Note from the Making and Knowing Project:

This essay was written for "The Art Technological Source," an 8-week graduate course at the University of Amsterdam offered by Dr. Marjolijn Bol in 2015 and 2016 to students enrolled in an MA program in either Technical Art History or Conservation and Restoration. Students worked on various recipes from BnF Ms. Fr. 640 on the following five topics: 1) tracing and painting on glass, 2) yellow dyes and their applications, 3) dragon's blood, 4) painters' varnishes, and 5) sieves.

This is an un-edited student paper that relies on an earlier state of the Making and Knowing Project's transcription and translation of Ms. Fr. 640. For an updated version of the text, see:

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Tourmentine clere meslee d'un peu de l'arme de mastic

An annotation on the resinous binding media in reverse glass painting in BnF Ms Fr 640

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Contents

Introduction

The late sixteenth century French BnF Ms Fr 640 manuscript contains eight recipes which are connected with the technique of reverse glass painting or *verre églomisé*. This term has been used to describe all types of non-fired painting or gilding on clear glass to be viewed from the opposite side. Technically speaking, a reverse glass painting is a glass plate covered with a design consisting of black lines or a layer of black paint that is etched. Subsequently the glass is decorated with translucent paint and then covered with a metallic foil.[1] The technique of reverse glass painting was used on a broad scale for small devotional objects such as domestic altars and reliquaries between the thirteenth and seventeenth century.[2]

The recipes which are described by the anonymous author-practitioner of the manuscript cover various aspects of the technique.[3] They concern the setting up of a glass design (fol. 39v_a3), the making and use of colors for glass (fol. 31v_4, fol. 37_2, fol. 41v_1, fol. 102v_1) and the backing of glass with metallic foils (fol. 39v_a3, fol. 41v_3, fol. 102v_1). Furthermore the author suggests the binding media which should be used for the paints: turpentine with a drop of mastic. Under chapter 'For laying colors on glass' on fol. 39v_a2 the author mentions: 'In order to stop your turpentine colors from running and to make them unified, mix the turpentine with some drop of mastic.'[4] In 'Tracing a story on glass' on fol. 39v_b2 the author recalls the binding media for the second time in quite a similar way: **'**Then you will fill the background with enamel azure or verdigris or fine turpentine-soaked laque platte, mixed with a little drop of mastic if you want the colors to be more unified and not to flow.'[5]

Turpentine and mastic as resinous binding media are of particular interest in this annotation, because it is often stated in contemporary literature on *verre églomisé* that a drying oil was normally used as a binding medium.[6] The use of oil is also confirmed by technical research on objects varying from the fourteenth to the sixteenth century.[7] Additionally, it was not specified in the recipe what kind of turpentine we had to use during the reconstruction: we experimented with turpentine oil and crude turpentine. It appeared that both were suitable to paint with and that both evaporated rapidly. But compared to the crude turpentine we noticed that the less viscous turpentine oil was easier for brushing manipulations.[8] The aim of this annotation is to understand why the author may have found a certain turpentine and mastic suitable for the paint and what kind of turpentine he was aiming for. In other words what are the implications for

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[1] Sandra Davison, *Conservation and Restoration of Glass* (Oxford: Butterworth Heinemann, 2003), 58.
[2] Rudy Eswarin ed, *Reverse Paintings on Glass: The Ryser Collection* (Corning: Corning Museum of Glass, 1992), 11, 13; Simone Bretz, *Hinterglasmalerei.. die Farben leuchten so klar und rein: Maltechnik, Geschichte, Restaurierung* (München: Klinkhardt & Biermann, 2013), 38.
[3] In this annotation I will continue to use the term 'author' to describe the writer of the manuscript instead of 'author-practitioner'.
[4] French transcription of the original text: 'Affin que tes couleurs a tourmentine ne sespandent pas & soient unies mesle y avecq la tourmentine un peu de larme de mastic.'
[5] French transcription of the original text: 'Affin que tes couleurs a tourmentine ne sespandent pas & soient unies mesle y avecq la tourmentine un peu de larme de mastic.'
[6] Frieder Ryser, *Glanzlichter: die Kunst der Hinterglasmalerei = Reflets Enchanteurs: l'Art De La Peinture Sous Verre* (Bern: Benteli, 2000), 13, 232; Eswarin, *Reverse paintings on glass*, 35.; Gislind M. Ritz, *Hinterglasmalerei: Geschichte, Erscheinung, Technik* (München: Georg D.W. Callwey, 1972), 55; Bretz, *Hinterglasmalerei,* 39, 58.
[7] Oliver Hahn et al., "Pigments, dyes, and black enamel - the colorants of reverse paintings on glass," *Archaeol Anthropol Sci* (2009): 263-271.
[8] *AnnotationWinter2016_MagdalenaPilkoIlseSteeman_39v_a3*: '19 February 2016' and '7 March 2016'.

using turpentine and mastic in reverse glass painting in BnF Ms Fr 640? First of all, the use of turpentine and mastic in the other recipes will be investigated in order to understand how turpentine and mastic are described by the author and for what purposes they were used. The second paragraph will concern the properties of turpentine and mastic by examining their source, structure and how they are processed. This is followed by the third section which will specifically focus on the suitability of turpentine and mastic for painting on glass. In the fourth paragraph the outcome of technical research on resinous materials in reverse glass paintings will be discussed and in the last section a comparison will be made with other treatises on reverse glass painting and how they differ from and overlap with each other. These aspects will be answered using historical technological sources, modern secondary literature and the observations made during reconstructing fol. 39v_a2 and fol. 39v_b2.

1. Turpentine and mastic in BnF Ms Fr 640

In order to understand why the author of the manuscript recommends the use of turpentine and mastic in reverse glass painting, it is valuable to look for related topics in the other recipes. Does turpentine in the recipe refer to turpentine oil or can this medium be interpreted differently? For what other purposes is turpentine also useful according to the author?

It is apparent from the manuscript that there were a lot of different turpentines and mastics known to the author. This may indicate the wide variety and knowledge of these materials available in the time of the manuscript. It can be noticed that the author of the manuscript is quite precise in describing a specific kind turpentine and mastic (table 1).[9] The recipe on fol. 39v_b2 is one of the many recipes of the manuscript that deals with a kind of turpentine. Fol. 2r_2 is entirely unrelated to the arts or crafts and it suggests to use turpentine as a remedy against pain. Most recipes where turpentine and mastic are mentioned provide information about making a varnish. One of them can be read in the first varnish recipe on fol.3r_a2. Already three different kinds of turpentine can be found here: Venice turpentine, turpentine oil and turpentine. There are also some variations on mastic: mastic, drop of mastic, mastic oil and mastic varnish. Furthermore, the author indicates the quality of turpentine. A gradation can be observed: common turpentine, clear turpentine and high-quality turpentine. But also turpentine oil, fine turpentine oil, good quality turpentine oil.

The turpentine mentioned on the examined fol. 39v_a2 is related to turpentine colors. By turpentine colors the author may have meant pigments that are already distempered in turpentine.[10] Since the author speaks of turpentine oil elsewhere in his treatise it seems to be the case that this turpentine on fol. 39v_a2 and fol. 39v_b2 is of a different kind. Turpentine colors are also mentioned on fol. 42r_a2. It tells one how one can paint stamps made out of wax with turpentine colors and mastic. Another relevant recipe can be found on fol. 40v_01. It describes how one can paint the background of a white enamel cross. This recipe does not mention turpentine colors, but it does say that one have to distemper dragon's blood or Indian lacquer (shellac?) with clear turpentine and mastic drops applied on a silver leaf.

[9] See appendices ‘Table 1’ for all the written turpentines and mastics in the recipes (English and French).
[10] The French ‘colours à tourmentine’ are interpreted as colors in turpentine. This is similar to the French words for oil paints, which are ‘couleurs à huile’.

2. Technical aspects of turpentine and mastic

Turpentine can be obtained from the sap of a variety of coniferous trees that are members of the pine family. The semi-liquid sap is collected by bleeding the trees from small cuts, which are made in the bark of the main branches, allowing the sap to drip (fig. 1-2).

Fig. 1. *Made incision in the bark of a Serbian spruce (backyard of Ilse Steeman)*.
Fig. 2. *Drop of crude turpentine collected from the same Serbian spruce*.

This crude turpentine is a natural resinous extract, which is also called an oleoresin or balsam: it contains a resin as well as a volatile oil.[11] However, the two can be separated from each other by steam distillation. The volatile distillate results in a pungent, fluid and translucent essential oil, which is in this case turpentine oil (also called spirits of turpentine). Chemically speaking, this distillate consists of a mixture of monoterpenes to which the oil owes its fluidity. Furthermore, it has the property to evaporates quite readily. The residue that is left after distillation is a concrete turpentine or rosin.[12] It is noteworthy that the distillation process to make essentials oils seems to have been not widely used in Europe until the fifteenth century and that the production of turpentine oil was only introduced in the sixteenth century.[13] This means that the use of turpentine oil mentioned in the manuscript was relatively new at that time.

Since the author speaks of turpentine in turpentine colors on fol. 39v_a2 and fol. 39 and of clear

[11] Rutherford J. Gettens and George L. Stout. *Painting Materials: A Short Encyclopaedia* (New York: Dover Publications, 1962), 72.
[12] John S. Mills and Raymond White, *The Organic Chemistry of Museum Objects* (Oxford: Butterworth-Heinemann, 1999), 95.
[13] Mills and White, *Organic Chemistry of Museum Objects*, 97; Ralph Mayer, *The Artist's Handbook of Materials and Techniques* (London: Faber and Faber, 1973), 382.

turpentine on fol. 40v_01 he may have meant an unprocessed crude turpentine. This may be contrary to the recipe on reverse glass painting on fol. 102v_1, which states 'they paint without any traces of oil'. Oil could refer then to turpentine oil. However, according to the art conservator and painter Ralph Mayer who is known for his publication *The Artist's Handbook of Materials and Techniques* (1973), it was mostly the case in old recipes that 'turpentine' referred to the crude turpentine.[14] Compared to turpentine oil, crude turpentine contain principally diterpenoids. A well known example of a crude turpentine that was in use in the sixteenth century is Venice turpentine, which is exudated from the Austrian larch (Larix Decidura). It belongs to the fine turpentines that do not crystallize and retain a long-lasting elasticity.[15] Noteworthy is that Venice turpentine is clearly described by the author of the manuscript and does, therefore, not seem therefore to be the recommended turpentine. Other crude turpentines that the author may have meant are Strasbourg turpentine or Olio d'Abezzo, which is obtained from the Tyrol silver fir (Abies Pectinata) and Burgundy Turpentine, which is exudated from the Pinus Maritimus. The latter is described as the source of French turpentine.[16]

Mastic, just as turpentine is similar in the way that it is a natural resin, but it is different in its origin and organic composition. Mastic is a triterpenoid resin and can be obtained from Pistacia trees (Pistacia Lentiscus) of the Anacardiaceae family. The crude resin can be exudated in a similar way to how turpentine is tapped.[17] However, mastic is collected from the bark than from the wood. It appears commercially in transparent tears, which corresponds to the author's description on fol. 39v_a2 and fol. 39: 'drops of mastic'.[18]

3. Turpentine and mastic on glass

Why turpentine is suitable for reverse glass painting is not mentioned by the author, but there are several reasons to think of. The first aspect is connected with how turpentine behaves in relation to the glass. From the reconstruction it appeared that turpentine colors distempered in turpentine oil as well as in crude turpentine adheres very well to the glass.[19] This is related to the cohesive forces of this resinous material. The similar molecules within the turpentine causes the material to stick to itself, which makes the turpentine a strong fixative. This means that the cohesive forces are strong. Between the turpentine and the glass there are also attractive or adhesive forces to be considered. The strong adhesive forces between turpentine and glass causes the turpentine to cling to the glass plate.[20] Secondly, it appeared from the reconstruction that crude turpentine and turpentine oil dry really quickly compared to a drying oil, because of the volatile components.[21] The crude turpentine dries even more quickly. Thirdly, it has to be

[14] Mayer, *The Artist's Handbook*, 382.
[15] Simone Bretz, et al, "A German house altar from the sixteenth century," *Conservation and Research of Reverse Paintings On Glass. Studies in Conservation*, Vol. 53, No.4 (2008): 209–224, accessed February 10, 2016.
[16] Mayer, *The Artist's Handbook*, 204.
[17] Mills, *Organic Chemistry of Museum Objects*, 107.
[18] Gettens and Stout, *Painting* Materials, 34.
[19] *AnnotationWinter2016_MagdalenaPilkoIlseSteeman_39v_a3*: '18 February 2016' and '7 March 2016'.
[20] Peter Atkins and Loretta Jones, *Chemical Principles, 5th Edition* (New York: W.H. Freeman and Company, 2010), 181.
[21] Gettens and Stout, *Painting* Materials, 72.

considered that glass, turpentine, mastic and the recommend colors in fol. 39v_a2 are light-transmitting and therefore translucent materials, which are very important aspects in reverse glass paintings. Verdigris, enamel azure and lacque platte distempered in turpentine work as a glaze. This translucency is also confirmed by the author on fol. 65v_3 where he tells us that people usually glaze with colors that do not have a body, like lake and verdigris. A glaze is a light-transmitting paint that is made with pigments and a binding medium sharing a similar refractive index.[22] The refractive index of materials is related to the degree to which light is transmitted and reflected to the eye. On a scale from 1 to 2, the indices around 1.5 are about to be translucent (table 2). In reverse glass painting the interaction of light with the recommended materials works as follows: the light is transmitted through the glass plate, to a similar or equal degree through the glaze and then reflected by the metallic foil. This causes the paint to illuminate from within (fig. 3).[23]

Fig. 3. *The visual effect of the interacting materials in reverse glass painting.*

The reflections on the surface of the glass help to create a sense of mystery, an aspect that was desired in *verre églomisé* devotional objects.[24] This same effect seems also to be applicable to fol. 40v_01 where it is described how silver leaf on a white enamel cross has to be painted with dragon's blood or Indian lacquer (shellac?) distempered in turpentine and mastic.

Unlike turpentine the author mentions clearly in his treatise why mastic should be added to the

[22] Marjolijn Bol. "Oil and the Translucent. Varnishing and glazing in practice, recipes and historiography, 100-1600." (PhD diss., University of Utrecht, 2012), 124.
[23] Gerald W.R. Ward, *The Grove Encyclopedia of Materials and Techniques in Art* (Oxford: Oxford University Press, 2008), 253.
[24] Eswarin, *Reverse Paintings*, 13.

turpentine colors. On fol. 39v_a2 and fol. 39v_b2 it can be noticed that the turpentine colors without mastic are apparently too fluid. In order to stop them from running and flowing, it is recommended in both recipes to add a drop of mastic. The same can also be noticed on fol. 3r_c1a, a recipe on the imitation of coral. It mentions to mix a purified resin with mastic, because it makes the mixture more solid and also finer. Furthermore the recipe on fol. 39v_a2 tells us that the mastic makes the colors more unified. From the reconstruction it appeared that this means that the addition of mastic enables to paint with less visible brushstrokes.[25]

4. Technical research on resinous binding media

That crude turpentine and mastic were used for reverse glass painting can be confirmed by technical research that was executed by Ursula Baumer, Patrick Dietemann and Johann Kolleron (Conservation and Science Department of the Doerner Institute, Munich) in 2009.[26] A sixteenth century house altar and a seventeenth century folding game box were examined with the aid of gas chromatography/mass spectrometry (GC/MS) to identify the resinous materials.[27] The outcome of this research has shown that diterpenoids were detected and not the monoterpenes that are characteristic for turpentine oil. On the sixteenth century *Corning House Altar* there were found heat-treated Pinaceae resin, Venice turpentine and to a minor extent mastic. But also small quantities of other materials such as camphor resin, spike oil and even egg were found.[28] On the seventeenth century *Game Box* larch turpentine and unknown triterpenoids were detected.[29]

5. Turpentine and mastic in other technological sources on reverse glass painting

There are multiple treatises throughout history that are concerned with reverse glass painting. In art technological treatises there are different binding media to be found whereby especially various kinds of oil seem to be preferred. For example Cennino Cennini states in his very well known *Il Libro dell'Arte* (1390) to use an oil (unknown which one) in combination with ground colors such as verdigris, lac, ultramarine blue and black.[30] In the sixteenth century *Marciana Manuscript* (1513-1527) it is recommended to use glue, nut oil or linseed oil.[31] Only a few of the reverse glass painting treatises are concerned with crude turpentine or turpentine oil and mastic. BnF Ms Fr 640 seems to be the first manuscript on turpentine and mastic in the current state of knowledge, since other treatises on the subject

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[25] *AnnotationWinter2016_MagdalenaPilkoIlseSteeman_39v_a3*: '19 February 2016'.
[26] Baumer, Ursula, et al. "Identification of Resinous Materials on 16th and 17th Century Reverse-glass Objects by Gas Chromatography/Mass Spectrometry. *International Journal of Mass Spectrometry*, Vol. 284 (2009): 131-141. Accessed February 10, 2016.
[27] *The Corning House Altar* (Attributed to Southern Germany). 1560-1580. Resinous Paints on Glass. 49.6 × 19.5 × 12.7 cm. The Corning Museum of Glass, Corning New York; *Game box*. Resinous Paints on Glass. 21 × 21 cm. Staatlich Kunstsammlungen Dresden, Grünes Gewölbe.
[28] Baumer, et al. "Identification of Resinous Materials," 136.
[29] Ibidem.
[30] Daniel V. Thompson, *The Craftsman's Handbook "Il Libro dell'Arte" Cennino d'Andrea Cennini*, 2nd ed. (New York: Dover Publications, 1954), 113.
[31] Mary P. Merrifield, *Original Treatises on the Arts of Painting, Vol. 2* (New York: Dover Publications, 1849), 617, 619.

derive from the beginning of the seventeenth century. In these sources it is clearly stated to use turpentine oil and not a crude one. The anonymous author of the *Paduan Manuscript* (1590-1650) explains us to use spirit of turpentine (turpentine oil) and heated Greek pitch (colophony): '105. Lustro di rasa - Lustro di rasa, for grinding bright colors [for painting] on glass, is made with equal parts of spirit of turpentine and Greek pitch, placed over a moderate fire until the pitch is melted.'[32] Another one is the *Mayerne Manuscript* (1615) written by the German Théodore Turquet de Mayerne. This author suggests to use turpentine oil together with a drying oil or turpentine oil with some mastic. In his chapter on 'Applying all colors on glass' he states: 'White pitch which comes from the pine, but this oil evaporates and that's why you should [add] a bit of dry oil, with smooth prepared linseed-, nut or hemp oil; or very little turpentine.' [33] And 'Turpentine oil and nothing else, and rub the colors with enough oil and in the absence [of this oil] use turpentine oil with a bit of mastic.'[34]

Conclusion

The aim of this annotation was to understand why the author of BnF Ms Fr 640 may have found turpentine and mastic suitable as binding media in his described technique on reverse glass painting and what kind of turpentine he was aiming for. Especially in the third paragraph it has been established why a crude turpentine or turpentine oil with mastic are suitable for painting on glass. First of all, it appeared that the resinous materials dry very quickly compared to an slow drying oil, because of their volatile components. Besides, it appeared that the terpenes and fatty oils contained within these resinous materials act as strong fixatives. This has to do with strong cohesive forces which make the resins themselves very strong. Furthermore, the strong adhesive forces in the paints make it possible to adhere very well to the glass. According to the author himself, mastic is added to reduce the turpentine's fluidity and to make the colors more unified. Other very important aspects to consider are the refractive indices of the recommended binding media, the colors and the glass. They are very suitable for the desired translucency effects in reverse glass painting, because they are all light-transmitting materials.

It has been demonstrated that there are pros and cons considering crude turpentine or turpentine oil as the recommended turpentine. In the first paragraph it appeared already that there are several kinds of turpentine to be distinguished in the manuscript and that the one the author recommends to use for reverse glass painting seems to be crude turpentine and not the oil. The second paragraph has shown that turpentine in old recipes, according to Ralph Mayer, mostly did not refer to the oil but to the crude form of turpentine. The use of this kind of turpentine can also be confirmed by technical research that was executed on two reverse glass paintings from the sixteenth and seventeenth centuries. The fifth paragraph has shown that BnF Ms Fr 640 may be the first manuscript on reverse glass painting that recommends to use turpentine. But compared to later treatises it can be noticed that authors clearly recommend to use

[32] Merrifield, *Original Treatises*, 696.
[33] Gudrun Bischoff, *Das De Mayerne-Manuskript: die Rezepte der Werkstoffe, Maltechniken und Gemälderestaurierung* (München: Siegl, 2004), 237: "i.e. weißes Pech, welches von der Tanne kommt; nur verflüchtigt dieses Öl und deshalb soll ein wenig Trockenöl, mit glätte bereitetes Leon-, Nuß- oder Hanföl genommen werden; oder aber ganz wenig Terpentin."
[34] Bischoff, *Das De Mayerne-Manuskript,* 237: "Terpentinöl und nichts sonst, und reibe die Farben mit gen. öle und in Ermangelung desselben Terpentinöl mit ein wenig Mastix"

turpentine oil and mastic. Based on all the observations in this annotation it is believed to be more likely that the author referred to a crude turpentine.

During the reconstruction we used one particular crude turpentine. However, what would be interesting for further research is to investigate a variety of different crude turpentines. Regarding the technique of reverse glass painting, it would be interesting if there are differences in the handling, volatility and visual properties.

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List of figures

Appendices

Table 1

Type of turpentine	Type of turpentine (French)	Folio
clear turpentine	tourmentine claire, tormentine clair	fol. 10r_1, fol. 40v_01
clear turpentine varnish	vernis clair de tourmentine	fol. 61r_2
clear Venice turpentine	tourmentine claire de venise	fol. 56r_a2
clear white turpentine oil	d'huile de tourmentine claire et blanche	fol. 99v_a6
common thick turpentine	grosse tourmentine commune	fol. 3r_a3
common turpentine	tourmentine commune	fol. 3r_b3b, fol. 66v_1
fine turpentine oil	huile de tourmentine fine	fol. 3r_b3b
fine turpentine	tourmentine fine	fol. 4r_1, fol. 3r_b3b
turpentine varnish	tourmentine on vernist	fol. 4r_1
good quality turpentine oil	grande quantite d'huile de tourmentine	fol. 3r_b3b - fol. 3r_b3c
turpentine	tormentine, tourmentine, termentine	fol. 3r_a2, fol. 3r_c2a, fol. 23r_1, fol. 31r_3, 39v_a2, fol. 39v_b2, fol. 59r, fol. 60v_1, fol. 61v_2, fol. 61v_3, fol. 67r_1, fol. 67v_b3, fol. 88r_a3, fol. 98r_a1 , fol. 109r_1 , fol. 133r_1
turpentine colors	couleurs á/de tourmentine	fol. 10r_1, fol. 39v_a2, fol. 39v_b2, fol. 40r, fol. 42r_a2
turpentine oil	d'huile de tourmentine, huile de tourmentine, huile de tormentine	fol. 2r_2, 3r_c2a, fol. 3r_d3, fol. 29v_6, fol. 31r_3, fol. 51r_a1, fol. 58v_4, fol. 60v_1, fol. 61v_2, fol. 66v_1, fol. 67v_a3, fol. 88r_a3 , fol.

		97v_1, fol. 98r_a1, fol. 117v_c1a, fol. 126_b3b
turpentine varnish		fol. 3v_a1, fol. 4_r1, fol. 4r_1, fol. 6r_1 , fol. 7r_a2, fol. 56r_a2, fol. 56v_1, fol. 61v_2, fol. 67v_b3
white turpentine oil	l'huile de tourmentine blanc	fol. 60v_1
whitest turpentine oil	d'huile de tormentine de la plus blanche	fol. 3r_a2
venice turpentine	tourmentine de venise, tormentine de venise	fol. 3r_a2, fol. 66v_1, fol. 73v_3, fol. 80r_2
Type of mastic	**Type of mastic**	**Folio**
drop of mastic	l'arme de mastic	fol. 39v_a2, fol. 39v_a3, fol. 40v_01, fol. 60v_1, fol. 97v_1
mastic	mastic	fol. 3r_c1a, fol. 4r_1, fol. 7r_b3, fol. 42r_a2, fol. 42v_b6, fol. 60v_1, fol. 71v_1, fol. 74r_3, fol. 77v_1, fol. 79v_1, fol. 97v_1, fol. 98r_a1, fol. 99v_a6, fol. 100r_3, fol. 120v_c5b, fol. 133r_3
mastic oil	huile de tourmentine dicelle ou de mastic	fol. 31r_3
mastic varnish	vernis de mastic	fol. 3r_c2b, fol. 97v_1, fol. 99v_a6

Table 2

Recommended materials BnF	**Refractive index**	**Used materials in reconstruction**	**Refractive index**
Support			
float glass	1.52	float glass	1.52
Binding media			
turpentine oil?	1.47	turpentine oil	1.47
crude turpentine?	1.53	crude turpentine	1.53
mastic	1.535-1.536	mastic	1.535-1.536
Colors			
verdigris	1.53-1.56	verdigris	1.53-1.56
enamel azure: ultramarine?	1.50-1.63	ultramarine artificial	1.50-1.63
enamel azure: smalt?	1.52	ultramarine artificial	1.49-1.52
lacque platte: madder lake?	1.66	madder lake	1.66