. Fourier transform infrared spectrometry (FT-IR) was also conducted on a several paint samples.

Staining tests were carried out to get an indication of the nature of the binding medium: Sudan Black B for the presence of lipids and Amido Black AB2 for the presence of proteins[6]. To get more precise data, samples were taken to undergo GC-MS analysis but at the time of publication these were not completed.

Figure 4 shows a detail of the blue background of the painting. The figure shows an area where the gilding has fallen off**,** showing a lighter azurite layer under a darker azurite layer.

Figure 4: Detail of Salvator Mundi, Studio of Sandro Botticelli
Blue background (blau von feldung?)

The cross-section taken from this area made this double azurite layer more evident. Staining with Amido Black 2 gave positive results for proteins in the top layer with the fine pigment particles. The FT-IR analyses identified both animal glue and gum throughout the whole sample.

It is possible that this is an example of the use of *blau von feldung*, a technique recently identified by Heydenreich, used to decorate monochrome blue passages, not only on paintings, but also on heraldic shields, doors, sculptures and walls (Heydenreich 2002). As is the case here, he found an azurite layer with large particles in an aqueous, proteinaceous medium. The specific choice of particle size and medium gives it a velvety and tactile appearance that contrasts with the smooth and shiny look of the gold leaf.

Another possible example of this *blau von feldung* was noted on the small canvas painting in the Brooklyn Museum (Netherlandish, '*Madonna and Child'*; Brooklyn Museum, NY. 26.5 x 21cm), during my brief survey of collections looking for other Tüchlein paintings in the U.S.

The green of the Christ's collar was identified by the use of polarized light microscopy (PLM) as a copper based green. FT-IR identified the green pigment as atacamite, a basic copper chloride. This basic copper chloride pigment has been found occasionally on German and Netherlandish paintings. It is often found in Asian art. Theophilius describes in his treatise how to manufacture *viride salsum*. According to Scott this is probably principally atacamite (Scott 2002).

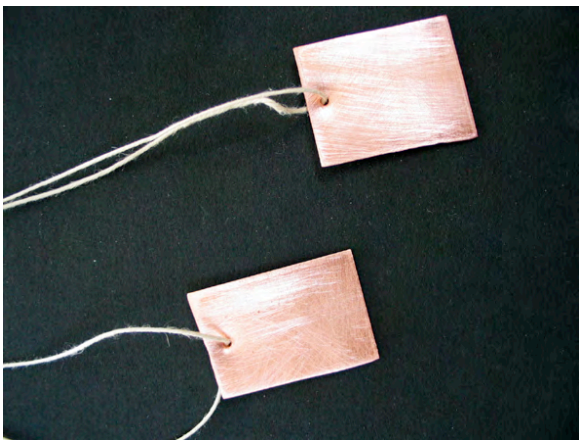


Figure 5: Copperplates with buffed up surface

Experiments were carried out following Theopilius' recipe in order to attempt to reproduce the pigment. Three copper plates were covered with honey (*Figs. 5-6*). Sea salt was sprinkled on top of the honey (*Fig.7*)

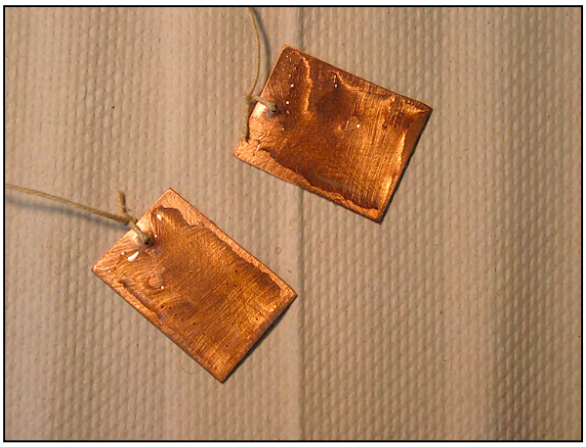


Figure 6: Copperplates covered with honey

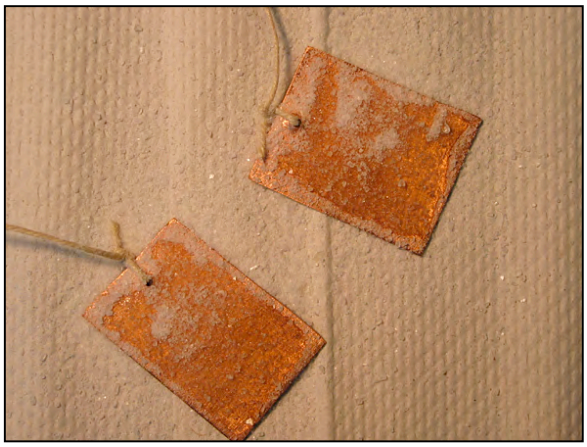
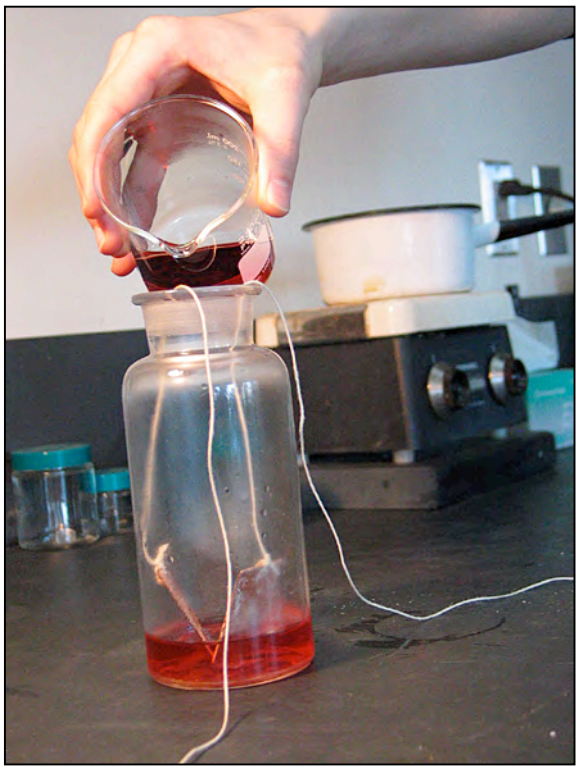


Figure 7: Copperplates sprinkled with sea-salt



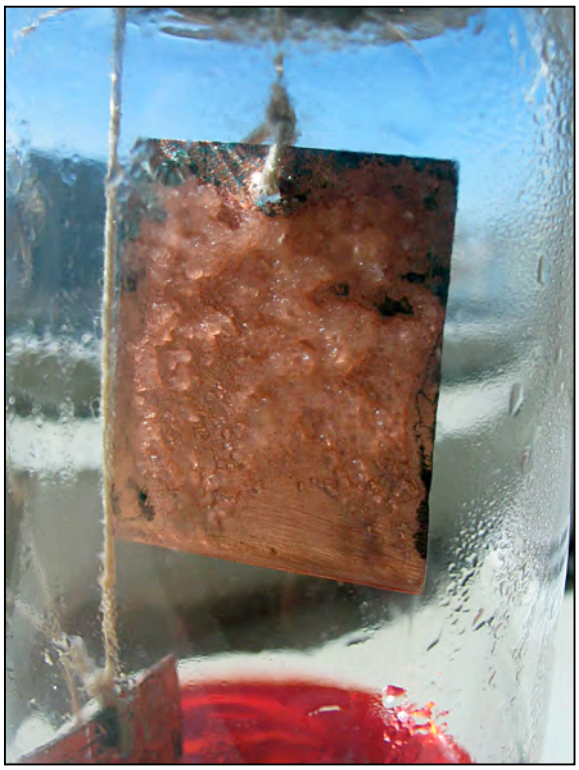


Figure 8: (Above left) Pouring of warm red wine vinegar on the suspended copperplates
Figure 9: (Above right) Results after a few minutes (slight green residue)

and the copperplates were suspended in a glass jar. Warm red wine vinegar was poured over them (*Fig.8*). The first results were visible after just a few minutes (*Fig. 9*), but the pigment samples were collected after four weeks (*Fig.10*). The pigment obtained was analyzed with the use of a Kaiser Hololab 5000R Raman Spectrometer with Raman Microprobe attachment with coherent CW Argon/ion and TI/S lasers at 785nm and 514.5nm. Three out of five samples turned out to be atacamite, the other two verdigris. Scott also stated that the vessel should be closed airtight; otherwise verdigris is obtained (Scott 2002). It is very possible that the glass jars were not sealed airtight (*Fig.11*).

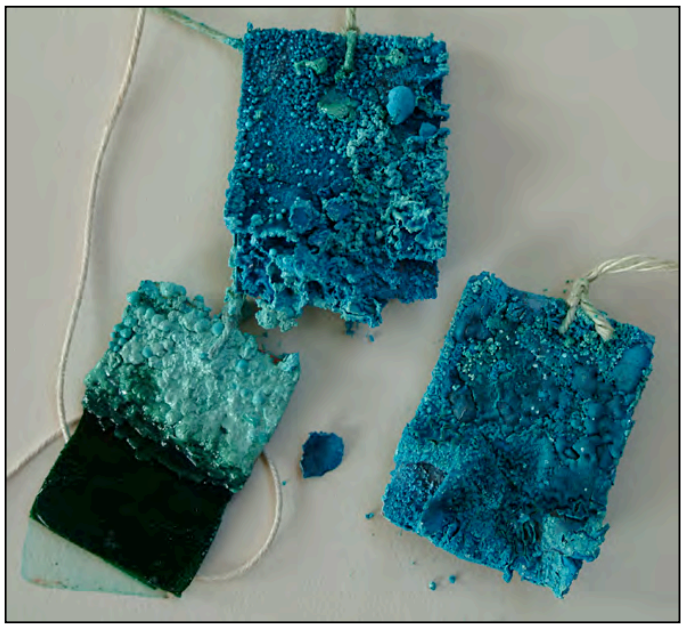


Figure 10: (Above left) The copper plates out of the jar (notice the difference in color between the plates suspended closer to the vinegar; the lighter green is atacamite and the others mostly verdigris)

Figure 11: (Right) Showing the glass jar and the not 100% airtight lid

4.1.3. Gilding

The gold leaf of Christ's halo was laid on a yellow mordant layer. FT-IR analyses of this yellowish mordant indicated the presence of animal glue, gum and raw sienna. XRF analysis from the same area suggests the presence of azurite, lead-white, ochre, calcium, gold and silver.

4.1.4. Binding Medium

The results for the staining tests on the cross-sections were positive for proteins. FT-IR shows the possible presence of animal skin glue and possible traces of gum Arabic. The mixture is mentioned in Jehan Le Begue's compilation manuscript from 1431, in the section on S. Audemar`s '*De Coloribus Faciendis'*. This section mentions a recipe that mixes animal skin glue with gum Arabic so it will last longer (Merrifield 1999).

4.1.5. Coating

There is no evidence of a varnish layer in the cross-sections even though the statutes of the Venetian Arte dei Pittori -registered in 1278- contain a regulation forbidding the sale of unvarnished painted objects (Dunkerton 1993). Ceninni mentions varnishing paintings on canvas in his *Il libro dell Arte* (Cennini) and

Mantegna mentions a varnish from Venice with regard to his canvas paintings for the Studiolo of Isabella d'Este (Dunkerton 1993). It seems most likely that these references all deal with canvas paintings made in the Italian technique.

Figure 12: (Above left) Detail of Saint Roch, Giovanni Canavesio
Figure 13: (Above right) Detail of Saint Roch taken with Digital Infrared photography, Giovanni Canavesio

4.2. '*Saint Roch*' Attributed to Giovanni Canavesio

The '*Saint Roch*' painting is attributed to Giovanni Canavesio (*Fig.2*). The curatorial file notes that the painting was first attributed to Borgognone when it entered the Fogg Art Museum collection in 1942. Until this study the painting was catalogued as a '*transfer from panel to canvas*'.

Digital Infra Red photography was used to study the painting[7]. This made several compositional elements more evident (*Figs.12-13*). On the left side of the figure the retreating boot and a piece of clothing from a second figure can be seen. The fragmentary image and the horizontal seam running through the painting support the hypothesis that the existing painting is a fragment from a larger composition.

4.2.1. Support

The support of the painting is a canvas with a fine plain weave with 22 threads per cm. A horizontal seam runs through the painting. As mentioned above, this could indicate that the painting is a fragment. In the 15th century the width that could be woven was relatively narrow due to the size of the looms. On the other hand the length of the textile had no significant restrictions, the use of a horizontal seam would be of no use if the actual width were the original width, unless the painter used two smaller pieces that he had in his studio**.**

Figure 14: Linen fiber sample, Saint Roch
Transmitted light microscopy, X 40

Two fibres samples were studied in transmitted light with the use of a microscope (*Fig.14*). The Z-spun fibers show the characteristics of linen with nodes and no twists. (Gettens/Stout 1963). The absence of a preparation layer is evident in areas with paint loss. A cross-section from the saint's left boot shows clearly that there is no ground present. By looking at the same sample under ultra violet light the presence of a glue size layer is detectable due to its clear fluorescence.

4.2.2. Paint Layers & Pigments

Ten paint samples were taken in order to analyze the paint layers. Additional staining tests and FT-IR was also done. All of the identified pigments corresponded to those used in 15th century Italy.

The Saint's mantle is in poor condition and shows the bare canvas, but some pigment particles were found in the interstices of the canvas. The reason for its bad state of preservation is not clear, but it is probably due to the materials and procedures used to make this type of painting and poor environmental conditions. FT-IR data showed a clear match for azurite and possible traces of a red insect lake**,** which may have been used to make the mantle look more purple.

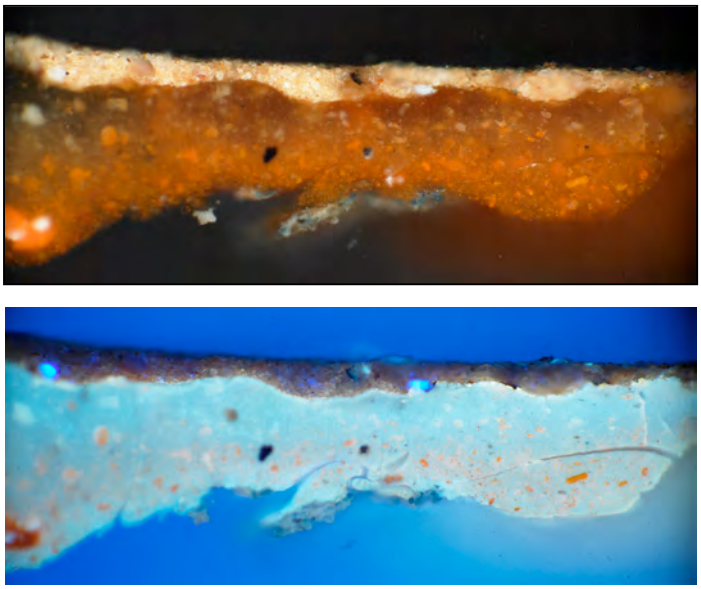


Figure 15: (Top) Cross-section from Saint Roch`s golden halo X 40, photographed under Visible light
Figure 16: (Bottom) Cross-section from Saint Roch`s golden halo; X 40, photographed under Ultraviolet light

4.2.3. Gilding

By studying the saint's halo under the microscope some small areas gilded with gold leaf were found. A sample from this area was studied under ultraviolet light and revealed five different layers (*Fig.15*). The first is probably the glue size layer. Layers two and three have similar components (the more reddish fluorescent layer is possibly caused by the presence of madder, a red lake and the white fluorescent layer probably by a resin). The fourth layer, which looks similar

to the first layer, possibly indicating a glue layer used as an adhesive for the gold leaf. The top layer lies on top of the gold leaf. Its function is rather unclear; it could be an original paint glaze or later overpaint that covers the gilding.

FT-IR analysis conducted on this area showed traces of ground gypsum, an animal glue and red earth. XRF noted the presence of gold, lead white, ochre, calcite and traces of copper. FT-IR analysis on samples from other areas with gilding (columns) indicated traces of saffron. Saffron was used, probably as a colorant, in different mordants**,** according to several treatises in Merrifield's compilation (Merrifield 1994).

4.2.4. Binding Medium

The cross-sections were stained with Amido Black AB2, and gave a clear positive stain for the presence of proteins. Afterwards the same cross-sections were stained with Sudan Black B. Some of the samples turned slightly bluish, indicating the minor presence of oils.

4.2.5. Coating

The painting has a dry matte appearance and appears not to have been varnished. Cross-sections show no evidence of any coating.

5. Conclusion

As mentioned in the introduction, the author defines Tüchlein as: A painting painted with an aqueous medium, (gum/glue) on a finely woven linen support, which is glue sized and unprimed and left unvarnished after the painting was finished. Taking all the above results into account it is possible to formulate an answer to the question: `*Can these two paintings be considered similar to the canvas paintings from the North made in the Tüchlein technique?* `.

Before answering the question it is important to state that there is no such thing as the Tüchlein technique**,** since the word was originally intended to describe a type of support rather than a technique. However, the author's definition serves to define one set of tools, materials, and procedures used historically to produce canvas paintings. Strict use of this category of paintings might help in reorganising existing information, thus facilitating future research.

Within the definition of Tüchlein used in this article, we can conclude that both paintings are very close to the Northern Tüchleins. The staining tests and FT-IR analysis are not the most precise methods of

identifying the nature of binding media. Both made it clear that the binding media for both paintings are protinacious and the FT-IR analysis indicated a gum and animal glue. Only the GC-MS results can give more certainty over the binding media used.

Out of all the above we can conclude that it is likely that there were more Italian painters than just Mantegna and Bellini who followed more Northern procedures than previously thought.

Acknowledgements

The author would like to thank Teri Hensick, Kate Olivier and Kate Smith for their advice and editing. Thanks also to the analytical lab from the Straus Center for Conservation, Narayan Khandekar (Senior Conservation Scientist at Harvard University Art Museums, Katherine Eremin (Conservation Scientist at Harvard University Art Museum) and Jens Stenger. (Andrew W. Mellon Post-Doctoral Fellow in Conservation Science at Harvard University Art Museums). Many thanks to Gunnar Heydenreich, Carolyn Tomkiewicz, Jill Dunkerton. And a special thank-you note to Paul Himmelstein and William Whitney.

Endnotes

1. Original text from Dürers diary from Dubois, H., H. Khanjian, M. Schilling, and A. Wallert. 1997. A Late Fifteenth Century Italian Tüchlein. *Zeitschrift fûr Kunsttechnologie und Konservierung* 11: 229.

> *"*[…] *hab ich zu kauffen geben auf ein Tüchlein ein-gemahlt Marien Bild"*
> *"Ich hab 4 gulden 5 stüber auß 3 Tüchlein gelöst"*
> *"Ich hab dem klein factor von Portugal, signor Francisco, mein Tüchlein mit dem kindlein geschenckt* […]*"*

2. Original description of Vasari from idem: 229, 230.

> *"condotta da lui a guazzo su una tela bisso, che da ogni banda mostrava parimente e senza biacca i lumi trasparenti, se non che con acquerelli di colori era tinta e machiata e de' lumi del panno aveva campato i chiari, la quale cosa maravigliosa a Raffaello."*

3. The triptych got divided over different museums: `*Annunciation*`, 1450-55, distemper on linen, 90.2 x 74cm in. J. Paul Getty Museum, Malibu/ `*Resurrection*`, 1450-60, tempera on canvas, 89 x 72.5 cm, Norton Simon Museum of Art, Pasadena / `*The Entombment*`, c.1450, distemper on flax canvas, 90.2 x 74.3 cm, National Gallery, London/ scholars dispute the painting from Brussels being part of the same trip-

tych: `*Crucifixion*`, 1450-60?, tempera op doek, 181.5 x 153.5cm Musees Royaux des Beaux-Arts, Brussels

4. The XRF analyses were conducted by Kathy Eremin (Conservation Scientist), the fibre and paint samples from the *Salvator Mundi* painting were taken by Jens Stenger (Andrew W. Mellon Post-Doctoral Fellow in Conservation Science. Together they also did the pigment identifications with the Raman Spectrometer. The FT-IR analyses were conducted by Narayan Khandekar (Senior Conservation Scientist); all three work at the Straus Center for Conservation at the Harvard University Art Museums.

5. '*The Resurrected Christ',* c. 1480, Sandro Botticelli; 44.5 x 29cm, Tempera on panel; Detroit Institute of Arts, Detroit, '*Man of Sorrows',* c. 1500, Sandro Botticelli; 47.6 x 32.3cm, Tempera on panel; Accademia Carrara, Bergamo.

6. The used reactive dyes for the staining test: a.) Sudan Black B (SBB): saturated solution SBB in a mixture of 30ml ethanol and 20 ml distilled water. b.) Amido Black AB2 (AB): 2.70225ml of N acetic acid (glacial 99.99%) in 45 ml of distilled water. 0.61236g of 0.1M sodium acetate in 45 ml of distilled water. 10ml of glycerine (glycerol 99+%). 0.1g Amido Black 10B

7. The digital photography was conducted with a Phase One digital back on a Hasselblad camera body. The digital back has a silicon CCD and the manufacturer has removed its IR filter. The Phase One detector is sensitive up to 1.1 microns into the IR spectrum.

References

Cennini, d`A.C. 1960. *The Craftsman`s Handbook.* New York.

Dubois H. & L. Klaassen. *Fragile Devotion: Two Late Fifteenth-Century Italian Tüchlein Examined*. In Villers, C. (ed.) 2000. *The Fabric of Images. European Paintings on Textile Supports in the Fourteenth and Fifteenth Centuries.* London.

Dubois, H., H. Khanjian, M. Schilling, and A. Wallert. 1997. A Late Fifteenth Century Italian Tüchlein. *Zeitschrift für Kunsttechnologie und Konservierung* 11: 228-237.

Dunkerton, J. 1993. Mantegna's painting techniques: 26-38. In Ames-Lewis, F. & A. Bednarek (eds.). 1993. 'Mantegna and 15th-century court culture; lectures delivered in connection with the Andrea Mantegna exhibition at the Royal Academy of Arts, London.

Fry, R. (ed.) 1913. *Albrecht Dürer. Records of Journeys to Venice and the Low Countries by Albrecht Dürer*. Boston.

Gettens, R.J. & G.L. Stout. 1966. *Painting Materials A Short Encyclopaedia.* New York.

Heydenreich, G. 2002. *Painting Materials, Techniques and Workshop Practice of Lucas Cranach the Elder. Volume 1*. Thesis presented for the Degree of Doctor in the Philosophy, University of London, Courtauld Institute of Art.

Kanter, L., H.T. Goldfarb & J. Hankins. 1997. *Botticelli's Witness: Changing Style in a Changing Florence*. (exhibition cat. Isabella Stewart Gardner Museum, Boston; January 24-April 6, 1997). Boston.

Marijnissen, R.H. 1985. *Schilderijen: Echt -Fraude-Vals: Moderne onderzoekingsmethoden van de schilderijenexpertise*. Zaventem.

Merrifield. M.P. 1999. *Medieval and Renaissance Treatises on the Arts of Painting. Original Texts with English Translations. Two Volumes Bound as one.* New York.

Nuttal, P. 2004. *From Flanders to Florence. The Impact of Netherlandish Painting, 1400-1500.* New Haven-London.

Onions. C.T. (ed.). 1934. *The Shorter Oxford English Dictionary on Historical Principles.* London.

Scott, D.A. 2002. Copper and Bronze in Art. Corrosion, Colorants, Conservation. Los Angeles.

Villers, C. 1995. Paintings on Canvas in Fourteenth Century Italy. *Zeitschrift für Kunstgeschichte* 58,1: 338-357.

Villers, C. (ed.) 2000. *The Fabric of Images. European Paintings on Textile Supports in the Fourteenth and Fifteenth Centuries.* London.

Wolfthal, D. 1989. *The Beginnings of Netherlandish Canvas Painting: 1400-1530*. Cambridge.