

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:

Making and Knowing Project, Pamela H. Smith, Naomi Rosenkranz, Tianna Helena Uchacz, Tillmann Taape, Clément Godbarge, Sophie Pitman, Jenny Boulboulle, Joel Klein, Donna Bilak, Marc Smith, and Terry Catapano, eds., *Secrets of Craft and Nature in Renaissance France. A Digital Critical Edition and English Translation of BnF Ms. Fr. 640* (New York: Making and Knowing Project, 2020),
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THE APPLICATION OF DRAGON'S BLOOD ON METAL

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Transcription [from tc_p029v_a6, 12 May 2014]

<title id="p029v_a6">

Sang de dragon </title>

<ab id="p029v_b6">

Ayes de la larme diceluy bien choisie qui demonstre son rouge transparent Et mets dans une bouteille de verre dans suffisante quantite de la meilleure eau de vye quie tu pourras Et lestoupe bien et si diligemment qui ne sesevente point Aultrement il ne vauldroit rien Et le laisse ainsy longuement Car tant plus il demeurera il sera plus beau et meilleur et se dissoudra sil est bon Sinon il viendra comme lie de vin Quand tu en voudras user fais un petit pertuis au tapon de la bouteille et en verse un peu et le rebouche a chasque fois puy laplique sur lor Le bon sang de dragon se trouve a grands lopins comme pieces de torteau cestuy la ne vault rien si est sophistique et estant rompu il monstre par les costes des escailles transparentes comme esmail rouge cler il est aussy grumelle en quelques endroits comme petits rubis Il fault que leau de vye soict fort ardente et plusieurs passes </ab>

<note id="p029v_c6c">

Le posant sur lor bruny il est subject a sesclater Et pour ceste occasion aucuns couchent dessus du vernis de tourmentine Le froid retarde que leau nopere et face extraction de la couleur Et pour ceste occasion on la peult tenir au pres du foeu </note>

Translation [from tl_p029v_a6, 2 May 2014]

<title id="p029v_a6">

DRAGON'S BLOOD </title>

<ab id="p029v_b1">

Have a well chosen drop of it which shows its transparent red and put it in a glass bottle with enough quantity of the best eau-de-vie possible and close it very quickly so it doesn't blow out or it will be worth nothing otherwise and leave it so for a long time, because the longer it stays, the more beautiful and better it will be and it will dissolve if it is good otherwise it will turn like some lie-de-vin. When you want to use some, make a small hole in the bottle stopper and pour some and close it again each time and apply it on gold. Good dragon's blood can be found [...] this one is no worth if it is sophisticated, and broken it shows on its edges some transparent scale as light red enamel, it is also lumpy in some points like small rubies. The eau-de-vie must be very [...] </ab>

<note id="p029v_c6c">

When it is applied on gold, it is prone to break, this is why some apply on it some turpentine oil. Cold stops the water from pouring into and taking the colour off. And for that, you can hold it by the fire. </note>

Transcription [from tc_p040v_a1, 22 May 2015]

<title id="p040v_a1">Croix des commandeurs</title>
de malte</title>

<ab id="p040v_b1">Ce beau rouge clair qui faict le champ de la croix</ab>
blanche desmail est ~~sang~~ larme fine de sang de dragon</ab>
destrempe en eau de vye Ou bien laque platte dinde</ab>
qui a mon advis se faict en flandres Destrempee avecq</ab>
tormentine claire & larme de mastic & posee sur une foeille</ab>
dargent non pas de celle dont usent les *paintres* Mays</ab>
de celle plus espesse qui est brunie par *ceulx qui font les*</ab>
foilles de pierrerie ~~Au~~ ou par les *orfevres* & cella luy</ab>
donne ce bel esclat</ab>

Translation [from tl_p040v_a1, 22 May 2015]

<title id="p040v_a1">Cross of the commanders of Malta</title>

<ab id="p040v_b1">The fine rouge clair which is the background of the white enamel cross is of fine dragon's blood drops soaked with eau-de-vie or Indian laque plate, which I believe is made in Flanders, distempered with clear turpentine and mastic drops and applied on a silver leaf, not the one used by *painters* but a thicker one, which is burnished by the *makers of foil backings for gemstones* or by *goldsmiths*, and that gives it its fine brilliance.</ab>

Transcription [from tc_p165r_a5, 10 August 2014]

<title id="p165r_a5">Sang de dragon</title>

<ab id="p165r_b5">Il se peult imiter avecq la laque qui le surpasse en beaulte</ab>
si dicelle destrempee a huile tu en glaces sur lor ou argent</ab>
Destrempee a vernis elle se meurt</ab>

Translation [from tl_p165r_a5, 30 July 2014]

<title id="p165r_a5">Dragon's blood</title>

<ab id="p165r_b5">You can imitate dragon's blood with lacquer, which surpasses it in beauty, if [when] diluted in oil, you use it to ice gold or silver. Diluted with varnish, it fades.</ab>

Project Aims

This annotation is written to contribute to *The Making and Knowing Project* which is initiated and guided by Pamela Smith: Seth Low Professor of History and Director of the Center of Science and Society at Columbia University in New York. The project is developed to research an intriguing French manuscript dating from the last decades of the sixteenth-century, referred to as the BnF Ms. Fr. 640. In this manuscript an anonymous French writer and practitioner describes a number of processes that one in this current time could classify as being part of several crafts, fine arts and technology. The aim of the project is to produce an open-access digital edition and English translation of the manuscript. However the process by which this critical edition is being produced is as important as its product.¹ Research for the digital edition promotes both cooperation and exchange of knowledge between students and academic and museum-based historians of art and historians of science based on different continents who work together in order to reconstruct the technical prescriptions. These findings are used to get a better understanding of the text and could eventually be included as annotations in the open-access digital edition.²

Introduction

In the context of the course *Art Technological Source Research*, students of the MA Conservation and Restoration of Cultural Heritage from the University of Amsterdam have conducted research into different recipes from the BnF Ms. Fr. 640. Students with a specialization in metal have been given the opportunity to look into the recipes about “dragon’s blood” (fig. 1).³ Because of the available facilities at the studio building of the University of Amsterdam an attempt was made to reproduce the method described on folio 29v during a four-day reconstruction workshop.⁴ The main recipe about dragon’s blood (BnF Ms. Fr. 640, folio 29v) gives a description on how one could dissolve the resin and prepare it for use and which one is best for this purpose. During the reconstruction workshop a number

¹ About the project. 18-05-2015. <www.makingandknowing.org>

² About the project. 18-05-2015. <www.makingandknowing.org>

³ Dragon’s blood is a red resin that can be obtained from two different monocot plant genera: *Dracaena* and *Daemonorops*. These can occur in the tropics as well as subtropics on different continents. The *Dracaena* are trees with large trunks and branches from which the dragon’s blood can be collected by means of an incision in the stems. The most common *Dracaena* species are originated on the island of Socotra or the Canary Islands. The *Dracaena* that originates on the island of Socotra is called *Dracaena cinnabari*. This species is mentioned by several ancient writers like Pliny the Elder and Dioscorides. During the Roman period the Arabs used the resin obtained from the *Dracaena cinnabari* as a product of trade. The resin from the *Dracaena draco*, which occurs on the Canary Islands however, never became an important product of trade, since it was too important to the inhabitants of the islands. The *Daemonorops* monocot produces the resin on the surface of its unripe fruits. These palm species occur in Borneo, Malaysia and Sumatra. Howes 1949, p. 139-140, Langenheim 2009, p. 70-73, 441-444. During the four-day reconstruction workshop dragon’s blood obtained from the *Dracaena cinnabari* species was used. The reason for using this resin was mainly because it was pre-ordered. However it seems as if the French author practitioner from the BnF Ms. Fr. 640 could be referring to this type, since on folio 29v the use of a *larme* is mentioned several times. *Larme* could here be translated as being a *drop* or *tear*. The dragon’s blood of the *Dracaena cinnabari* is often described as being collected in teardrops. Cotgrave 1611, used online: < <http://www.micmap.org/dicfro/search/cotgrave/larme> > Langenheim 2009, p. 441.

⁴ The recipe about dragon’s blood on folio 29v can be recognized as being the main recipe on this subject.

of difficulties were encountered and several questions remained unanswered. Each of the four students that associate to the specialization metal formed a research question. These will be answered in four separate annotations that combined will form an overarched research into the preparation and usage of dragon's blood during early modern times.

The manuscript refers several times to dragon's blood, but this annotation will mainly focus on those recipes where the actual use of the substance is mentioned namely; the folio that describe the application of dragon's blood on a metal support. The primary question is in what way the BnF Ms. Fr. reveals why dragon's blood is applied on metal. The reason for addressing to this question is to enhance a better understanding of the usage of dragon's blood during the early modern period and it gives an insight into the historical approach of metal surfaces.

The annotation will start by discussing the directions that the manuscript gives for the application of dragon's blood on metal. It then proceeds with findings in other (art technological) literary sources in combination with a description of the performed reconstructions.⁵ Followed by a conclusion. To answer the main question of this annotation the focus will be on three folio discussing the applying of dragon's blood on a metal support: 29v, 40v and 165r. All figures are included in an appendix.

The application of dragon's blood on metal as implied by the author of BnF Ms. Fr. 640

Collecting all the folio on which the application of dragon's blood on metal is mentioned, resulted in the following three: 29v, 40v and 165r. On these folio the author practitioner of the manuscript only speaks of gold and silver to be suitable for this purpose.

The main recipe concerning dragon's blood on folio 29v gives a description on the preparation of the dragon's blood solution and in the end informs: "... and apply it on gold."⁶ Later the manuscript author comments on this recipe by writing the following in a side note: "When it is applied on gold, it is prone to break, this is why some apply on it some turpentine oil. Cold stops the water from pouring into and taking the color off. And for that, you can hold it by the fire."⁷ Here the application on gold is mentioned again, after which tips are given for a better outcome, however the reason for applying the dragon's blood on a gold surface is not revealed. Slightly more information on why one should apply the dragon's blood on a gold or silver surface is given on folio 40v and 165r. Folio 40v describes the application of dragon's blood on silver leaf to obtain a fine and brilliant red background color like the one in the Cross of the Commanders of Malta (fig. 2). The description on 165r reveals the substance could be used to ice gold or silver.⁸

⁵ For a comprehensive report of the four-day reconstruction workshop one can consult the logbook.

⁶ BnF Ms. Fr. 640, folio 29v.

⁷ BnF Ms. Fr. 640, folio 29v.

⁸ The description on folio 165r is not very clear. The author states: "You can imitate dragon's blood with lacquer, which surpasses it in beauty, if [when] diluted in oil, you use it to ice gold or silver. Diluted with varnish, it fades." The part where the author gives the description "when diluted in oil, you use it to ice gold or

After reading these recipes carefully, it is clear the author notes the possibility of applying the dragon's blood to a gold or silver surface. But it is only on folio 165r that the reason for the application of the dragon's blood to the surface is briefly mentioned by the word *ice* (*en glaces*, tc_p165r). It is difficult to know in this instance what the word *ice* meant to the manuscript author. A first guess could be to color. The author describes on folio 40v that dragon's blood is able to give a surface a brilliant and red (background) color. When the word *ice* is looked up in a modern dictionary, its meaning is: *to cover or decorate*.⁹ In this sense it could be possible that the author gives a recipe on how to color a gold or silver surface. But the question is here, if this was also the meaning the word *ice* had in late sixteenth-century France. To find out, the French word *glacer* (*to ice*) was looked up in an early seventeenth-century dictionary of French and English Tongues by Randle Cotgrave. Here the meaning of the word *glacé* or *glacer* is described as: *frozen, concealed, hardened, turned into, covered over with or ice*.¹⁰ It was the definition of *turned into* that became noticed. Should the *en glaces* in the recipe on folio 165r be used in the meaning of *turned into*, it would place the recipe in a totally different perspective: it would be a description on how dragon's blood could be used *to turn* something *into* gold or silver. The different meanings of the English word *ice* and French word *glacer* could help as a guideline for finding more information about the function of the application of dragon's blood on a metal surface. Research was done into other art technological and literary sources to see if similar recipes could be found and/or the reason for applying dragon's blood on metal could be revealed.

Other findings in regard to the application of dragon's blood on metal

After looking into other literary sources, dating from the early modern period till now, two main reasons for using dragon's blood as an ingredient to prepare a substance that could be used to apply on a metal surface were found and will be explained below.

First of all, the red resin seemed to be used to give color to metals. In the early modern period the main reason for the coloring of metal in this way was to improve the color of gold or to glaze other metals in imitation of gold. One early text, the *Mappae Clavicula* (9th century) contains many recipes for gold-colored coatings, including one for an "easy way of gilding". The ingredients are: gold colored sandarac, orpiment, gum tragacanth, an egg-yolk and a goats gall.¹¹ What became noticed is that these ingredients are mainly yellow colored materials. How they were used or on what surfaces is

silver" could refer to the dragon's blood, but also to the lacquer with which one could imitate the dragon's blood. Either way, when following the recipe the substance (being dragon's blood or an imitation) should be used to ice gold or silver. As the meaning of the word *imitation* is: *to use or follow as a copy, to appear like or resemble*, it could be assumed that if that part of the recipe refers to the imitation of dragon's blood, the type of surface on which the substance should be applied to, would be the same as for the dragon's blood as well. Dictionary. 28-05-2015. <<http://dictionary.reference.com/browse/imitation?s=t>>. BnF Ms. Fr. Folio 165r.

⁹ Dictionary. 28-05-2015. <<http://dictionary.reference.com/browse/ice?s=t>>.

¹⁰ Cotgrave 1611, used online: <<http://www.micmap.org/dicfro/search/cotgrave/ice>>

¹¹ Smith and Hawthorne 1974, p. 36.

not stated. Recipes for gold-colored varnishes like these are often found in craftsmen's recipes or formula books and become more explicit as time goes on.¹² Therefore, it was in art technological sources of a later time that the mentioning of dragon's blood could be found. Unfortunately not a lot of information on the use of the dragon's blood dating to the late sixteenth-century was obtained, however related recipes could be found dating from the seventeenth- till the twentieth-century, which can be very interesting as they give a description on how dragon's blood was used as an ingredient for gold-colored varnishes.

During the seventeenth- and eighteenth-century various white-colored metals were used as under layer for gold-colored varnishes. One name for silver-colored leaf coated with gold varnish in the seventeenth-century was *Golden Mecca*, the coating being composed of: shellac, gamboges and dragon's blood (fig. 3).¹³ A recipe that is commonly mentioned in later gilding manuals.¹⁴ During the seventeenth- and early eighteenth-century, the use of silver leaf as a component of "silver gilding" in this way, offered craftsman a cheaper and entirely convincing alternative to gold leaf. Gold varnishes or lacquers were also used extensively on brass to overrule the somewhat greenish cast and to make the metal more nearly resemble gold. This seemed to have been common practice during the eighteenth- and nineteenth-century for a lot of objects made of polished brass, such as: scientific instruments, furniture hardware and decorative objects (fig. 4).¹⁵ But in these recipes, dragon's blood is unfortunately not often mentioned.¹⁶ Later, even gold was coated to further manipulate the color. This was commonly done during the nineteenth- or twentieth-century. The colored coating, sometimes referred to as *Ormolu*, was commonly composed of: seed-lac, gamboges and dragon's blood dissolved in alcohol, then mixed with diluted animal glue.¹⁷ The coating was used to deepen the color of the gold as well as to even out inconsistencies and lap-marks in the gilding.¹⁸

The recipes for gold-colored varnishes during these centuries can be characterized as organic coatings based on drying oils or alcohol-soluble resins, colored with a variety of red and yellow organic dyes or resins.¹⁹ The colorants most often used in early modern recipes for gold-colored coatings included natural plant dyes like: annatto, saffron, turmeric and alkanet, dyewoods like: brazil wood, red sandalwood, eaglewood or cam wood and/or colored resins like: gamboges, alloës, accroides, and of course dragon's blood.

¹² The twelfth-century treatise by the monk Theophilus also contains recipes for making gold-colored varnishes. But these are only early examples of many of such recipes and instructions that were subsequently published. Theophilus translated by Hawthorne and Smith 1963, p.37-40, 115-119. Thornton 2000, p. 309.

¹³ DeVoe 1971, p.97.

¹⁴ Parker 1688, p. 62-64. Bonnani 1742, p. 44-52.

¹⁵ Thornton 2000, p. 310.

¹⁶ Unknown 1767, p. 26-27, 31, 34.

¹⁷ The term Ormulu is also an English term to refer to the eighteenth-century finely ground, high carat gold-mercury amalgam to an object of bronze. Scott-Mitchell 1905, p. 32. Schulze, translated by Thomson 1839, p. 47-52.

¹⁸ Thornton 2000, p. 308.

¹⁹ During the conference on Friday 22 may 2015, it has been said that the colors yellow and red are important for creating a cold (like) color. Further research on this topic could be interesting.

Another reason to use an ingredient like dragon's blood to apply on the surface of gold or silver (leaf) during the early modern period, was to provide this surface with an intense red color. The author of the manuscript describes on folio 40v how it's possible to create a fine and brilliant red background color using dragon's blood, like the red in the background of the Cross of the Commanders of Malta (fig. 2). As it is possible to create a translucent or opaque fine and brilliant red color on a silver or gold (leaf) surface using dragon's blood, one could state that the use in this way can be interpreted as being an imitation of red enamel, also known as *Rouge Clair* or *Ruby Glass*.²⁰ Ruby glass is difficult to create. The enamel has to melt in order to apply it on the metal, which can influence or even spoil the color of the glass.²¹ That red enamel was very difficult to create is confirmed by the sixteenth-century goldsmith Benevento Cellini, who found it was impossible to enamel red onto silver or copper, though it could be done on gold.²²

An enameling technique fairly popular during the early modern period was *Limoges*. Limoges is an enameling technique originated in the town with the same name in western France at the end of the fifteenth-century. It allows the greatest freedom to the enamellist, as it can be applied with a brush just as one would apply paint. It can cover a whole surface with enamel, without cloissons or any metal separations whatsoever (fig. 5).²³ So one could perhaps anticipate, that the use of the dragon's blood substance could have imitated such a type of enameling. The reason for using this imitated solution then would be, because of the difficulty by which red enamel could be created. To conclude: The dragon's blood substance could be used as a cheaper and easier method by which a similar appearance of a red Limoges enamel on a gold or silver (leaf) surface could be obtained.

Reconstruction

In order to test above described findings and to see if it is in fact possible to reconstruct the recipes of the Bnf Ms. Fr. 640 a view experiments were done. The first to be accessed was the preparation of the right dragon's blood solution for use as described on folio 29v.²⁴ To test the solution as well as the function of the solution it was applied on two types of metal surfaces. Firstly on brass, as the color of this metal is equal to that of gold and at first it seemed like no gold or gold leaf would be available for use. The resemblance with gold was stimulated by polishing half of the brass plate. The brass plate

²⁰ That it is possible to use dragon's blood for this purpose can be found in the logbook of the four-day reconstruction workshop. Also this is mentioned by the author of the manuscript on folio 40v. Cellini states red enamel was discovered by a wise men, who was a alchemist and goldsmith as well. While engaged in the search to make gold, he mixed together a certain composition and when his work was done, there appeared among the stuff in the metal rest of his crucible a sediment of the loveliest red glass, just as we see it to this day. Cellini states this enamel is far the most beautiful of all, and is termed in the goldsmiths' art *smalte roggio* or *rogia chlero* (Rouge Claire, red enamel). Cellini, translated by Ashbee 1967, p. 16.

²¹ 21-05-2015. <http://www.britishmuseum.org/explore/highlights/articles/i/investigation_royal_gold_cup.aspx>

²² Cellini, translated by Ashbee 1967, p. 16-17.

²³ Maryon 1912, p. 197-206. Untracht 1957, p. 66-67.

²⁴ Extensive information on how the dragon's blood solution was made can be found in the logbook of the four-day reconstruction workshop. Also the annotation of Marianne Nuij may provide additional information on this subject.

was divided into four sections and these sections were divided into four sections again. In this way four different solutions, of which all were once applied with and once without being mixed with turpentine oil, could be applied on the polished as well as the un-polished brass surface. The reason for adding turpentine oil was because the author practitioner on folio 29v describes: “When it is applied on gold, it is prone to break, this is why some apply on it some turpentine oil.” What can be concluded from applying the solutions on brass is that the solutions with the higher concentration of dragon’s blood were more difficult to apply finely. Brushstrokes and sometimes even bubbles that were formed by the evaporation of the alcohol from the solution remained visible (fig. 7). Also with respect to these solutions, the brass got a very red color, unlike a more gold color that could have been desired during the early modern period. As for the solutions with a lower concentration of the resin these gave a more even surface, and could be used to give the brass a different tincture.

The second surface on which different dragon’s blood solutions were applied was gold leaf. Two tinctures of gold leaf were applied on a copperplate: one yellowish kind and one red. Again the solutions with a higher concentration of the dragon’s blood resin had a more red color and were of a thicker substance which made it more difficult to apply finely, although less brushstrokes or bubbles remained visible this time (fig. 8/9). As for the solutions with a lower concentration of the resin, these substances did manage to give the gold leaf a different tincture or a somewhat different gold-like appearance.

The second experiment consisted of reproducing the recipe on folio 40v: “The fine rouge claire which is the background of the white enamel cross is of fine dragon’s blood drops soaked with eau-de-vie or Indian laque plate, which I believe is made in Flanders, distempered with clear turpentine and mastic drops and applied on a silver leaf.” Here the author dissolves the resin in eau-de-vie and adds it to a mastic varnish, which is a mixture of mastic and turpentine.²⁵ For the experiment a mastic varnish was used that had been made in November of 2002, consisting of 125 grams mastic and 250 grams of turpentine.²⁶ To a dragon’s blood solution containing 2 grams of dragon’s blood resin dissolved in 4 ml eau-de-vie, one drop of this varnish was added. This substance was then applied on a polished silver plate and gave a very good result (fig. 10). The substance was very work-able, had a beautiful deep-red color, was translucent and could in all probability resemble an enamel-like layer. Because of this good result it was then applied on the gold leaf test plates, as it is known gold leaf could also have been used as an under layer for enamel imitating or coloring layers during the early modern period (fig. 6). The application of this substance on the gold leaf test plates gave the same

²⁵ That the author is most likely referring to *turpentine* as being the binding agent, is when he states: “distempered with clear turpentine..” on folio 40v not all that clear, as turpentine in Dutch could also be translated as spirits. For this reason more experiments are described also using spirits in the logbook. The reason why it’s expected that the author refers to turpentine (or maybe even turpentine oil) and not spirits is because in contrast to spirits, turpentine is a natural product, it has a greater dissolving power and it is been said to leave a stronger coating. More information on this subject can be obtained from the logbook of the four-day reconstruction workshop.

²⁶ This already made mastic varnish was used, as the time necessary to dissolve mastic in turpentine is quite long.

positive outcome (fig. 8/9).

To conclude these experiments on the application of dragon's blood on a metal surface, it seems as if the result, as regards to color or translucency, depends on the proportions used during the preparation of the solution. However, also the metal support the solution is applied on could enhance a better outcome; hence the results on the brass plates in comparison with those on silver or the gold leaf. Unfortunately not all findings on why dragons' blood could be applied on metal during the early modern period were substantiated by these experiments. The use of dragon's blood as an ingredient to make a substance by which Rouge Clair or Ruby Glass can be imitated, could be demonstrated a bit. Although not all was quite clear while considering the recipes, still a pretty good result was achieved during the four-day reconstruction workshop.²⁷

Conclusion

In order to look for the reason why dragon's blood would be applied on a metal surface, three recipes in which this act is mentioned were studied carefully. These recipes did not give a lot of information on the function of applying the dragon's blood on metal, although the author did make quite clear only gold or silver (leaf) would be suitable for this purpose. Most of the clues were found in recipes on folio 40v and 165r. The recipe on folio 40v described the way by which the use of the dragon's blood substance could enhance a fine and brilliant red color on silver leaf. The recipe on 165r was a little more cryptic by referring to the use of the substance with the verb *to ice* or *en glaces* in French.²⁸ While doing further research it became noticed that this verb in early modern times had several meanings: it could refer to *cover* or *decorate* or it could mean something like *turn into*.

After searching through other art technological and literary sources, two main reasons for using dragon's blood as an ingredient for a substance that could be used to apply on a metal surface were found. The first reason seemed to be to improve the color of gold or to glaze other metals in imitation of gold. This practice became fairly popular for white-colored metals during the seventeenth- and early eighteenth-century and even for colored metals like brass or gold itself during later decades. Although no recipes dating earlier than the seventeenth-century were found, practice like this could have been known in earlier times. This method by which a metal surface is "gild without the use of gold" kept on being used till modern time. The other reason could have been to imitate red enamel also known as Rouge Claire or Ruby Glass. Limoges enamel was a fairly popular enamel technique during the early modern period, but the creating of a red color very difficult. In this way the dragon's blood substance could have been used as a cheaper and easier method by which a similar appearance of a red Limoges enamel on a gold or silver (leaf) surface could be obtained.

These findings were partly confirmed by the experiments done during the four-day

²⁷ A more detailed description of all the experiments can be found in the logbook of the four-day reconstruction workshop. This comprehensive report of the experiments also contains more pictures.

²⁸ Transcription of folio 165r.

reconstruction workshop. The preparing of the dragon's blood solution as well as the applying of the solution were all well managed. It became noticed that indeed it is possible to use the dragon's blood resin to create an enamel like layer on a silver or gold leaf surface. Also the gold leaf could be made into a different tincture by using a thin dragon's blood solution. Unfortunately a truly golden varnish was not obtained.²⁹

So to end here with an answer to the overarching question: in what way does the BnF Ms. Fr. reveal why dragon's blood is applied on metal, one could say that it is quite a mysterious way. The manuscript author gives only a few short indications on the function of applying the dragon's blood on a gold or silver (leaf) surface.³⁰ But these can be deciphered by searching through other art technological and literary sources dating from the early modern period till recent time.

Acknowledgements

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²⁹ This doesn't seem to reject all findings. The author of the manuscript does not directly mention the recipe as being to create a gold-colored varnish. However, no proof of it being not the case for these recipes can be given either. Further research on this topic could be interesting.

³⁰ One can think of several reasons why the author did not elaborate on this subject.

References

- Bonnani, F. *Verhandeling over de vernissen waar in de wyze opgegeeven wordt, om 'er een toe te stellen, dat 't Chineesch vernis volmaakt gelykt: benevens verscheide andere zaken rakende de schilderkunst, 't vergulden, 't etsen, etc.* Leiden: Jacobus Willeke, 1742.
- Cellini, B. *Treatises on Goldsmithing and Sculpture*. Florence, 1568. Translation by C.R. Ashbee. New York: Dover Publications Inc, 1967.
- Cotgrave, R. *Dictionarie of the French and English Tongues*. London, 1611. 27-05-2015 <<http://www.micmap.org/dicfro/search/cotgrave/>>
- DeVoe, S. S. *English Papier Mache of the Georgian and Victorian Periods*. Middletown: Wesleyan University Press, 1971.
- Dictionary. May 2015. <<http://dictionary.reference.com/>>
- Dossie, R. *The Handmaid of the Arts*. London: J. Nourse Bookseller, 1758.
- Howes, F.N. *Vegetable Gums and Resins*. Waltham, Massachusetts: Chronica Botanica Company, 1949.
- Langenheim, J.H. *Plant Resins: Chemistry, Evolution, Ecology and Ethno botany*. Portland: Timber Press, 2009.
- Maryon, H. *Metalwork and Enamelling: A practical Treatise on Gold and Silversmiths' work and their allied crafts*. London: Chapman and Hall Ltd, 1912.
- Parker, G., J. Stalker. *A treatise of japaning and varnishing, being a compleat discovery of those arts : with the best way of making all sorts of varnish for japan, wood, prints, or pictures : the method of guilding, burnishing, and lackering... and of painting mezzo-tinto-prints*. Oxford, 1688.
- Schulze, Aug., G. Entrup-Bavink. *Leerboek der Verlakkunst, of praktische handleiding om alle soorten van Lakken en Vernissen te bereiden*. Translation by W. Thomson. Groningen: J. Oomkens, 1839.
- Scott-Mitchell, F. *Practical Gilding Bronzing and Laquering*. London: The Trade Papers Publishing Company, 1905.
- Smith, C. S., J. G. Hawthorne. *Mappae Clavicula: A little Key to the World of Medieval Techniques*. Philadelphia: Penn, American Philosophical Society, 1974.
- The British Museum: Investigation of the "Rouge Claire" glass on the Royal Gold Cup*. 21-05-2015. <http://www.britishmuseum.org/explore/highlights/articles/i/investigation_royal_gold_cup.aspx>
- Theophilus. *On Divers Arts: The Foremost Medieval Treatise on Painting, Glassmaking and Metalwork*. Translation by J. G. Hawthorne, C. S. Smith. New York: Dover Publications Inc, 1963.
- Thornton, J. 'All that glitters is not gold: other surfaces that appear to be gilded.' In: Drayman-Weisser, T., e.a., red. *Gilded Metals: History, Technology and Conservation*. London: Archetype Publications Ltd, 2000: 307-317.
- Unknown. *BnF Ms. Fr. 640*. France, Late 1700.
- Unknown. *Lak, Vernis en Verf-Konst, om alle soorten van lakken, vernisse en verfen te beryden door een liefhebben beschreven*. Amsterdam: Gerred ten Boekelaar en Zoons, 1767.
- Untracht, O. *Enamelling on Metal*. New York: Greenberg Publisher, 1957

Appendix



Fig. 1. Dragon's blood from Socotra.
Photo: Michaela Groeneveld, 13-04-2015.



Fig. 2. Several crosses for the Commanders of Malta.
Photo: <http://vaticannewworldorder.blogspot.nl/2012/04/welcome-to-official-website-of.html>. 21-05-2015.



Fig. 3. This gilt silver table is covered with a yellow varnish that imitates gold. Much southern Italian gilded furniture used silver that was coated with this type of varnish to create a golden luster: a sort of "poor man's gold."
Italian (Sicilian) Silver Gilt Side table. 1750.
J. Paul Getty Museum, Los Angeles U.S.A.
Photo: <http://www.getty.edu/art/collection/objects/1272/unknown-maker-side-table-italian-mid-18th-century/>. 21-05-2015.



Fig. 4. Clock pendulum bob of brass, covered with a gold-colored varnish.
Photo: Thomson 2000, p. 310.



Fig. 5. Limoges Enamel, and Diamond Brooch, Tiffany & Co. The enamel scene depicting a cherub playing a harp, framed by old mine-cut diamond melee. 7-8 inches. Auction House Skinner.

Photo:

<https://www.bidsquare.com/l/180/antique-18kt-gold-limoges-enamel-and-diamond-brooch-tiffany-co.> 21-05-2015.



Fig. 6. Splendid and colourful Hinterglasmalerei in the Amelierung technique with gold foils on two panels of the Corning House Altar. ca. 1560–1580, before restoration. The red paints contain dragon's blood from Dae. draco. The width of the altar with closed wings is 19.5 cm. Photo: Simone Bretz, Oberau, © The Corning Museum of Glass, Corning (NY)

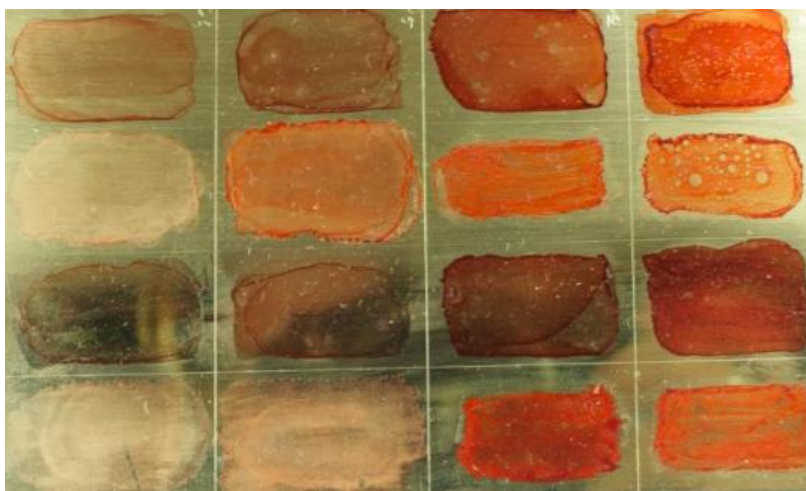


Fig. 7. Testing plate of Brass. Here the two bottom rows are applied on the polished half of the plate. From left to right: higher concentration of dragon's blood put in solution. Photo: Michaela Groeneveld, 15-04-2015.



Fig. 8. Test plate of copper with gold leaf: reddish tincture. From bottom to top: higher concentration of dragon's blood in solution. Middle: Same solution as applied on silver, recipe from folio 40v.

Photo: Michaela Groeneveld, 15-04-2015.



Fig. 9. Test plate of copper with gold leaf: yellowish tincture. From left to right: higher concentration of dragon's blood in solution. Middle: Same solution as applied on silver, recipe from folio 40 v.

Photo: Michaela Groeneveld, 15-04-2015.

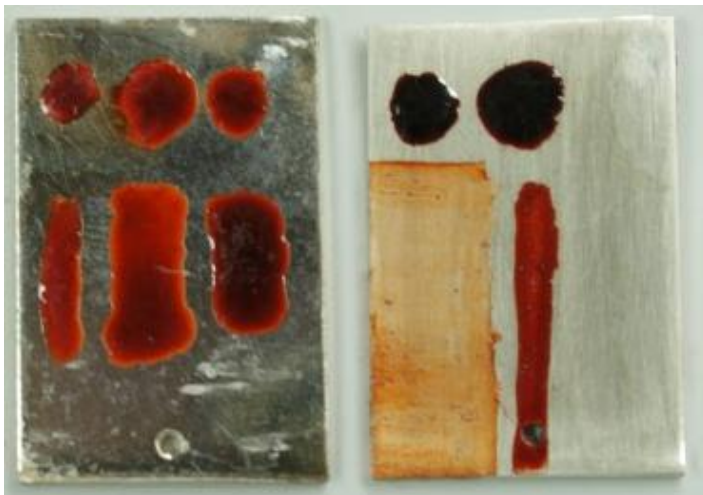


Fig. 10. Test plates of silver. Left: polished. Dragon's blood solution prepared as described in the recipe on folio 40v. Right: un-polished. Same solution as applied on gold leaf, recipe from folio 29v.

Photo: Michaela Groeneveld, 15-04-2015.