

## **Indigo, Smalt, Ultramarine - a Change of Blue Paints in Traditional Ethiopian Church Paintings in the 19th Century sets a Benchmark for Dating**

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The present contribution deals with different blue paints that were used in traditional Ethiopian paintings. A short survey of the application of the most important blue paints is given in addition to a brief historical and technical information. Blue paints consist of different materials. In the second half of the 19th Century the colour blue proliferated at the walls of the Ethiopian churches. It became a brilliant, intensive blue and can be perceived as a striking difference compared to the Indigo blue, which was predominantly used before. This new blue has also been applied in painting of manuscripts, scrolls, and icons. This new blue paint is synthetic Ultramarine and was first manufactured industrially by J.B. Guimet in France in 1830. Its evidence is therefore an important criterion for dating objects of art. That show the scientific investigations of blue paints of four objects of the museum Haus Völker und Kulturen. The result of this interdisciplinary research is an important criterion for dating specific Ethiopian painting objects.

### **I Introduction**

In 1984 I visited a number of churches in the Däbrä Tabor Region. As the most important ones for my topic I will discuss in detail the Church of Zura(m)ba (Zuraba Areggawi Tsirha Aryam) and the Church of Mahedärä Maryam. They were built in different periods :

- According to a letter of Siraq Asnaqä (1992), Vicar of the monastery, written to the Tabor Society in Heidelberg Zura(m)ba was established by Atse Gebre Meskel in the year 528, and both Abuna Aragawi and Saint Yared have taught there. The present church was built by Atse Särsa Dengel (1563-1597); (according to my personal opinion the paintings of the present church originate from the late 18th century). Until today Zura(m)ba is »a place deeper than the sky and higher than the earth« (Asnaqä (1992) and a famous church school for Deggua.
- Heyer (1981) told us about the church of Mahedärä Maryam and that it was built by Atse Särsa Dengel in the year 1587; the church was created as a memorial for his wife Itege Maryam Sina, who died there. Three hundred years later Emperor Yohannes IV (1872-1889) ordered the painter Za-Yohannes to decorate the church with paintings. Until today we can still admire his beautiful and shining paintings.

The blue of the paintings of both churches is strikingly different and typical for each type of paint and shows very clearly a change in the type of blue colour from the 18th to the 19th century. In most of the old churches we can see the discrete blue of Zuramba, whereas the churches painted in the 19th century show the shining blue of Mahedärä Maryam, which literally jumps out at us. This difference I have already mentioned in my paper Marx (1993).

During many years I observed in great detail the chronological sequence of the different blue colours in Ethiopian church paintings. From the various authors describing paintings, painters, colours, and dyes of Ethiopia one of the best is Irving-Tournerie (1986). In the Ethiopian collection of the museum Haus Völker und Kulturen in St. Augustin, Germany, I could clearly observe the different blue paints. Gräber (1997) gave me a photograph of the church Däräsge Maryam in the Simen mountains, ordained on Maskal, September 26th, 1852, which was built by the German botanist Georg Wilhelm Schimper and decorated by the German painter Eduard Zander. This photo shows exactly the same shining blue colour which I saw in Mahedärä Maryam.

Up to now the paints from the above mentioned churches were not identified by a scientific physical analysis. We only have photographs to compare the paints. We cannot finally conclude without scientific methods, which dye or pigment has been used for a given painting, but we have a few analytical investigations of other Ethiopian church paintings and if we compare the photographs of these analysed and identified paints we can *see* the difference in the case of Indigo and Ultramarine.

The previously published scientific investigations of the different blue paints in Ethiopian Church paintings yielded the following results:

**Indigo** was found in: Icon IES 4190, 16./17. cent.; Icon IES 4261, 16./17. cent.; Icon IES 4126, 16./17. cent.; Icon IES 4792, 17./ 18. cent.; Icon IES 4793 , 15./16. cent. :  
Weihs, F. (1973)

Inv.Nr.13 984, 17. cent.; Inv.Nr. 14 148 : Raunig, W. (1975)

**Smalt** was found in: Icon IES 4187, 17./18. cent. : Weihs, F. (1973)

Inv.Nr. 14 148 *small amount of Smalt mixed with Indigo and orpiment for green.*  
Raunig, W. (1975)

#### **Ultramarine natural-**

**Lapis lazuli**-was found in: Wallpainting from Lalibela, late 16th/early 17th cent. (today at Nationalmuseum in AA) *natural Ultramarine (Lapis lazuli), only ground* :  
Wehlte, K. and Denninger, E. (1959)

#### **Ultramarine synthetic**

was found in: VK München Inv.Nr.: 80-301261 ca.1900, Battle of Adua ( 1896): Fitz St. (1985)

Indigo, Smalt, and Ultramarine both in natural and synthetic forms are the most important and common blue paints (dyes) of Ethiopian church painting, others like azurite or plant colours are without important significance.

It is well known that most of the colours came to Ethiopia from abroad ; Indigo came from Arabia or India, the Portuguese introduced Smalt, a ground cobalt-glass. The use of natural Ultramarine is rare, possibly it was found in Afghanistan and took a very long way unto the wallpainting in Lalibela. But what about the synthetic Ultramarine, which was first produced in France by Guimet in the year 1830 and which covers an important place in Ethiopian church paintings? The connections for commercial trade of paints between Ethiopia and Europe existed well before this date. Richard Pankhurst (1966) wrote: "Imported materials were, however, not slow to enter the Ethiopian artistic world. They are mentioned in the early 19th century by Salt (1814) who records that the court painter at Chelicut used paints imported from Cairo by a Greek." He continues: "The extensive popularisation of imported paints and brushes nonetheless took place much later during the Menelik period. Emailaf Heruy states that such imported goods, as far as he knows, were first used when his father painted the Addis Ababa church of St. George in the early 20th century." The use of modern synthetic dye-stuffs is discussed by Fitz (1985) who remarked: „Man kann davon ausgehen, dass alle diese Farben nicht vor 1900 verwendet wurden..." (One can assume that all these paints were not used before 1900)

The wallpaintings of the church of Mahädäre Maryam in the Däbrä Tabor Region and Däräsge Maryam in the Simen mountains are completed some time *before* 1900: Mahädäre Maryam was finished in the time of Emperor Yohannes (1871-1889) and the church Däräsge-Maryam was completed in the year 1852. According to Gräber (1997) the constructors and painters of the latter were Georg Wilhelm Schimper and Eduard Zander. Zander was an educated painter from Germany. After careful visual examination of these paintings I came to the conclusion that the blue paint of Däräsge Maryam is synthetic Ultramarine. If I am correct this is the first known sample of the use of this material in Ethiopian church painting.

For confirming this assumption by a scientific analysis I would need a sample of the paint material of Däräsge Maryam or of the other churches, which I have mentioned above. Unfortunately I did not yet get the material. If synthetic Ultramarine can be identified in a painting it certainly cannot be produced before 1830. It is interesting to show and to investigate the introduction of modern colours in Ethiopia, but to use them for dating of manuscripts, icons and church paintings is more important. To begin with this work I investigated some very interesting manuscript paintings of the Ethiopian collection in the museum Haus Völker und Kulturen, as I will show in Chapter V.

This background is worth to be researched further by investigating both the use and development of blue paints in Europe during the 19th century. During this period Schimper had come from Germany to Ethiopia in the year 1837 and Zander in the year 1847. Zander ordered material from Germany, Alexandria and Trieste (von Krosigk, 1935). Just during that time, the Simen mountains and the Highland of Däbrä Tabor were visited by a number of foreign visitors as Rüppel, Harris, Heuglin, Reitze. In this region worked and lived missionaries like Gobat, Flad, Aichinger (who built the Cherkos church close Adigrat for Dejjazmatch Sabagaddis (see Gräber 1997)). On his travel from Germany to Ethiopia in 1854 the craftsman-missionary Martin Flad passed the Hospital of the German Deaconesses in Jerusalem. There he met the deaconess Pauline Keller, who was the pharmacist of the German Hospital. In the year 1858 Flad returned from Ethiopia to Jerusalem and married there Pauline Keller. In October 1858 the couple went together for missionary work to Ethiopia. Later they belonged among others, also Schimper and Zander, to the hostages of Emperor Tewodros in Magdala. The following fact is of importance: in the year 1855 the German Deaconess's of Jerusalem ordered and received (invoice of Oct. 5, 1855, s. Appendix) five pounds of high grade synthetic Ultramarine. So the German missionaries knew definitely this material for the usage of painting. (see Leverkus 2000.2).

## II. Blue paints and dyestuffs

Blue paints and pigments are rare in nature and therefore some of them were always very expensive, like Lapis lazuli. This very special pigment was only used for very few paintings. But blue paints always played also an enormous role in economy and industry. I will demonstrate this by the example of Indigo: Indigo is a plant dyestuff and can be produced from different plants, the most important were the woad-plant (*Isatis tinctoria*) and the Indigo-plant (*Indigofera tinctoria*). For centuries the cloth in Europe was dyed with woad; people cultivating and trading woad made their living with this plant. Whole territories depended on it, such as Thuringia, where the University of Erfurt could be established in 1392 by the taxes of the woad-trade. When the Portuguese imported the cheaper plant Indigo from overseas in the 16th century it replaced woad, and the population of whole regions, impoverished. About three hundred years later the Indian natural Indigo was replaced by the synthetic Indigo which was produced industrially in 1897 and the important Indigo-trade broke down. The chemical dye-stuff industry began to prosper.

There is no doubt that the most important blue paints applied in Europe were also used for Ethiopian church paintings. The known investigations show Indigo, Smalt and Ultramarine. Below I will give a short survey of their use for artists in addition to a brief historical and technical information

### II.2.a Indigo

Balfour-Paul (1997) writes: "Indigo was the most important and universal natural dyestuff known to man from prehistoric times; without it, mankind would have had almost no source of blue dye colour until the invention of synthetic dyestuffs in the second half of the nineteenth century."

Indigo is a so-called '*lac*'. Since ancient times it has been used not only for dyeing but also for painting. Precipitated on a substrate, it also can be manufactured as a solid pigment powder. Indigo can be extracted from different plants. In ancient times the main plants for the extraction of Indigo were *Isatis tinctoria* (woad) and *Indigofera tinctoria* (Indigo). *Isatis tinctoria* was widespread. Long before Hellenic times the plant was cultivated in Egypt and Mesopotamia. Indigo occurs in textiles in the middle of the 3rd millennium in Egypt. It became more widespread in Syria, but interestingly not in Palestine. In the year 1228 Indigo from Baghdad is found as '*Indigo bagadel*' in the customs records of Marseilles. See Roosen-Runge (1984). Indigo was used for manuscript painting since antique times. It is firmly established that from the 14th to the 19th century Indigo was also used as an artist's paint, in oil, tempera and water-colours.

The colour of this blue paint tends to be a bit black and green.

In Ethiopia it was the most used paint for the colour blue until the second part of the 19th century. Indigo was cultivated in Yemen and dying techniques were developed there. Because of close trade ties between Yemen and Ethiopia it was obviously imported from there.

## II.2.b Smalt

Smalt is a moderately fine to coarsely ground potassium glass of blue colour. The blue is due to small but variable amounts of cobalt added as cobalt oxide during the production process.

Certainly Smalt was known to the Venetian glass-makers as early as the fifteenth century. It seems to have been little used by Italian painters of the fourteenth and fifteenth centuries, because the superior pigments Ultramarine, and azurite were generally available, but when those pigments became scarce in the 17th century, Smalt was employed as a substitute. See Mühlethaler and Thissen (1969). Besides it was also a cheaper pigment for wall-decoration purposes.

However, it is not a useful pigment for artists painting thin lines, and can be used better for colouring areas. See Gehrcke (1990).

In the Netherlands and also in England it was used from the 16th century until the 19th century; it was a so-called 'leading pigment'.

It was also used to paint and glaze ceramics, tiles and china.

The colour of Smalt is pale to deep purplish blue.

It can be combined with all binding-agents.

It is found in Ethiopian paintings. Apparently it was imported from Italy or Portugal.

## II. 2.c Ultramarine -Lapis lazuli

In Ur in Mesopotamia Leonhard Wolley discovered a big amount of jewels with rich use of Lapis lazuli, the most important was the so-called Mosaikstandarte of Queen Schu-ad. Lapis lazuli was also found in the grave room of Ramses II. See Wagner (1960) But the Egyptians never used Lapis lazuli for paintings. See Fuchs (1982).

Since medieval times Lapis lazuli was used for mosaic and paintings. It was imported from the Orient (Afghanistan) and later from Chile to Europe, so it was called „Azurum ultramarinum = the blue from overseas“, and was very expensive. The preparation of a pigment ready for painting was a very complicated procedure. Marco Polo described it in 1271. Dürer complained of the high cost for one Unze ( differs from 28,7g - 30,1g) of 12 Dukaten. See Wehlte (1985).

According to Beckmann (1792) „Ultramarin erster Qualität kostete in Paris 1763 je Unze 96 Livr., die minderwertigste, als ›cendre outremer‹ bezeichnete je Unze 48 Livr., während der Hamburger Gledisch die Unze »feinen aechten orientalischen Ultramarins« für einen Dukaten lieferte.“

( Transl. : Ultramarine of top quality costs 96 Livr. per Unze in Paris in the year 1763, of the worst grade, called ›cendre outremer‹ 48 Livr. per Unze, whereas Gladisch from Hamburg sold the Unze for one Dukaten )

It was used pure or in mixture (different layers of paints like Azurite) in Europe. It can be very well used for glazing.

The colour is a clear blue.

Until today we have discovered only one wallpainting from Lalibela made with Lapis lazuli: Here the painters have used only very fine grounded natural Lapis lazuli. We do not have any scientific investigations of very old paintings.

### III The development of synthetic Ultramarine

Blue dyes were not only used for paintings: In the past centuries there was always a high need for blue paints and dyes on the world market. Manufacturing ceramics and bone china, glass production, paper making, production of white linen, laces and other textiles, sugar production, starch production, printing paints and household purposes like laundry-blue, blue paints and dyes were not conceivable without these paints.

In paper making, sugar production, starch production and for laundry people use the optical bleaching effect of the colour blue: The addition of some blue lets a white material appear much whiter than it is. Just only for these purposes there was a big market.

The application of Indigo and Smalt creates special problems. Indigo does not dye fast enough for most practical purposes and Smalt has a bad constitution for smooth painting and drawing. The need for good and cheap blue paints resulted in important inventions of blue pigments during the 18th and 19th century, like Prussian blue in the year 1710, Thénards blue in 1802, and Coelin in 1860. But especially the love to and the need of the unique Ultramarine was one important reason for the development of synthetic colours. The first allusion gave Goethe, in his „Italienische Reiseberichte“ on April 18, 1787, when he reported that he observed a blue coating on the bricks of an abandoned sulphate-oven in Palermo; he assumed this substance to be artificially formed lazure-stone and meant that a synthetic production could be possible.

The French chemists Clement and Desormes were the first to succeed in a chemical analysis of Ultramarine in 1806. Their colleague Gay Lussac initiated the Societé D'Encouragement Pour L'Industrie for inviting to a competition with a prize-money of 6.000 Franc for the first person to find an economical method for producing synthetic Ultramarine in the year 1824. In the year 1828 the prize was awarded to Jean Baptist Guimet from Toulouse. Simultaneously and independently Christian Gottlob Gmelin in Tübingen and Friedrich August Kötting in the Königlich Sächsische Porzellanmanufaktur Meißen in Germany developed similar methods for the production of synthetic Ultramarine. This invention was one of the first successful synthesis of a natural substance. Guimet in France started the first industrial production in 1830. Further production was started by Leverkus, an ancestor of C. Erich Leverkus, in Wermelskirchen in 1834, and by Zeltner and different other companies in Germany, and by Johann Setzer in Vienna (Austria) in 1842. After starting the manufacturing in July 15th, 1839, Zeltner produced 50 kg of various qualities of synthetic Ultramarine daily. In the World Expositions in London 1851, Paris 1855 and 1867 Goldmedals were awarded to the German exhibitors for the production of synthetic Ultramarine which was an important success for them.

C. Erich Leverkus (2000.2) writes in a private letter to A. Marx: The synthetic Ultramarine „...verdrängte zuerst die Smalte beim Bläuen vom Papier, weil es weicher war als das sehr harte Kobaltoxyd und infolgedessen die zum Schreiben benutzten Gänsekeile nicht so schnell abnutzten“ ( Transl.: ... replaced at first Smalt in bleaching of paper because it made the paper much softer than the hard Cobaltoxyde so that as a consequence the goose keels used for writing did not abrades so soon.)

In fine artist paintings it appeared first in 1849 in a painting of Rottmann, later in the sixties of nineteenth century in paintings of Böcklin, Marées, and Feuerbach, as shows by an investigation by Kühn (1969) in the Schack-Gallery in Munich

Schmauderer (1969) reports that a short time after 1830 Ultramarine was used for paint on chalk, for wallpapers, for optical bleaching of paper, laundry and sugar, in printing, in dying of linen, wool, cotton and laces etc., for sweets and for the production of lacquers, ink and sealing-wax. Advertising panels of companies, cars, also the „Marterln“ (catholic wayside shrines) in Bavaria were painted with Ultramarine. Wagner (1960) mentioned that farmers used Ultramarine for painting the walls of the stables, because flies will not sit and stay there. This blue was a very common one put to use in Germany. In the middle of the 19th century housewives could buy the Ultramarine laundry-blue in each grocery or drugstore.

#### **IV Ultramarine - the new Blue - the new Ultramarine**

It is being made from about equal amounts of china clay, sulphur, and sodium carbonate, with lesser amounts of silica and rosin or pitch. The mixture is fired slowly to 750° C (1,380° F) and cooled in a sealed furnace. Ultramarine is used in paints, lacquers, and decorating materials. It has a particularly brilliant blue colour and is very lightfast.

According to Wagner (1960) Ultramarine is composed of the following elements in somewhat varying concentrations depending upon the different production methods:

Na	14 – 21 %
Al	12 – 16 %
Si	17 – 20 %
S	6 – 14 %
O	37 – 41 %

The approximate chemical formula is then given by  $(\text{Na}_8\text{Al}_6\text{Si}_6\text{O}_{24}\text{S})$ .

Different qualities of Ultramarine were developed for different purposes. There is a wide range from cheap to expensive, from moderately finely to coarsely ground material in different shades of colour on the market.

It is very permanent pigment useful for all types of painting, also for glazing, and there are special types for chalk.

Although its chemical composition is almost identical to „Lapis lazuli“, its colour is not comparable with the purity and brilliance of the natural product. Depending on the proportion of the ingredients, the shade varies from greenish to reddish blue, which imparts the colour a flashy impression especially in the cheaper varieties. We can recognise the difference among the two pigments especially well under artificial illumination. Synthetic Ultramarine pigments shows contrary to Lapis lazuli spherical equal sized particles in the microscope. Becker (1990)

It was and is even today still exported in great amounts to Africa. Even today you can buy a cube of laundry-blue for 1 Ethiopian Birr at most kiosks in Addis Ababa, produced by Reckitt & Colman, Nairobi, Kenya. A rumour says, that laundry-blue in Africa was/or is used for a very special purpose: taken orally, the sulphur in the synthetic Ultramarine reacting with the acidity of the stomach will procure abortion. Leverkus (2000.2)

#### **V . Benchmark for better Dating of Paintings**

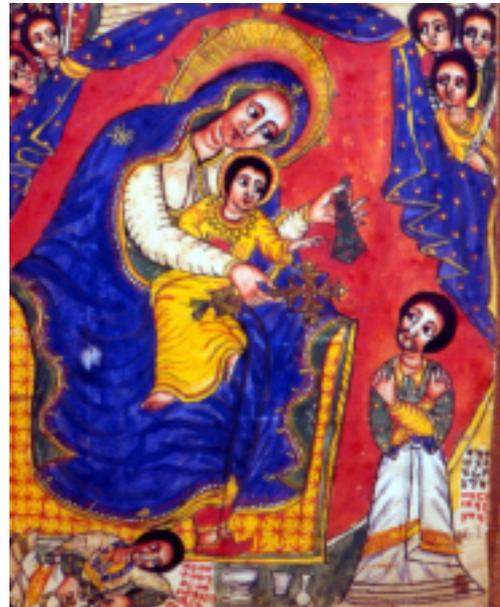
In consequence of this fact the synthetic Ultramarine serves as a benchmark for better dating of any painting; a painting which is painted with synthetic Ultramarine, which can be identified by a non-destructive analysis, cannot be older than 1830.

In lack of any material from one of the churches which I described in the introduction I began this first scientific investigation of the colour blue with a study of objects from the Ethiopian collection in the museum Haus Völker und Kulturen. I have chosen four manuscript paintings for this study. In three cases the description of the manuscripts has been published by Sixt (1994.1), (1994.2), (1994.3). where they were attributed to the 18th century with a question sign. In general the traditional character of church paintings makes it difficult to assign them to a certain time. In addition the palaeographical findings in manuscripts can be supported and supplemented by dating them with a scientific investigation of the paints.

V.1 The Objects of Museum Haus Völker und Kulturen



HVK 30687 (1544) Psalterium



HVK 30057 (1455) Loose Parchment Folio



HVK 30680 (1450) Protecting Scroll  
a. Protecting Angel with sword



HVK 30059 (1494) Double Folio with two  
Miniatures - left page

## **Description of objects of art:**

### **HVK 30687 ( 1544) Psalterium**

Description in: Sixt (1994.1)  
Wooden boards covered with leather  
Parchment  
142 pages  
19,5 : 14,5 : 6,0 cm  
Miniatures and decorations in red, purple, blue,  
yellow ink as well as some drawings  
Second Gondarene School  
18th cent. (?)

### **HVK 30057 (1455) Loose Parchment Folio**

Description in: Sixt (1994.2)  
Depicted in Thiel and Helf: (1984)  
in one side a sewed tear  
27,0 : 22,0 cm  
Text: Song of Songs, 8,8-14  
Miniature at the backside: St. Mary with the child Jesus  
in the colours red, yellow, white, blue and green  
The miniature is painted in the style of the  
Second Gondarene School  
18th cent. (?)

### **HVK 30680 (1450) Protecting Scroll**

Description: Sixt (1994.3)  
Stripe of three pieces of parchment  
195,5 : 10,5 cm  
3 parts with text  
3 miniatures:  
a. Protecting Angel with sword  
b. Squares of faces (without mouth) in a geometric shape  
c. 2 figures, one with a hand-cross (Gebre Manfas Qeddus ?)  
painted with black, red and blue ink  
18th cent. (?)

### **HVK 30059 (1494) Double Folio with two Miniatures**

unpublished  
22,7 : 33,5 cm  
parchment  
St. Mary with the child Jesus, two archangels  
painted with black, blue, orange-red ink

## **V.2. Methods of Scientific Investigations**

Many methods are used to identify pigments. The choice of the method is, of course, critical in obtaining pertinent information. Most information can be obtained by using more than one type of analysis and indeed multiple techniques are often required. In this respect I am relying on the profound experience of the „Abteilung Restaurierung und Konservierung von Schriftgut, Graphik und Buchmalerei der Fachhochschule Köln“.

For this investigation the following techniques have been applied:

**XRD** ( x-ray diffraction method    crystal structure, pigment identification )

**EDX** ( energy dispersive x-ray fluorescence spectroscopy ,    chemical element in pigment information)

**VIS** ( visible image reflectance spectroscopy    fingerprint method )

These analytical methods are non-destructive and allow a qualitative determination of the material, the obtained spectra are specific for the material and can be compared with reference curves from known pigments.

### V.3. Results

In this manuscript I shall limit myself only to the results of the blue pigments, but I will refer to some preliminary results of this investigation.

Nr. and object	blue	red	yellow	green	violet
<b>HVK 30687 ( 1544)</b> <b>Psalterium</b>	Prussian blue + Ultramarine	cinnabar and red lacquer (possibly Eosin) <i>used ink for writing:</i> only cinnabar			lacquer
<b>HVK 30057 (1455)</b> <b>Loose parchment folio</b>	Ultramarine + Prussian blue  possibly titanium white as fillings material (20th cent.?)	cinnabar	barium sulphate as filling material  possibly plumb chromate, lacquer	barium sulphate as filling material	
<b>HVK 30680 (1450)</b> <b>Protecting scroll</b>	Indigo + Prussian Blue + Ultramarine ( <i>sleeve of the angel</i> )  and Prussian blue + Ultramarine	cinnabar + ? (Filling material, probably Anhydrite)			
<b>HVK 30059 (1494)</b> <b>Double Folio with two miniatures</b>	Prussian blue + Ultramarine	lacquer			

## VI Discussion

In the four objects we investigated we found

- Indigo, Ultramarine and a further pigment, not mentioned before in investigations of Ethiopian paintings: Prussian blue. That is certainly a surprise, as well as the occurrence of the blue pigments in a mixture: Ultramarine + Prussian blue in addition with some Indigo. The use of Ultramarine clearly shows that the paintings can not be older than 1830, the earliest date of production of synthetic Ultramarine.
- But from where did the artists obtain the Prussian blue? Here I shall refer again to the history of a special material, the laundry blue.

Laundry blue was not only produced from Ultramarine, Smalt and Indigo. Another pigment, Prussian blue, played an important role in the trade of blue paints. Prussian blue is any of several deep-blue pigments that are composed of complex iron cyanides and hence called iron blues. Prussian blue has a reddish tint. Prussian blue was first synthesised by Diesbach in Berlin about 1704 by the reaction of iron(II) salts with potassium ferrocyanide. The iron blues often are mixed with yellow pigments, such as lead chromate or zinc chromate, to produce greens. It was produced industrially since the end of the 18th century. See Wagner (1960). It replaced more and more the commonly used Smalt in the recipes for laundry blue.

In former times the laundry was a very important subject in the households. The use of starching was widespread. According to Bertrich. (1966) Queen Elizabeth I of England (1533-1603) had a small disfigurement; a Dutch chambermaid was able to hide this by big lace- and pleated collars, which she could starch perfectly. Lace- and pleated collars became fashionable in England and throughout Europe. So starching of the laundry developed to be a kind of art celebrated by Ladies in the Salons in presence of the Gentlemen. A small

addition of a blue colour to the starch gave a shining white impression of the laundry. In England Queen Elizabeth I prohibited this bluing, but without success; people continued to blue their laundry. In Germany it was common practice, to use Smalt, Prussian blue and since 1830 synthetic Ultramarine. Laundry Blue, a mixture of Silicium, Calciumcarbonate, Smalt, Indigo and/or Prussian blue, was traded world-wide. The “ Kerikeri Accounts and Reports 1830-43 “, Church Missionary Society Archives, registered in 1833 the delivery of 125 g Prussian blue from Sydney, Australia to Kerikeri, Oceania. See Barton and Weik (1998). This proves that this material reached Australia in the early 19th century. The way from Europe to Africa, probably Marseilles to Alexandria, is much shorter. I was told by Mr. Schmalfuß (2000), that the mainly pure pigments were transported to Africa and mixed and extended locally with other suitable materials by different recipes. Various recipes are given in Andés (1909). So we can summarise: laundry blue was used during centuries in daily life in Europe. Europeans ( colonists, missionaries, soldiers and travellers knew the use of it and distributed this knowledge world-wide. So it was probably available on the markets and bazaars in Alexandria and Cairo. If we consider the importance of the colour blue in oriental cultures - blue is the colour against the evil eye - we can suppose, that the trade with blue paints played an important role in Alexandria and Cairo and that the Greek merchant, (or his follower) which Salt mentioned in his book of 1814, was able to supply painters in Ethiopia with Smalt, Prussian blue, and also the new Ultramarine very soon after the industrial production began in France by Guimet in the year 1830. Salt himself was a painter, so he was especially destined to consider from where the Ethiopians obtained their pigments. In my opinion it is a very small step to use the laundry blue for painting.

- The results of the analysis of blue pigments show the typical mixture of laundry blue of the middle of the 19th century with a part of synthetic Ultramarine. This blue colour is very typical and I assumed only from the visual impression that it must be synthetic Ultramarine. However, I had to substantiate my subjective assumption by an analytical analysis. The present results confirm my first hypothesis and moreover my guess that it could be laundry blue. The results confirm both of my assumptions and prove that all paintings cannot be older than 1830.
- The identification of the other colours will further limit the time of origin again: If the red lacquer is Eosin, the painting of HVK 30687 ( 1544), Psalterium, can not be older than 1884; if the white is titanium white, painting of HVK 30057 (1455), loose parchment folio, originate from the 20th century. This analysis will be published subsequently.
- But there some pitfalls for the analyst along the way. We have to consider, that paintings were applied later than the writings: e.g.: in HVK 30687 (1544), Psalterium, the red ink contains only cinnabar, an natural pigment used since ancient times in Ethiopian paintings. The writer and the painter could have lived at different periods.

## **VII Summary**

New information on pigments in some Ethiopian paintings and manuscripts show, that European synthetic pigments were available in Ethiopia during the 19th century and, consequently, there a well developed market between Europe and Ethiopia must have existed already during this period. Possibly foreigners like the painter Eduard Zander, the botanist Georg Wilhelm Schimper and some of the missionaries introduced the knowledge of the existence of modern paints. Ethiopian artists used laundry blue for their paintings. This fact can also explain the increase of the blue colour at the churchwalls during this century.

The identification of pigments can help to date a work of art: the identification of certain pigments by scientific analysis can limit the period of a painting or manuscript with high confidence. These investigations will be

extended to other pigments in Ethiopian paintings of the collection of the Museum Haus Völker und Kulturen in co-operation with Fachhochschule Köln, Abteilung Restaurierung und Konservierung von Schriftgut, Graphik und Buchmalerei.

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### **References**

- Andés, L.E. 1909. 'Wasch-, Bleich-, Blau-, Stärke- und Glanzmittel'. Wien und Leipzig, Hartleben, (191-227).
- Asnaqä, Siraq 1994. 'Das Kloster Zuraba'. Kirche und Schule, Tabor Society Heidelberg e.V., vol. 46: (17-21)
- Balfour-Paul, J. 1997. 'Indigo in the Arab World'. Richmond, Surrey, Curzon Press
- Barton, G. and Weik, S. 1998. Waschblau als Pigment. Maltechnik/Restauro, München. vol5. (320-323)
- Becker, H. 1990. 'Blau als Pigment - oder blau ist nicht gleich blau'. In 'Blau: Farbe der Ferne', Gehrcke, H. (Ed. ) Heidelberg, Wunderhorn (36-52)
- Beckmann,, J. 1792. 'Beyträge zur Geschichte der Erfindungen', vol. 3, Leipzig (181)
- Bertrich, F. 1966. 'Kulturgeschichte des Waschens'. Düsseldorf-Wien, Econ (64-67)
- Chojnacki, St. 1971. 'Notes on Art in the 15th and 16th Century', Journal of Ethiopian Studies, Vol IX, (89)
- Fitz, St. 1985. 'Untersuchung der Farben von neuerer äthiopischer Volksmalerei'. Mensch und Geschichte in Äthiopiens Volksmalerei, Fisseha, G. and Raunig,W. (Eds.), (28-29)
- Fuchs, R. 1982. 'Gedanken zur Herstellung von Farben und der Überlieferung von Farbrezepten in der Antike am Beispiel der in Ägypten verwandten Blaupigmente'. Diversarium artium studia.Festschrift für Heinz Roosen-Runge zum 70. Geburtstag am 5. Oktober 1982, (Engelhardt, H. and Kempter, G., eds.), Wiesbaden
- Gräber, G., 1997:1. Private communication
- Gräber, G. 1997:2. 'Auf Spurensuche im Simengebirge'. Kirche und Schule, Tabor Society Heidelberg e.V., vol. 50 (13-25).
- Heyer, F.1981. 'Die Kirche in Däbrä Tabor', Erlangen, Oikonomia, (27)
- Irving-Tournerie, P. 1986. 'Colour and Dye, Recipes of Ethiopia', London, Private publication
- Krosigk, von, F.1935. 'Ein Weizenkorn fliegt gegen den Wind', Mühlhausen, Bergwald
- Kühn, H. 1969: 'Die Pigmente in den Gemälden der Schack-Galerie'. In Gemälde-Katalog Schack-Galerie. Bd.2, München, (Bayer. Staatsgemäldesammlungen)
- Leverkus, C. E. 2000.1. Private letter to Marx, A., dated from 29.03.2000
- Leverkus, C. E. 2000.2. Private letter to Marx, A., dated from 13.03.2000

- Marx, A. 1993, 'Ethiopian Icons-Technique, Religious and Cultural Aspects', In Proceedings of the 3rd Conference on the History of Ethiopian Art, Addis Ababa, (not yet published)
- Mühlethaler, B. and Thissen, J. 1969. 'Smalt'. Studies in Conservation, vol.14 (47-61)
- Pankhurst, R., 1966. 'Some Notes for a History of Ethiopian Secular Art'. Ethiopia Observer, Vol.10,1. (12)
- Raunig, W. 1975. 'Zwei Ikonen aus der Äthiopien-Sammlung des Völkerkundemuseums der Universität Zürich'. Ethnologische Zeitschrift Zürich. (151-172)
- Roosen-Runge, H. 1984 . 'Buchmalerei'. Kühn, H. et al, (Eds.)Reclams Handbuch künstlerischer Techniken, Stuttgart, Reclam jun., (96f)
- Schmalfuß, Manager of Sächsische Blaufarbenwerke, Schindlerswerk, oral information to A. Marx, 08.03.2000.
- Schmauderer, E. 1969. 'Die Entwicklung der Ultramarin-Fabrikation im 19. Jahrhundert'. Tradition, Bruckmann, München, vol.14 (127-152)
- Sixt, V. 1994.1. VOHD, XX,6, (Hammerschmitt, E., Ed). Stuttgart, Steiner (113-117)
- Sixt, V. 1994.2. VOHD, XX,6, (Hammerschmitt, E., Ed). Stuttgart, Steiner ( 107-108)
- Sixt, V. 1994.3. VOHD, XX,6, (Hammerschmitt, E., Ed). Stuttgart, Steiner (105-107)
- Thiel, J.F. and Helf, H. 1984. Christliche Kunst in Afrika, Berlin, Reimer, (Nr. 78, p.75)
- Wagner, H. 1960. PIGMENTE, Herstellung, Eigenschaften, Anwendung. Stuttgart, Wissenschaftliche Verlagsgesellschaft (228)
- Wagner, H. 1960.2. PIGMENTE, Herstellung, Eigenschaften, Anwendung. Stuttgart, Wissenschaftliche Verlagsgesellschaft (335)
- Wehlte, K. 1967. Werkstoffe und Techniken der Malerei, Ravensburg (151)
- Wehlte, K. und Denninger, E., 1959. 'Naturwissenschaftliche Untersuchungen an einer äthiopischen Wandmalerei'. Maltechnik, Technische Mitteilungen für Malerei und Bildpflege, vol.1.1 (1-19)
- Weihls, F. 1973. 'Einige technische Details zu äthiopischen Ikonen'. Religiöse Kunst Äthiopiens, Ausstellungskatalog Stuttgart-Zürich-Wien, (293 -308)

**Appendix**

Invoice from Vogelsang & Cie., Düsseldorf, 5. Oct. 1855  
 for five pounds Ultramarin very fine à 12 Groschen (= 2 Thaler)  
 to Diakonissenverein Jerusalem

17126 5

usadem  
 N<sup>o</sup> 19.

2.00  
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 35  
 15  
 5  
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 34  
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 19

Düsseldorf den 5. Oct. 1855

Rechnung für den Kauf des Diakon. Vereins Rechnung  
 von Vogelsang & Co.

200 Rube. 4 Pfundulpen mit 8 Th. Emulsion 13  
 Stücke 7 Th. 7 Pfund Stb. 1. 12. 14  
 " " 1 St. mit 5 Th. feinst. Ultramarin 8  
 Ultramarin à 12 Gsch. = 2 Thaler 19  
 Zinf. St. D. = 18 Gsch.

Die factura und formen bestand  
 angelesen und geprüft sind  
 für richtig  
 H. Vogelsang & Co.  
 Vogelsang & Co.

Kopie aus:  
 Kaiserswerther Diakonie  
 Fachbibliothek für Frauendiakonie  
 und Flederer-Archiv  
 Alte Landstraße 178, 40489 Düsseldorf  
 Sign: AKD 271: Rechnung  
 von H. Vogelsang & Co. an den Diakonissen-Verein  
 am 5. Oct. 1855  
 Mit dem persönlichen Gebrauch für den im  
 Bestandtrag angegebenen Zweck.  
 Weiterverwendung für andere Zwecke, Vervielfältigung  
 an Dritte, Druck und Vervielfältigung oder Anfertigung  
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