In Varying Shades of Brown
- Searching the colourful past of a 18th century masterpiece

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Front page: Figure 1  The masterpiece of Gottlieb Iwersson and its original drawing.
ABSTRACT

The colourful past of the late 18th century marquetry furniture has seldom been highlighted. Through ageing and environmental influences, colourful marquetry furniture has lost their original expression. The current knowledge of how Swedish cabinet-makers in the late 18th century used dyes to colour their furniture is limited. Trace of colour has been observed and the use of dyes has been mentioned, but deeper research in this filed is missing.

A visual examination and studies of archive documents and previous research have been performed to investigate the colourful past of Gottlieb Iwerssons masterpiece, a secretaire in Gustavian style made for the king Gustav III. The result shows that the secretaire has a colourful past in accordance with its original drawing. A hypothetical picture has been created to illustrate the colourful original appearance.
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1. INTRODUCTION

In varying shades of brown – that’s how the visual appearance of antique wooden furniture can be described. It is generally known that wood changes in appearance as time goes by, which often shows clearly on marquetry veneered furniture; the wood changes it’s colour, contrasts are reduced and colours fade. The result is a piece of furniture with a very different expression than the original appearance.

In order to better understand and appreciate artefacts, art historians and conservators are searching for knowledge about the materials artefacts have been made of. Knowledge about the dyestuffs used for staining wood cannot only give a hint of the original appearance, but also contributes to the information about dating and origin, the chemistry of degradation and material history. Further, it may also form the basis for prevention and conservation measures.

The current knowledge of how Swedish 18th century cabinet-makers coloured their furniture, and to what extent, is limited. There are relatively few scholars and collectors in furniture history that deal with aspects of the use of dyes by Swedish cabinet-makers. Traces of colour can be seen on several pieces of furniture from the late 18th century, even if most of them today have a rather brown appearance. One valuable contemporary source that indicates the use of dyes is a description of an intarsia made by the Royal cabinet-maker Georg Haupt in 1776. An excerpt of the description follows: [...]inlaid work of veneer in different colours...blue, yellow and red banners...golden fringe...oak leaf festoons and laurel twigs, tied with red ribbons...all inlaid in a light grey bottom that looked like a silk-moire...covered with a thin varnish...[1]

Another historic source is inventory documents from the master cabinet-makers. Where “grey wood”, “grey-stained veneers” and “imitation wood species”, may refer to the use of dyes.

An interesting aspect is that some of the preserved masterpiece drawings, from the old cabinet-makers guild, are coloured. One of them is the drawing of Gottlieb Iwerssons masterpiece, a royal secretaire in Gustavian style, from 1778. This secretaire most likely had a colourful past, which partly is revealed by its interior. A colourful past, which seems to contrast with the commonly communicated picture of the Gustavian style - classical and simple with a restrained palette.

1.1 Aim and goal

The aim of this thesis is to highlight the fact that colourful marquetry furniture has lost their original expression through ageing and environmental influences. This thesis aims to contribute to a balanced picture of the rather ‘brown’ view on late 18th-century marquetry furniture and to raise questions and thoughts about their colourful past.

The goal of this project is to create a hypothetical picture of how Gottlieb Iwerssons masterpiece originally appeared. In addition, review previous research in order to give a brief overview of the scientific analysis methods used for identification of dyestuffs in wood marquetry, as an introduction to further research possibilities.

1.2 Question at issue

Has the masterpiece of Gottlieb Iwersson been as colourful as the original drawing shows? i.e. how did the masterpiece originally looked like?

Sub-questions:

What type of veneers have been used in making the secretaire?

What kind of surface treatment coats the masterpiece? Does the finish affect the colour appearance?

Which traces of colour can be seen on the masterpiece?

Which dyes were known at the time of production of the secretaire?

How can the drawing be evaluated as a source in attempt to define the original appearance of the secretaries’ colours?
1.3 Limitations

The limitations have been significant for this project. The original approach was to carry out a scientific analysis in an attempt to identify some of the dyestuffs in the marquetry of Gottlieb Iwerssons masterpiece. This requires collaboration with an institute with expertise competence and equipment for the analysis. A closer interaction with some institutes was discussed, but for several reason this could not be realised at this point. Because of this, the project was for the time being limited to a visual examination of the object together with literature studies. In the examination of the masterpiece no samples could be taken, neither could any veneer or bronzes be lifted for further observations. The outcome of this study should rather be regarded as a preliminary study.
2. PROJECT APPROACH

To answer the question at issue and to reach the goal of this thesis, a visual examination of Gottlieb Iwerssons masterpiece and its drawing has been performed. In addition, literature studies was conducted to give a historical review presenting Iwersson and his masterpiece and to find answers to the sub-questions. Furthermore, previous research has been reviewed to introduce the scientific methods used for identification of dyestuffs in wood marquetry.

Iwerssons masterpiece is a magnificent piece of craftsmanship. It has been selected as an example to highlight the colourful past of marquetry furniture in Sweden. The colourful original drawing makes it an interesting object in the search for the original appearance, and was the source to the questions aroused regarding a colourful past. Access to both the masterpiece and the drawing has been essential to carry out the examination. Moreover, it has a documented provenance, presented in part 3.2.

The visual examination were simply performed by macroscopic observations of the masterpiece and its drawing to answer the sub-questions. The results were then interpreted with support from literature studies and previous research to create a digital picture of the masterpiece’s original appearance. The picture was created in Adobe Photoshop CS5.

The studied literature has mainly consisted of published articles, books related to the topic and historic documents from the National Library of Sweden. Both Swedish and international sources are reviewed. In some cases the author of the article has been contacted for further questions about their work. Their remarks and contributions are referred to in notes. Regarding the examination of the masterpiece and the drawing, the sources consist of proven experience in combination with literature studies and discussion with colleagues within the conservation field.

The method used for this study requires a critical approach, as the results of the visual examination are not of scientific nature. The reliability of the method can be regarded as low since the outcome of interpreting the results of the visual examination can vary, due to several factors including personal experience. However, the method, supported by literature studies, is regarded as sufficient to meet the aim of this thesis. As for the literature study, it is by no means comprehensive, but instead selected to give a summarized overview of the topic, in relation to this thesis.
3. HISTORICAL REVIEW

This chapter aims to give historic information about the study object and its maker, describing the special provenance of Gottlieb Iwersson’s making of his masterpiece. The chapter also include the history of the drawing in order to evaluate it as a valuable source. Furthermore, the commonly communicated picture of the Swedish Gustavian style is presented, perhaps in this text provocatively, but as an interesting aspect in relation to an colourful past of the wooden marquetry furniture of its time. The chapter ends with a review of historic sources to give answers on which dyes were known at the time of the production of the masterpiece.

3.1 The Gustavian style

The secretaire, dated 1778, was made during the Swedish Gustavian period. The Gustavian style has become very important in the Swedish style history. The period began with King Gustav III’s coronation in 1771, and can be viewed as a Swedish version of the French Louise-the sixteenth. The style, including architectural, decorative and applied art, was in fashion until about 1785, followed by the late-Gustavian style. Its distinctive contrast to the preceding rococo is due to the forms dating back to ideals of the Classical antiquity. Posterity’s scholars and collectors usually characterize this style as classic and simple in a restrained palette. It is one of the most favoured styles adapted to the reconstruction of historic buildings and in museums. It has a high popularity on the auction markets and it has been launched in a series of furniture by IKEA. Internationally it has been presented as “the Swedish country style”. This popular image of the Gustavian style has in recent years been questioned.

One of the contributions to the debate is Victor Edman’s “The eighteenth century as Swedish ideal, modern reconstructions of historic environments” (2008). In three case studies of restoration projects, Edman examines archive material in order to highlight how the image of eighteenth century historic environments was created. Edman’s studies shows that the image of the Gustavian style, created during the early 20th century often differ from the image given by archive material and old documents. In the later chapters of the book, Edman describes the reconstruction of Gustav III:s Pavilion at Haga. In the text it appears that on several occasions during the reconstruction, the information in the archive material and old documents, has been neglected in favour of contemporary aesthetic values.

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2 Translation of the original Swedish title; Sjuttonhundratalet som svensk ideal, moderna rekonstruktioner av historiska miljöer.
This seems to be valid for the entire 20s; our contemporary style ideal fits our perception of the Gustavian style, an incorrect perception, according to Edman’s review. The ‘false picture’ of the Gustavian style, which is still dominant, should be questioned to obtain a more nuanced and true description. This includes the brownish appearance of the Gustavian wood marquetry furniture. The question, “does a colourful past of these furniture fit the ‘false picture’ of the Gustavian style?”, might be considered as a provoking one, but should be faced.

3.2 Gottlieb Iwersson and his masterpiece

Iwersson is considered to be one of the best Swedish Royal cabinet-makers, a part of his history is known. One of the more comprehensive texts about Iwersson is Ernst Fischer’s book from 1916: Kongl. Slottssnickaren och Schatullmakaren Gottlieb Iwersson. Which is primarily based on studies of archive sources.

Son of a master cabinet-maker, Iwersson, born 1750 in Malmö Sweden, started his training early in his father’s workshop. In 1769 he became a journeyman and the same year he applied for the master title in the city of Malmö, but was denied. The competition was fierce. In hope for better luck, Iwersson moved to Stockholm, where he worked as a journeyman in the workshops of Nils Dahlin and Petter Ljunggren, two well-known cabinet-makers. In 1774 Iwersson applied for the master title at the cabinet-makers guild in Stockholm, but was again denied. Many older cabinet-makers were already in line. This would not stop Iwersson, he was an ambitious man and kept applying for the title, but without success.

In his impatience, Iwersson turned in person directly to the king, Gustav III, an action that created quite a stir, not at least at the cabinet-makers guild in Stockholm. Iwersson offered the king a drawing of a secretaire. The monumental piece, with marquetry and bronzes of the Royal coat of arms, was entirely in the king’s taste. “In accordance with the king’s desire, the piece of furniture started by Iwersson, will be called a Secretaire en armoir... and be regarded as a masterpiece”3. Thus the cabinet-makers guild in Stockholm had to approve it as a masterpiece and with the completion of the secretaire, Iwersson finally received the master title in 1778.

3 Free translation after Fischer (1916, p.18); “Dock likwäl och til aller-underdånigsta wyrdnad fullaste åtlydnad af Hans Kong. Maij:ts nådige wiljas befallning komer det af Ifverson redan påbegynte Stycket kalles en Secretaire en armoir el:r Skrifpulpet... att för M:re stycke anses...”
Iwersson started his own workshop, and he was successful, especially after the death of Georg Haupt in 1784, when Iwersson inherited the title as the foremost of contemporary cabinet-makers. He is still considered to be one of Sweden’s greatest royal cabinet-makers, and his furniture became significant for the late Gustavian period.

**The masterpiece**
Made for the King Gustav III, the centre front is decorated with a large marquetry of the Swedish Royal coat of arms. Underneath, the figures on the drawer illustrate the king’s interest in arts, music and literature. The side panels present hanging garlands of leaves, nailed on the background in a rosette ribbon. The garland frames an arrangement of the Swedish flag, banners, crossed swords and a crowned G – for Gustav III. The lower parts of the sides are decorated with an inlay of a festoon and a garland, held by golden rings. Most of the figures in the marquetry have fine inlays of contrasting shadows. The decoration of gilded ornaments and fittings strengthens the secretaire’s lavish appearance. The legs stand on small wheels. In the bottom corner of the lower front drawer the signature is inscribed – Gottlieb Iwersson.

The history of the maker, Gottlieb Iwersson, and the consignee King Gustav III, is quite well known. But it does not seem to exist much documentation of the secretaire between the making in 1778 and today. What is known is that the secretaire has been in Royal possession since it was first given to King Gustav III. Today, the secretaire is in the care of the Royal Collections. The latest placement in public view was in the White Cabinet at the Royal Castle in Stockholm, a room decorated in Gustavian style, and a part of the reception rooms. At the moment it is placed in storage, as it has been for the last 20 years. According to the furniture conservators of the Royal Collections, no previous documentation of treatment has been found.

**History of the drawing**
The masterpiece drawings from the old Cabinet-makers Guild in Stockholm, were found in the estate of Knut Theodor Edberg when he died in 1926 (Sylvén 1982). He was a member of the Cabinet-makers Society in Stockholm. According to Stefan Erelöf at Stockholm’s Cabinet-makers Society, the drawings were found in the attic, were they likely had been stored for over a hundred years of time. Knut Theodor’s father, Carl Knut Edberg, had previously kept the drawings. He was born in 1814, and became a master cabinet-maker in 1843.

4 Personal and mail contact with Jan Blåberg, Furniture Conservator at the Royal Collections, April 2012
5 Personal contact with Stefan Erelöf, March 2012
A few years later in 1846, the guild system was deregulated and the law on freedom of trade was instituted. Thus, the old Cabinet-makers Guild of Stockholm was dissolved. Documentation states that during this event, the drawings were given to the new Cabinet-makers Society in Stockholm (Wallin 1927). As a member of the old Cabinet-makers Guild, it is not unlikely that the drawings got in Carl Knut Edberg possession. He was also one of the initiators of the new Cabinet-makers Society, and later one of the founders of todays Cabinet-makers Society in Stockholm, from 1882, where the drawings are archived today.
Figure 2  The front of the masterpiece, today’s appearance.
Figure 3  Left side of the masterpiece, today’s appearance.
3.3 Dyes in the late 18\textsuperscript{th} century Sweden

The art of staining wood, development and history, coincide in many respects with the art of dyeing textiles. Some of the oldest tapestries in Sweden, dyed with plants are from 1100-1200 a.ch. and written documents are found from the mid 16\textsuperscript{th} century (Anderberg 2000). During the 18\textsuperscript{th} century, several scripts about plants are published, many of them by Carl von Linné, eminent Swedish botanist.

In the late 18\textsuperscript{th} century, synthetic dyes were not yet invented; dyes were primarily produced from plants and animals, but also from minerals and other earth materials. The Swedish word for stain “bets” derived from the German “beize” and means “something that bites into”. The term derived from that in the dyeing process with natural dyestuffs, several chemicals that have the ability to “fix” the dye were used. Such substances are called mordants. This, and the fact that the use of different mordants has a major impact on the resulting colour, refers to the importance of seeking knowledge about both dyes and mordants to understand the history of dyeing. Moreover, many of the inorganic substances used as mordants have also been used alone to colour wood.

There are some older publications concerning the topic dyeing, which also contains recipes, but most are written about the dyeing of textiles. However, much of this knowledge also applies to the dyeing of wood and is a valuable source for the dyestuffs and mordants used, and for the dyeing process.

The first Swedish book about the art of dyeing is “Johan Linders Swedish colour art - with native herbs, grasses, flowers, leaves, bark, roots, plants and minerals”\textsuperscript{6}, by the doctor and botanist Johan Lindestolpe, and was first published in 1720. The book includes some recipes, primarily for textiles. The recipes described how to colour with dyes from the nature, like alder bark, blueberries, elderberries, tormentil root, birch leaves, barberry, safflower etc. together with pre-treatment substances and mordants such as; soaps, alum, urine, salt, vitriol, acids, potash etc.

Another source, almost contemporary with the production of Iwersson’s masterpiece, is “Chemical lectures of H.T. Scheffer”\textsuperscript{7}, edited by Torbern Bergman, and first published in 1775. The book contains a collection of notes from the eminent chemist Henric Theophilus Scheffer, 1710-1759.

\textsuperscript{6} Free translation of the Swedish title; Johan Linders Swenska färge-konst, med inländske örter, gräs, blommor, blad, lö, barkar, rötter, wester och mineralier.

\textsuperscript{7} See references, Scheffer, H. T., Bergman, T. (ed.) (1775) and (1992).
In the chapter about dyeing, following description can be read: “Dyeing, is really nothing else than to saturate the surface of a body with particles, which emits the kind of rays, whose colour you desire”, a quite early, both elegant and explanatory description of what colour really is.

Many natural dyestuffs are mentioned in the book, including; weld, sawwort, dyer’s broom, madder, turmeric, fustic, logwood, kermes, cochineal, sumac, red sandalwood, alder bark, hazel-roots, nut-husk, tyrian purple, indigo, safflower etc. The dyes are divided into different groups depending on their solubility in water, which affects the use of mordants and the dyeing process. The division is reminiscent of today’s classification of natural dyes, which are divided into three categories, according to their application method. Mordant dyes: soluble in water but needs to be applied with a mordant. Vat dyes: not soluble in water, needs to undergo a chemical process to become soluble and will after dyeing become insoluble again. Direct dyes: soluble in water and can be applied without mordants (Hofenk de Graaff 2004). These facts can be helpful tools in the identification of dyestuffs, as you may expect presence of a mordant together with some of the dyes.

Later publications have been written exclusively for dyeing wood. One of the more comprehensive books are “Most complete handbook for dyeing in all sorts of colours, polishing and painting of all types of wood, bone, horn and ivory: most reliable methods...” first Swedish edition published in 1857, after German original by Stöckel and Thon. This book provides a step-by-step guide to the craft of colouring wood. Some of the mentioned dyestuffs are; sandalwood, madder, cochineal, indigo, logwood, barberry root, quercitron, persian berries, galls, walnut shells, bloodroot etc.

These books include chapters of recipes for different colours. The colours described are mainly red, yellow, blue and black, which can be directly obtained by the dye, while the colours brown, grey, violet and green, are often described as a mixture of colours. Often mentioned in the books is how the use of dyes can make simple wood resemble more expensive exotic woods. This is, among others, described by the pharmacist Nils Nyström in “About the making and use of amber varnish on dyed Swedish wood species” and published in Stockholm 1798. This is coincident with an increasing interest of furniture in mahogany.

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8 Free translation of the Swedish title: “Fullständigaste handbok för betsning i alla slags färger, polering och lackering af alla träslag, ben, horn och elfenben: Tillförlitligaste methoder....”
9 Free translation of the Swedish title; “Om bärnstens fernissans tillredande och nytjande på betsade svenska trädsorter.”
Some of the mentioned species is native to Sweden while others are imported. In Sweden we know very little about the use of these dyes in wood marquetry furniture. However, we do have quite extensive information of how cabinet-makers travelled around Europe to improve their skills and were influenced by international trends. We can therefore presume that they had knowledge about how to dye wood.

Internationally many of them are documented in published literature, mostly applied on textiles, some including descriptions of how they can be detected by various analyses (Hofenk de Graaff 2004). The so far performed research on dyes and mordants used in wood marquetry has successfully identified some of the dyes from plants and animals mentioned in this chapter. These are:

Red: Brazilin from brazil wood, carminic acid from cochineal and santalin from red sandalwood.

Yellow: Apigenig and luteolin from weld, berberine from barbery, curcumin from turmeric, morin from old fustic and young fustic.

Blue: Indigo from indigo-plant or woad, indigodisulfonic acid, logwood, elderberries.

Green: Xylindein - fungi of the genus Chlorociboria. This colouring fungi has not been found in any of the Swedish publications reviewed here, but has been found in several masterpieces with marquetry made in Europe, many from the 16th century (Unger 2010).

Brown: Ellagic acid, gallic acid (several plants such as walnut tree or oak species) – in combination with iron, copper and zinc salts.

(Unger 2010)

In appendix A. dyes found in the historic source reviewed in this part are listed with their English, Swedish, German and Botanical names. Concluding this review, the history of dyes in Sweden and the application on wood, is in need of further research as recommended in chapter 8.
4. IDENTIFICATION OF DYESTUFFS

To better understand how the faded colours originally looked like, the chemical components of a dye need to be investigated. This can be done by a variety of different instrumental methods of analytical chemistry, both qualitative and quantitative. Qualitative analysis indicates the different types of chemical components present, while a quantitative analysis determines the concentration of a component. There are many different chemical components within dyed wood, therefore reference samples of undyed wood is often required to identify the chemical components of a dye from the wood's own components. High or low concentrations of a component might indicate the presence of an added substance, like a dye or a mordant (Piening in press), or the presence of components related to environmental impact, like dust (van Bommel et al. in press).

Organic dyestuffs are generally less stable than inorganic. Natural dyes usually have weak light fastness, suffer fading and other photochemical degradations, and can with time be destroyed, which make the identification difficult. To interpret the data received from the analysis a reference spectra-library of material, pigments and dyestuffs, is essential. It might also be required to make reproductions of dyed wood with old recipes, to compare with the spectra from the analysed object or sample.

This chapter includes a brief description of what colour is and why colour fades, focusing on organic dyestuffs because these historically were those mainly used for dyeing and in addition due to strong degradation has been the main issue in previous research. As mentioned in part 3.3, the use of inorganic substances as mordants are important in the dyeing process and for the result. However, this will not be elaborated in this text to limit the scale of this project.

This part is also intended to serve as a basis to better understand the following part that describes previous research and the methods used for identification of dyestuffs in wooden marquetry. This part gives an overview of the current state in the research and can be regarded as an introduction to further research possibilities.
4.1 Colour and colour fading

The complex science of colour, including all the causes of colour, covers a large field of studies in physics and chemistry. To give an introduction to why the secretaire has lost its colours, a brief description of why wood and dyes appears coloured and why colour fades follows\(^\text{10}\).

Colour can be described as “visible light”, but what is light? Light is electromagnetic radiation, which is a form of energy emitted and absorbed by charged particles. This energy exhibits wave-like behaviour as it travels through space. The waves vary in length or frequency and intensity. The range of all possible frequencies of electromagnetic radiation is shown in the electromagnetic spectrum (figure 4). A part of this spectrum, the range of wavelengths from around 390 nm to 750 nm, can be detected by the human eye and is known as visible light. The human brain interprets the different wavelengths in the visible region of the spectrum as different colours.

![The Electromagnetic Spectrum](image)

**Figure 4** All the colours in the visible region of the spectrum are present in white light.

When light falls on an object, some light will be absorbed and some reflected, or if the object is transparent, transmitted through it.

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\(^{10}\) The following description is a summary of several studies of literature, see; Nassau 2001, Mills and White 1987, The Conservation Unit of the Museums & Galleries Commission 1992, Harris 2010, in references.
In a molecule, different types of chemical groups known as chromophores are responsible for the molecule’s colour. These groups confer colour if their structure is large enough and have conjugated bonds, i.e. joined in a long chain, with alternating single and double bonds (figure 5). Light energy is absorbed and emitted by the electrons (charged particles) in a molecule. When the electrons absorb light they go to a state of higher energy, an excited state. To excite an electron a certain amount of energy (wavelength) needs to be absorbed, this is determined by the structure of the chromophores. If the energy absorbed corresponds with some of the wavelengths in the visible spectrum, the eye and brain can interpret the reflected or transmitted light as having a particular colour.

A variety of phenomena may alter the colour of a substance by a change in the environment. One of them is photochromism, or the change of colour by exposure to light.

The loss of colour in organic dyes occurs when the conjugated bonds in the chromophores structure breaks up, and the chromophores lose the ability to absorb wavelengths in the visible spectra. The breakup of bonds requires energy input, which simply can come from the heat of the surroundings or the absorption of light or other radiant energy. Further, moisture and presence of other chemical compounds, like metal ions enhance discoloration. Discoloration of wood and organic dyes caused by light often refers to photo-oxidation. The absorption of light initiates radical chain reactions where oxygen reacts with the conjugated system, resulting in splitting the chromophores structure and thereby the loss of colour.

It is a paradox that the absorption of light makes it possible for us to see colour, and at the same time is the cause of photochemical degradation, like fading. Areas protected from exposure to light can still show bright colours, both of dyes and the wood’s natural colours. This is valuable sources to the original appearance of marquetry furniture and the cabinet-makers use of dyes.
4.2 Review of previous research

Identification of dyestuffs in wood marquetry has previously been performed with different methods. The art of dyeing wood has gained much of the textile industry; also a part of the research on dyestuffs identification in wood has developed from methods used for the corresponding research in the field of textile dyeing. They both share the difficulties in identification of natural dyes in historic artefacts. To my knowledge, no Swedish studies of identification of dyestuffs in wood have been published. However, there are a number of related research studies conducted about paintings and textile materials. The results of these studies are focused on inorganic substances, as the analysis of organic substances is more difficult (Bergstrand & Hinrichs Degerblad 2011).

Some Swedish private furniture conservators have done smaller studies in attempt to identify dyestuffs in wood, but without elaborated or published results\textsuperscript{11}. In one of these studies, a sample was submitted to The Swedish National Heritage Board for analysis. The sample was a small piece of birch veneer taken from an unexposed surface inside a secretaire in late Gustavian style. In this covered area, the veneer had a silver shimmering grey colour, and the question at issue was if any traces of iron(II)sulphate, believed to be the cause of the grey colour, were present. The result showed no trace of iron or sulphur, but the surface treatment was determined to be wax (carnauba wax).

A coloured reconstruction of marquetry has been made by Per Kortebäck (Ljungström 2006) from a roll top desk by the Royal cabinet-maker George Haupt. The centre of the roll top shows the small Swedish Royal coat of arms, with some traces of colour. The reconstruction was made of dyed wood after the heraldic rules of the small Royal Swedish coat of arms and is coloured in yellow, blue and green. This appearance was most likely also what was intended by Haupt.

![Figure 6](image)

\textsuperscript{11} Contact with furniture conservator Anette Glöde and phone contact with Thomas Wall, March-April 2012.
Internationally research on the use of dyes in marquetry furniture, wood panels and parquet floors, have the last years increased in the restoration of wooden artefacts. This is not at least shown by the extensive book “Vom Färben des Holzes”, the result of many years of research by the authors Hans Michaelsen and Ralf Buchholz (2006). This book includes historic facts, research projects, reconstructions and a collection of 2000 dye recipes.

The two main methods used for identification of organic dyes are ultraviolet-visible spectroscopy (UV/VIS-spectroscopy) and High-performance liquid chromatography with a photodiode array detection system (HPLC-PDA) (Unger 2010). Perhaps the most essential difference between these methods is that the UV/VIS spectrometry can be used as a non-destructive method and can be carried out in situ, while HPLC requires a sample.

**UV/VIS-spectroscopy** is one of the most widely used analytical techniques in chemistry and life sciences. The method is used to characterize the absorption, transmittance or reflectivity of a material, for example a dye or a coating.

**UV/VIS absorption spectroscopy** measures the amount of light absorbed by a sample at a given wavelength. As the name suggests, UV/VIS absorption spectroscopy measures wavelengths within the visible part of the spectrum, and in the adjacent ultraviolet region. Often, measurements can also be made in the adjacent infrared region, thereby covering the wavelength range from about 190 nm to 1100 nm. The results of measurements are shown in the form of an absorption spectrum, a graphical representation of absorbance as a function of wavelength. The method is commonly used to measure the absorption of radiation in its passage through a gas, a liquid or a solid, which refers to the need of a sample.

However, a non-destructive approach is **UV/VIS reflection spectroscopy**, the study of light that has been reflected or scattered from a solid, liquid, or gas. This is the method used for analysing wooden artefacts without taking a sample. Dr. Heinrich Piening at the Bavarian Department of State-owned Palaces, Gardens and Lakes, have performed several analysis with **diffuse reflection spectroscopy**12. The used measuring equipment comprises a fibre-optic light source, a handheld scanner (measuring appliance), a spectrometer with a diode array detector and a computer with analytical software.

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12 Mail contact with Dr. Henirich Piening, April-May 2012, see also Piening (2001), (in press) and (2009) in references.
The credibility of the results of this method has been discussed. This is referred to results with low accuracy due to the effect of thick layers of aged varnish, decolourization, reflectance of the wood itself and degradation of both the colorant and the wood (Unger 2010; van Bommel et al. in press). Dr. Maarten van Bommel, at the Cultural Heritage Agency of the Netherlands, describes the method as more suitable for identification of different colour groups (yellow, red, blue) and that other methods give better results to identify a specific dye.

Dr. Piening means that these effects have quite low influence and the problems relate to the difficulties to extract the absorption properties of the object investigated from the reflected light, as you will only obtain information of the reflected light, i.e. not a spectrum of absorption. Commercial reference data libraries can only calculate spectrum of absorption, it is therefore essential to adapt and extend a commercial program, i.e. build up ones own reference library, for mathematical treatment of the data received. This is the main difference between results with high or low accuracy.

**High performance liquid chromatography** (HPLC) is a type of chromatographic analysis technique, where the different components of a sample are identified by separation. Together with a Photodiode array (PDA) detector the technique is a very sensitive tool for identification of all dyestuffs soluble in aqueous or non-aqueous solvents and give results with high accuracy. The main disadvantage with the method is the need of a sample. However, the sample needed can be quite small, only a thin layer scraped of a veneer is usually sufficient.

To extract the dyes, the sample is ground and mixed with a solvent. The suspension is then homogenized and centrifuged, separating the liquid, including the dye, from the wood (Unger 2010). The solution is put in a colon and by pressure, a solvent extracts the different components from another, i.e. separates them. The components are then identified by their retention time, which is compared to values of known reference materials (Hofenk de Graaff 2004; van Bommel 2005).

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13 Personal contact with Dr. Maarten van Bommel, March 2012.
14 Mail contact with Dr. Henirich Piening, April-May 2012.
15 Chromatography - a chemical separation technique that exploits the fact that the substances to be separated are distributed differently between a static (stationary) and a moving (mobile) phase (Simonsen 2005).
16 The greater tendency a substance has to linger in the solution, the longer it needs to go through the column. This time, referred to the *retention time*, is different for different substances (Hofenk de Graaff 2004).
The PDA detector gives additional information, as it records the UV-visible absorption spectra of the components. This can help to identify compounds with almost the same retention time and also distinguish different types of dyestuffs (red, yellow or blue) (Hofenk de Graaff 2004; van Bommel 2005). The technology is more developed for the identification of dyes in textiles than in wood. A variety of organic dyes have been identified in historical textiles, which have been helpful for the application of the method on wood\textsuperscript{17}.

Application of HPLC for identification of organic dyes in wood has also produced results (Unger 2010). Prof. Dr. Achim Unger, at the University of applied sciences in Potsdam, has a lot of experience in detecting natural dyes by means of HPLC. Unger describes that the method performs very exact results and its possibilities are very extended, especially in the case of degradation products of dyestuffs\textsuperscript{18}.

Modified HPLC methods and devices can provide more detailed results. Dr. van Bommel has studied HPLC-PDA with a fluorescence detector to obtain a more sensitive tool for identification. Both Dr. Unger and Dr. van Bommel state that the right choice of solvent for extraction is essential\textsuperscript{18,19}. Dr. van Bommel suggests that further research will be devoted to determine the efficiency of this extraction for wood samples\textsuperscript{19}. Another chromatographic method used for identification of natural dyestuffs is thin-layer chromatography (TLC), but has in recent years largely been replaced by HPLC (Hofenk de Graaff 2004).

In addition to the above-mentioned methods there are also several methods used to identify inorganic components, as the process of dyeing wood with natural dyes often required the use of a mordant, usually inorganic metal salts. X-ray fluorescence (XRF) is a very quick and non-destructive method, but the disadvantage is a low sensitivity and to distinguish which elements originate from the staining process and which from the wood (van Bommel et al. in press).

\textsuperscript{17} Hofenk de Graaff (2004), personal contact with Dr. Maarten van Bommel, March 2012 see also van Bommel (2001) in references.
\textsuperscript{18} Mail contact with Prof. Dr. Achim Unger, April 2012.
\textsuperscript{19} Personal contact with Dr. Maarten van Bommel, March 2012.
Another method is scanning electron microscope combined with energy dispersive X-ray spectroscopy (SEM-EDS). The method is applicable directly on the surface of a sample or a cross-section. The sensitivity is quite low, but an advantage is that in cross-sections the penetration depth of the detected element can be determined, and hence be distinguished from the wood's own elements (van Bommel et al. in press).

Further, optical (atomic) emission spectrometry (OES/AES) has been used for identification of inorganic components and also ion chromatography (IC) and pyrolysis-gas chromatography/mass spectrometry (Py-GC/MS) for quantitative elemental analysis (Unger 2010). A quite recent experimented method is time resolved fluorescence (TRF) (van Bommel et al. in press).
5. RESULTS OF EXAMINATION

In this chapter the results, observations made during the visual examination of the drawing and the masterpiece are presented. The results are complex to communicate. For the masterpiece, most of the observed aspects are shown in pictures.

5.1 The drawing

In the visual examination of the drawing it was first noted that it seems to be in good condition. It is stored in a hard paper-box, together with other masterpiece drawings. The drawing shows the front- and right side of the secretaire and a sectional view showing the construction of the carcass, but not the interior. The text states that the Cabinet-makers Guild in Stockholm approved the drawing made by Gottlieb Iwersson on the 21st of March 1778.

The drawing is substantially consistent with the secretaire. The marquetry on both right and left side of the secretaire are equal and consistent with the drawing (compare figures 2-3 and 6-7). The marquetry on the front of the folding desk is also in line with the drawing, with the exception of the small details in the centre of the Royal coat of arms, which are not included in the drawing. On the lower front drawer the placement and shape of the objects differ slightly between the secretaire and the drawing. However, except for a book and a piano, all objects are illustrated in the drawing. The main difference between the secretaire and the drawing are the bronzes, some are missing on the drawing and some has a different shape.

Remarkable are the beautiful colours painted on the drawing. The colours are most likely painted with aquarelle. They seem to be in good condition, i.e. not suffered degradation from environmental- and light influence, and it is therefore likely that they have more or less the original appearance. Regarding the choice of colour for the various motives, the colouring feels natural; green leaves, yellow lions, the Swedish flag in blue and yellow etc. The Swedish Royal coat of arms, including the escutcheon of the Holstein-Gottorp family, also seems to be coloured after how the original appeared in contemporary contexts (compare figure 7 and 8-9). It is known which colour the Royal coat of arms had in 1778, but the shades could vary, depending on the artist. Of note is that the colour behind the crown on the drawing is blue, while the original (figure 8) had a purple colour.

20 Discussed in mail contact with Gwen Tauber, paintings conservator at Rijksmuseum Amsterdam, April 2012.
21 According to the National Herald Henrik Klackenberg, personal phone contact, April 2012.
Figure 6  The original drawing of Iversons masterpiece, dated 1778.

Figure 7  The original drawing of Iversons masterpiece, coloured in aquarelle.
Above:
Figure 8  The Swedish Royal coat of arms 1751-1818. Illustration in Berghman (1951).

Left:
Figure 9  The escutcheon of the Holstein-Gottorp family. Illustration in Heymowski (2001).
5.2 The masterpiece

In this project the analysis of the secretaire was limited to a visual examination. The examination of the secretaire was performed in the workshops of the Royal Collections, assisted by Furniture Conservator Jan Blåberg. The secretaire was photographed and examined from different aspects; *current condition, previous conservation, wood species, traces of colour, surface treatment, comparisons with the more colourful interior, appearance in UV-light, accordance with the drawing*. All aspects were observed macroscopically. No samples were taken, neither of wood, dyes, or the surface treatment. Veneer or bronzes could not be lifted to observe trace of colour underneath.

**Condition and previous restoration**

In general the secretaire is in good condition, the main disturbing aspects are the visual appearance; colour change and trace of previous restoration. Sanding of the veneer in previous restoration has caused loss of engravings and ‘stains’, especially prominent on the front of the secretaire.

**Surface treatment**

The surface looks quite glossy, in some light trace of application or polishing is visible. The surface treatment is determined to be a transparent varnish, probably resin based.

**Appearance in UV-light**

In UV-light the surface shows a homogenous opaque (grey/white) appearance, except the areas were the veneer has been sanded, as these probably have a thinner layer of varnish which may also been more recently applied. The areas, which appear yellow in normal light, also have a fairly strong yellow colour in UV-light, almost fluorescent (figure 10). This is to be compared with the extremely strong fluorescent yellow inlays in the secretaires’ interior (figure 11).
Above:
Figure 10  The front of the secretaire in UV-light.

Left:
Figure 11  Yellow fluorescence in UV-light inside the secretaire's interior.
**Wood species**
The veneer on the outside shows varying colours of brown and little contrast between the different wood species. The veneer on the inside interior has more colour and contrasts preserved. The identified and discussed wood species are presented in table 1. and marked with numbers in figures 12-19, 24. For species on the secretaires right side (figure 20-21) see figures 18-19.

**Table 1. Identified and discussed wood species**

<table>
<thead>
<tr>
<th>Common name</th>
<th>Botanical name</th>
<th>Reference image</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Tulipwood</td>
<td><em>Dalbergia decipularis</em> <em>L.</em></td>
<td><img src="image" alt="Tulipwood" /></td>
</tr>
<tr>
<td>2. Amaranth</td>
<td><em>Peltogyne</em> <em>spp.</em></td>
<td><img src="image" alt="Amaranth" /></td>
</tr>
<tr>
<td>3. Kingwood</td>
<td><em>Dalbergia cearensis</em> <em>L.</em></td>
<td><img src="image" alt="Kingwood" /></td>
</tr>
<tr>
<td>4. Birch</td>
<td><em>Betula</em> <em>spp.</em></td>
<td><img src="image" alt="Birch" /></td>
</tr>
<tr>
<td>5. Flamed birch</td>
<td><em>Betula</em> <em>spp.</em></td>
<td><img src="image" alt="Flamed birch" /></td>
</tr>
<tr>
<td>6. Hornbeam</td>
<td><em>Carpinus betulus</em> <em>L.</em></td>
<td><img src="image" alt="Hornbeam" /></td>
</tr>
<tr>
<td>7. Maple</td>
<td><em>Acer</em> <em>spp.</em></td>
<td><img src="image" alt="Maple" /></td>
</tr>
<tr>
<td>8. Mahogany or mahogany-like</td>
<td></td>
<td><img src="image" alt="Mahogany" /></td>
</tr>
<tr>
<td>9. Walnut</td>
<td><em>Juglans regia</em> <em>L.</em></td>
<td><img src="image" alt="Walnut" /></td>
</tr>
<tr>
<td>10. Ebony</td>
<td><em>Diospyros</em> <em>spp.</em></td>
<td><img src="image" alt=" Ebony" /></td>
</tr>
<tr>
<td>11. Boxwood</td>
<td><em>Buxus</em> <em>spp.</em></td>
<td><img src="image" alt="Boxwood" /></td>
</tr>
<tr>
<td>12. Pear</td>
<td><em>Pyrus</em> <em>spp.</em></td>
<td><img src="image" alt="Pear" /></td>
</tr>
<tr>
<td>14. Light hardwood</td>
<td></td>
<td><img src="image" alt="Light hardwood" /></td>
</tr>
</tbody>
</table>
Traces of colour
On the secretaires outside, pale traces of colour could be seen. Following traces of colours were observed:

- **Blue-green,** the hue and colour intensity varies, many parts look quite green, some more blue. But they all appeared to have a mix of both green and blue shades.

- **Green,** some traces are very pale.

- **Red,** some parts difficult to distinguish from the wood’s own colour.

- **Yellow,** traces of yellow colour was very difficult to distinguish from the wood’s own colour. Some parts in the marquetry appeared to be “extra” yellow. The friezes are framed with yellow appearing lines.

- **Black,** most of the figures in the marquetry are modelled with shadows. Some of them appear very dark, almost black, others are paler in a black-blue-green shade.

- **Brown,** some parts indicates they have been dyed, but without a clear trace. This refers to parts believed to be birch that appears in light or dark brown colour. In these areas where the veneer has been sanded the colour is more light grey.

The areas with trace of colour observed are marked out in figures 12-13 and 16-21, with reference to the colour boxes above and figure texts. The dark/black colour of the shadows are not marked as these are quite visible themselves.

Above right:
Figure 12 The upper part of the front.

Right:
Figure 13 The Swedish Royal coat of arms on the secreatires front.
Figure 14  Green colour on the middle part of the front.

Figure 15  Blue-green or mint green colour around the bronzes. Middle part on the secretaires right side.
Figure 16  The left part of lower intarsia on the front side

Figure 17  The right part of lower intarsia on the front side.
Figure 18-19  The upper and lower intarsia on the secretaire's left side.
Figure 20-21  The upper and lower intarsia on the secretaire’s right side.
Figure 22  Blue-green colour in the upper frieze, right side of the secreatire. The t-shaped inlays appears extra yellow. The black lines could likely be ebony.

From left:
Figure 23  Blue-green colour in the friezes of front corners, yellow lines around.
Figure 24  Blue-green colour on the legs, yellow lines around.
Figure 25  A darker and more blue colour on the inside of the back legs.
In contrast to the secretaires outside, the interior still has colours preserved. Both of the wood’s natural colour and dyes (figure 26-29).

Figure 26   The colourful interior of the secretaire.

Figure 27   Interior - coloured in yellow, grey, green and blue, also showing a more natural colour of amaranth (purple) and tulipwood (orange/pink).
Above:

Figure 28 A green festoon with red ribbons and yellow mounts, inlaid in a grey/brown/yellow bottom.

Right:

Figure 29 A yellow roset ribbon holding a green garland, inlaid in a gold shimmering bottom.
6. ANALYSIS

The different aspects observed in the examination all contributes to the visual appearance of the secretaire and the results serves to give answers to the sub-questions in order to create a picture of the secretaries original appearance, thus answering the main issue. Because of its scale the results are not discussed in detail. The chapter gives a generally analysis of the results, aiming at answering the sub-questions.

What type of wood species have been used in making the secretaire?
The basic observation to create a picture of how the secretaire originally appeared is to define the type of wood species used in the marquetry. Not all parts of the marquetry have been coloured with a dye; also the wood’s natural colours have been used to create different decorative effects. It is commonly known that ageing and environmental influence changes the natural colour of wood, making the identification of the wood very difficult. A more definitive identification requires microscopic analysis of samples, which was not possible to take during this examination. The observations was interpreted by literature studies, wood references and discussions with colleagues, compared by previous identifications, wood used by Iwersson in other furniture and by other contemporary cabinet-makers.

The result shows that many tropical woods have been used. This includes tulipwood and amaranth, seen on the cornice, friezes, corners and legs and as framing of the figurative marquetry. They can be compared with the veneers used in the interior were their natural colour are better preserved. The tropical woods were definitely chosen for their natural decorative colours, and have probably not been dyed. Contemporary cabinet-makers commonly used these wood species and they are also found in documents of import and export of wood during the 18th century (Sylvén 1999; Glöde 2002).

For the parts believed to been coloured, the identification of wood species was more difficult. The results shows that mostly light hardwoods has been used for these parts, which can be viewed as a natural choice to bring out brighter colour of the dyes.

In comparison with previous descriptions of the wood used in the secretaire, which can be read in Sylvén (1999) and Ljungström (2006), the majority of the identified wood species in this study are mentioned. However, also other wood species are mentioned, like poplar, satinwood and rosewood. These could not be identified on the secretaire, but rosewood could be referred to kingwood.
Most of the identified and discussed wood species in the secretaire have previously been identified in other pieces made by Gottlieb Iwersson (Sylvén 2004; Fischer 1916).

Regarding the observations in UV-light, there are several woods that fluoresce in UV-light. Two species used in cabinet making and for extractions of dyes are Venetian sumac or Smoketree (Cotinus coggygria Scop. / Rhus cotinus L.) and Barberry (Berberis Vulgaris L.) (Hofenk de Graaff 2004; Krutisch et al. 2007). Both species are mentioned in the studied Swedish historic recipes and Barberry have also been identified used as veneer in the masterpiece of Georg Haupt (Johansson 2005).

The yellow wood in the interior is similar to some of the smaller yellow parts on the front. It is possible that it is the same wood specie, even if the parts on the outside fluorences less strongly then on the inside. Less fluorences could be due to exposure to light and influence of the surface treatment. Further, with darker surroundings, the UV-light got more intensive in the interior than on the outside, which could also affect the intensity of the fluorescence.

What kind of surface treatment coats the masterpiece? Does the finish affect the colour appearance?

The surface treatment is most likely not the original. Standing in the light of public view at the Royal Castle of Stockholm, a well-polished surface was probably appreciated. Transparent varnishes are sensitive to photochemical oxidation and turns yellow and dark with time, this will affect the colour appearance of the underlying material. A yellowing varnish contributes to the secretaries current colour appearance.

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22 Mail contact with Dr. Henirich Piening, April-May 2012.
**Which traces of colour can be seen on the masterpiece?**
The result of the examination shows that traces of several colours can be seen on the secretaire, not least in the interior. In comparison with the interior and the original drawing the traces of colour found conform well. Also with the image of the Swedish Royal coat of arms in 1778 (figure 8). The information found in old recipes and knowledge gained by previous research, have been taken in consideration and been used for comparison when determining the original colours to create the hypothetical picture. In Sylvén (1999) and Ljungström (2006) some of the wood species in the marquetry are described as probably been coloured with a dye. They all seem to be consistent with the interpretation of the results in this study.

**Which dyes were known at the time of production of the secretaire?**
Literature studies reviewed in part 3.3 indicates that a variety of dyes from plants and animal were known in the late 18th century. The dyes found in these books are listed in appendix A. Most of them can be compared with international research on the subject. Michaelsen and Buchholz (2006) are in the book “Vom Färben des Holzes” presenting reproductions of old recipes. These, and reconstructions of coloured marquetry, have been used for comparison when searching the right shade of colour for creating the hypothetical picture of the secretaire (Krutisch et al. 2007; Michaelsen & Buchholz 2006).

**How can the drawing be evaluated as a source in attempt to define the original appearance of the secretaries’ colours?**
Considering its history and present condition, the drawing should be valued as an important source for the identification of the secretares original colours. Furthermore, both the shape and the colours of the drawing are consistent with the secretaire’s shape and the observed traces of dyes. Important aspects to evaluate the drawing.
It may also be reflected on how well Iwersson tried to live up to the drawing when he made his masterpiece. It feels natural to think that Iwersson tried to emulate the drawing and its colours in order not to disappoint the King. However, it can also be reflected on if the drawing is the same that Iwersson showed to the King, as the Cabint-makes Guild had quite strict rules regarding the making of masterpiece drawings.
Whether the colours in the drawing are well preserved, may be further analysed by more advanced methods. For a deeper evaluation of the drawing, a paper- and a paintings conservator should be consulted.
7. CONCLUSION

To determine the colourful past of Iwersson’s masterpiece by a visual examination this thesis has proved to be difficult. However, the results show a clear indication that parts of the secretaries marquetry have been dyed. It is also clearly evident that the wood’s own colours have changed, due to aging and environmental influences, and thus contributes to the secretaires changed appearance. To answer the question at issue, the conclusion of this thesis is that the masterpiece of Gottlieb Iwersson has a colourful past in accordance with the original drawing. Figure 32 and 33 shows a hypothetical picture of how the secretaire originally looked like. The created pictures are in line with reconstructions made in previous research (Krutisch et al. 2007; Michaelsen & Buchholz 2006).

The tulipwood on the cornice, friezes, corners and legs and the amaranth framework are regarded as certain results and are as seen in figures 32-33 very important for the total expression of the masterpiece. The parts with tulipwood and amaranth in figure 32-33 can be compared with the preserved interior and the reference images in table 1 on page 31. The colour of the Swedish Royal coat of arms and most of the figurative marquetry on the sides can also be regarded with high probability. The traces of color match the colors on the drawing and the colors of the Royal coat of arms (Figure 8), a coloration that feels natural. Neither is there doubt that the T-shaped frieze in the top and the friezes on corners and legs has been blue since nothing in the results of this study indicates otherwise. The today brown background of the figurative marquetry was determined to have been in a gray colour, indicated by several aspects, especially when compared with background veneer in secretaires interior (figure 28). Also previous research has shown that grey coloured veneer with time can obtain a brown color (Michaelsen et al. 2008).

For the veneer behind the bronzes on the middle front drawer, the results are not unequivocal, but the colour was determined to have been blue, despite trace of a bright green colour in some parts (figure 14). The trace of a strong green colour could be due to a later restoration. Blue colour does with time usually appear more green, which is enhanced by a yellow varnish. A blue colour is consisten with the drawing and contribute to a more aesthetically pleasing overall expression. Most of the figures in the marquetry on the lower front drawer showed vague trace of colour. Its color scheme in the hypothetical picture is less clear, in essence, it is based on the wood species original colours.

To address the aim of this thesis, the picture contributes to raise questions and thoughts about the colourful past of late 18th century marquetry furniture.
Figure 32: Hypothetical picture of the original appearance of Gottlieb Iwerssons masterpiece, front side.
Figure 33  Hypothetical picture of the original appearance of Gottlieb Iwerssons masterpiece, right side.
8. FURTHER RESEARCH

This thesis shows that the current knowledge of dyestuffs used by the Swedish 18th century cabinet-makers is very limited. Further research is necessary for us to understand and appreciate the extent of the colourful past of our antique furniture. For this, research should be performed on several aspects discussed in this thesis;

- Investigation of documented recipes, reproduction of recipes
- Trade routes and import of wood, plants, insects etc.
- Deeper knowledge on the wood species used in marquetry furniture
- Identification of dyes in furniture by scientific analysis
- Investigate the use of different mordants and how they affect dyes

Several of these aspects have been investigated internationally and the previous research is an important source to find out more about the use of dyes in Sweden. Internationally the research is currently focusing to improve the application of the various analysis methods on wood, identify more of the dyes documented in historic recipes and the identification and use of mordants\textsuperscript{22} (Unger 2010).

\textsuperscript{22} Personal contact with Dr. Maarten van Bommel, March 2012.
ACKNOWLEDGEMENTS

I wish to thank my supervisor Johan Knutsson for fruitful discussions and comments. Essential for this thesis, I would like to thank Lars Ljungström, Jan Blåberg and Lassi Koivinen at the Royal Collection and Stefan Erelöf and Lars Broth at Stockholm’s Cabinet-makers Society, for making the examination of the masterpiece and the drawing possible and answering questions about the objects. Thanks Dr. Heinrich Piening, Dr. Achim Unger and Dr. Maarten van Bommel, for answering questions and offering new aspects and knowledge on the different analysis methods. I’m grateful to Gert van Gerven for numerous discussions and encouragement. Thank you, Gwen Tauber for comments on the drawing. Thank you, Anna Womack for an interesting discussion about the Gustavian style. Finally, I would like to thank colleagues for valuable discussions and for answering questions, and to friends and family for encouragement, support and comments.
REFERENCES

All photos and figures made by Elise Andersson, if no reference are given.


APPENDIX

A. Table of dyes - appendix to part 3.3

This table aim to give an example of the species named in the historic recipes reviewed in part 3.3. The species are listed with their English, Swedish, German and Botanical names and grouped after the colour they are described to give. The sources they are found in are marked S for Scheffer (1775) and S&T for Stöckel & Thon (1857). Several of them can also be found in Linderstolpe (1720), together with many indigenous plants. However, because they are named with old names, they require deeper research to be determined more certainly.

<table>
<thead>
<tr>
<th>Colour</th>
<th>English</th>
<th>Swedish</th>
<th>German</th>
<th>Botanical name</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>RED</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Madder</td>
<td>Krapp</td>
<td>Krapp</td>
<td>Färberöte</td>
<td>Rubia tinctorum L.</td>
<td>S, S&amp;T</td>
</tr>
<tr>
<td>Kermes</td>
<td>Kermes, oäkta Koschenill</td>
<td>Scharfachkörner</td>
<td>Coccus ilicis</td>
<td>S</td>
<td></td>
</tr>
<tr>
<td>Cochineal</td>
<td>Koschenill (sköldlus)</td>
<td>Cochenille</td>
<td>Coccus cati L.</td>
<td>S, S&amp;T</td>
<td></td>
</tr>
<tr>
<td>Red sandalwood</td>
<td>Rött sandelträ</td>
<td>Sandelholz</td>
<td>Pterocarpus santalinus L.</td>
<td>S, S&amp;T</td>
<td></td>
</tr>
<tr>
<td>Safflower</td>
<td>Safflor</td>
<td>Saflor, Färberdistel</td>
<td>Carthamus tinctorius L.</td>
<td>S, S&amp;T</td>
<td></td>
</tr>
<tr>
<td>Lac dye</td>
<td>Lacksköldlus</td>
<td>Gummilack</td>
<td>Kerria lacca/Coccus lacca</td>
<td>S</td>
<td></td>
</tr>
<tr>
<td>Red currant</td>
<td>Röda vinbär</td>
<td>Rote Johanniseere</td>
<td>Ribes rubrum L.</td>
<td>S</td>
<td></td>
</tr>
<tr>
<td>Alkanna</td>
<td>Alkanna</td>
<td>Alkannawurzel, Orkanette</td>
<td>Anchusa tinctoria L.</td>
<td>S, S&amp;T</td>
<td></td>
</tr>
<tr>
<td>Orchil</td>
<td>Orselj</td>
<td>Krautorseille, Persis</td>
<td>Roccella</td>
<td>S&amp;T</td>
<td></td>
</tr>
<tr>
<td>Brazilwood</td>
<td>Fernbock, Röd Bresilja</td>
<td>Rotholz</td>
<td>Caesalpinia</td>
<td>S&amp;T</td>
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<tr>
<td>Tormentil</td>
<td>Blodrot</td>
<td>Blutwurz</td>
<td>Potentilla erecta (L.)</td>
<td>S, S&amp;T</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>YELLOW</td>
<td></td>
<td></td>
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<tr>
<td>Fenugreek</td>
<td>Bockhorssklöver</td>
<td>Bockshornklee</td>
<td>Trigonella foenum-graecum L.</td>
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<td></td>
</tr>
<tr>
<td>Barberry</td>
<td>Berberis</td>
<td>Gewöhliche</td>
<td>Berberis Vulgaris L.</td>
<td>S, S&amp;T</td>
<td></td>
</tr>
<tr>
<td>Persian berries/</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Avignon berries/</td>
<td></td>
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</tr>
<tr>
<td>Dyer's buckthorn</td>
<td>Getapel/Avignonbär</td>
<td>Gelbbeeren, Kreuzbeeren</td>
<td>Rhamnus</td>
<td>S, S&amp;T</td>
<td></td>
</tr>
<tr>
<td>Saffron</td>
<td>Safran</td>
<td>Safron</td>
<td>Crocus sativus L.</td>
<td>S</td>
<td></td>
</tr>
<tr>
<td>Sawwort</td>
<td>Ångskära</td>
<td>Färberscharte</td>
<td>Serratula tinctoria L.</td>
<td>S</td>
<td></td>
</tr>
<tr>
<td>Bay willow</td>
<td>Jolster</td>
<td>Lorbeer-weide</td>
<td>Salix pentandra L.</td>
<td>S</td>
<td></td>
</tr>
<tr>
<td>Dyer's broom</td>
<td>Färgginst</td>
<td>Färber-Ginster</td>
<td>Genista tinctoria L.</td>
<td>S</td>
<td></td>
</tr>
<tr>
<td>Cow-parsley/</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Wild chervil</td>
<td>Hundkäx</td>
<td>Wilder Kerbel</td>
<td>Anthriscus sylvestris (L)</td>
<td>S</td>
<td></td>
</tr>
<tr>
<td>Common nettle</td>
<td>Brännässla</td>
<td>Große</td>
<td>Urtica diovis L.</td>
<td>S</td>
<td></td>
</tr>
<tr>
<td>Yellow chamomille</td>
<td>Färgkulla</td>
<td>Färberkamille</td>
<td>Anthemis tinctoria L.</td>
<td>S</td>
<td></td>
</tr>
<tr>
<td>Fustic (old fustic)</td>
<td>Gul bresilja</td>
<td>Gelbholz</td>
<td>Morus tinctoria L.</td>
<td>S, S&amp;T</td>
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<tr>
<td>Annatto</td>
<td>Orleana</td>
<td>Orlean</td>
<td>Bixa orellana L.</td>
<td>S, S&amp;T</td>
<td></td>
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<tr>
<td>Weld</td>
<td>Färgreseda, Vau</td>
<td>Wau, Gelbkraut</td>
<td>Reseda luteola L.</td>
<td>S, S&amp;T</td>
<td></td>
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<tr>
<td>Quercitron</td>
<td>Färgek</td>
<td>Färbereiche, Quercitron</td>
<td>Quercus velutina Lam.</td>
<td>S&amp;T</td>
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<td>Turmeric</td>
<td>Gurkmeja</td>
<td>Gelbwurzel, Kurkuma</td>
<td>Curcuma</td>
<td>S, S&amp;T</td>
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<td>Gamboge</td>
<td>Gummigutta</td>
<td>Gummi-gutti</td>
<td>Garcinia hanburyi</td>
<td>S, S&amp;T</td>
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<tr>
<td>Colour</td>
<td>English</td>
<td>Swedish</td>
<td>German</td>
<td>Botanical name</td>
<td>Source</td>
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<tr>
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<td>-------------</td>
<td>-----------</td>
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<td>-------------------------------------</td>
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<tr>
<td>BLACK/</td>
<td>Bearberry</td>
<td>Mjölon</td>
<td>Immergrüne Bärentraube</td>
<td>Arctostaphylos uva-ursi (L.)</td>
<td>S</td>
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<tr>
<td>GREY/BROWN</td>
<td>Alder bark</td>
<td>Al bark</td>
<td>Schwarzerie</td>
<td>Alnus glutinosa (L.)</td>
<td>S, S&amp;T</td>
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<tr>
<td>BROWN</td>
<td>Sumac</td>
<td>Sumak</td>
<td>Sumach, Gerberbaum</td>
<td>Rhus</td>
<td>S, S&amp;T</td>
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<tr>
<td></td>
<td>Hazel roots</td>
<td>Hasselrötter</td>
<td>Hasel Wurzeln</td>
<td>Corylus avellana L.</td>
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<tr>
<td></td>
<td>Nut-husk</td>
<td>Nötfnas</td>
<td>Nuss-Schale</td>
<td></td>
<td>S</td>
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<tr>
<td></td>
<td>Galls</td>
<td>Galläpple</td>
<td>Galläpfel</td>
<td>Growths on trees, especially Quercus infectoria caused by insects</td>
<td>S, S&amp;T</td>
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<tr>
<td></td>
<td>Tormentil</td>
<td>Blodrot</td>
<td>Blutwurz</td>
<td>Potentilla erecta (L.)</td>
<td>S,T</td>
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<td></td>
<td>Walnut shells</td>
<td>Valnötsskal</td>
<td>Nussbaum-Schale</td>
<td>Juglans nigra L.</td>
<td>S,T</td>
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<tr>
<td></td>
<td>Oak bark</td>
<td>Ek bark</td>
<td>Eichenrinde</td>
<td></td>
<td>S,T</td>
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<tr>
<td>BLUE</td>
<td>Woad</td>
<td>Vejde</td>
<td>Färber-Waid</td>
<td>Isatis tinctoria L.</td>
<td>S, S,T</td>
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<td></td>
<td>Indigo</td>
<td>Indigo</td>
<td>Indigostrauch</td>
<td>Indigofera spp.</td>
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<td>Logwood</td>
<td>Kampeschträd</td>
<td>Blauholz</td>
<td>Haematoxyllum campechianum L.</td>
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<td></td>
<td>Blueberries</td>
<td>Blåbär</td>
<td>Heidelbeere</td>
<td>Vaccinium myrtillus L.</td>
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<td></td>
<td>Elderberries</td>
<td>Fläderbär</td>
<td>Schwarz Holunder</td>
<td>Sambucus nigra L.</td>
<td>S</td>
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</tbody>
</table>

Some of the following inorganic substances are mentioned to be used in the dyeing process, mainly in Stöckel & Thon (1857), some also in Scheffer (1775) and Linderstolpe (1720):

- Potash
- Sodium
- Barite
- Lime
- Ammonia
- Citric acid
- Acetic acid
- Gallic acid
- Nitric acid
- Hydrochloric acid
- Sulphuric acid
- Tartaric acid
- Alum
- Arsenic salts
- Sulfates/Vitriol salts (iron, copper, zinc)
- Potassium bitartrate
- Tin salt

Pottaska
Soda
Baryt
Kalk
Ammoniak
Citronsyra
Ättiksyra
Galläppslyra
Salpetersyra (skedvatten)
Saltsyra
Svavelsyra
Vinsyra
Alun
Arseniksalter
Vitriol (järn-, koppar-, zinkvitriol)
Vinsten (Kaliumvätetartrat)
Tennsalt