

Resumo

Conhecem-se centenas de receitas medievais para a produção de cores, iluminuras e tintas, no Ocidente latino. Pelo contrário quase nada parece ter sobrevivido do mundo bizantino que lhe foi contemporâneo. Há uma enorme lacuna entre os papiros de Estocolmo e Leiden, datados aproximadamente da terceira centúria (c.), e os tratados pós-bizantinos como o Anônimo 1566 de Jerusalém e, o mais conhecido, Herme-neia do séc. XVIII, escrito por Dionísio de Phourna. Tem sido muitas vezes assumido que os textos pós-bizantinos reflectem mais fielmente as tradições bizantinas, mas uma análise rigorosa desses tratados tardios revela, afinal, em parte, influências das técnicas ocidentais pós-medievais. Portanto, não podem ser tomados sem alguma cautela como substitutos dos textos bizantinos perdidos. Além disso, durante os 1000 anos que durou o Império bizantino, a arte bizantina não foi uniforme – nem em estilo, nem textualmente. A técnica da pintura varia entre *scriptoria* de diferentes regiões e cronologias, novos pigmentos foram inventados (amarelo de estanho e chumbo, azul de esmalte) – mudanças que os textos pós-bizantinos não referem. Do tempo bizantino, encontram-se publicadas apenas umas poucas receitas, sobretudo de tintas. Num projecto coordenado por Peter Schreiner (Universidade de Colónia) e Doris Oltrogge (Fachlochshule Koln), a pesquisa sistemática em manuscritos catalogados poderá ampliar este número para cerca de 80 receitas relacionadas com a produção de manuscritos. Os principais tópicos são tintas, crisografia, douradura, a produção de vermelhão e de laca vermelha. Os primeiros textos datam do séc. XII, tendo muitos deles sido escritos nos sécs. XIV e XV.

Até agora não sobreviveram tratados sobre técnicas artísticas comparáveis a Theophilus ou Cennino. Há igualmente poucos vestígios de papiros da Antiguidade Tardia. Sendo a maioria das receitas «novas» e únicas, algumas técnicas são comparáveis às que são descritas nos textos do Ocidente, mas é apenas possível referir uma influência directa nos manuscritos escritos por gregos exilados na Itália do séc. XV. Algumas das técnicas descritas podem ser observadas nos manuscritos bizantinos. Por outro lado, há ainda muito poucas receitas para a produção de pigmentos sintéticos, mesmo quando as análises científicas mostram que alguns pigmentos sintéticos importantes, tais como, o amarelo de estanho e chumbo foram usados na iluminura bizantina mais cedo que no Ocidente – podendo ter sido inventados em Bizâncio. ●

palavras-chave

BIZÂNCIO
RECEITAS
ILUMINURAS
CRISOGRAFIA
PIGMENTOS

Abstract

Hundreds of mediaeval recipes on colour production, book illumination and inks are known from the Latin West. On the contrary nearly nothing seems to have survived from contemporary Byzantium. There is an enormous gap between the late antique papyri in Stockholm and Leiden, dating from about the 3rd century, and the post-byzantine treatises like the 1566 Anonymous in Jerusalem and the better known 18th-century Hermeneia, written by Dionysios of Phourna. It has often been assumed that the post-byzantine texts reflect rather faithfully byzantine traditions, but a close analysis of these later treatises reveals at least partly influences of postmediaeval Western techniques. Therefore, they cannot be taken without reservations as substitute for lost Byzantine texts. Furthermore, Byzantine art is not uniform – neither in style nor in text – during the 1000-year-period of the Byzantine Empire. The painting technique varies between scriptoria of different times and locations, new pigments were invented (lead-tin yellow, smalt) – changes on which the post-byzantine texts give no information. From the Byzantine time, only some few recipes, mainly on inks, are published up to now. In a common project of Peter Schreiner (University of Cologne) and Doris Oltrogge (Fachhochschule Köln) a systematic survey on catalogued manuscripts could enlarge this number to about 80 recipes dealing with the techniques of manuscript production. The main topics are inks, chrysography, gilding, and the production of vermilion and of red lakes. The earliest texts date from the 12th century, most of them were written in the 14th and 15th centuries. So far no treatise on art technology – comparable to Theophilus or Cennino – has survived. There are also only few traces of the late antique papyri. Most of the recipes are «new» and unique. Some techniques are comparable to those described in Western texts but a direct influence can only be stated in manuscripts which were written by Greek exiles in 15th century Italy. Some of the techniques described can be observed in Byzantine manuscripts. On the other hand, there are still extremely few recipes for the production of artificial pigments, even if analysis can show that some important artificial pigments like lead tin yellow were used in Byzantine illumination earlier than in the West – and were perhaps invented in Byzantium. ●

key-words

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BYZANTINE RECIPES AND BOOK ILLUMINATION

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1. For the most comprehensive overview see: Clarke 2001.

2. In this article «Byzantine» is strictly defined as a period term, i.e. the time before the fall of Constantinople in 1453. Texts written by Greek scribes before the middle of the 15th century in places outside the Byzantine Empire – especially since the later 14th century in areas already under Turkish dominion or by exiles in Italy or elsewhere – are considered as Byzantine. The major Greek texts on painting technique dating from the 16th century onwards belong to the post-byzantine period.

More than 400 mediaeval manuscripts dealing with the production of pigments and inks, with binding media, and with the techniques of painting and book illumination have survived from the Latin West.¹ On the contrary nearly nothing seems to have come down to us from contemporary Byzantium. This is more than strange if we consider that the earliest known Latin source – the Carolingian Lucca manuscript – is clearly a translation from the Greek (Clarke 2001, 8). There are, however, Greek texts on art technology from Antiquity: information on pigments are found in the *Book on stones* written in the 4th century BC by Theophrast or in the medical treatise of Dioskurides, dating from the 1st century AD. Probably in the 3rd century AD the Leyden and Stockholm papyri were written, which transmit the most comprehensive collection of recipes for metallurgy, dyeing and alchemy (Halleux 1981). The art of writing is considered in 16 recipes for true and false chrysography (Trost 1991, 58-102).

On the contrary, texts on art technology seem to be nearly non-existent in Byzantine times, that is in the period between ca. 500 and 1453 AD.²

The Postbyzantine tradition

Due to this lack of original sources from mediaeval Byzantium studies on Byzantine painting technique usually refer to the *Hermeneia tis zographikis (the Treatise of Painters)* written in 1730-1733 on Mount Athos by the painter-monk Dionysios of Phourna (Papadopoulos-Kêrameus 1909; Hetherington 1974; Bentchev 2004). This treatise is generally assumed to transmit rather faithfully the earlier Byzantine tradition. This is certainly true for large parts of the iconographical section: post-byzantine wall and icon painting depends largely on mediaeval models and so do Dionysios' descriptions of the major scenes from the New Testament. However it has been stated that in some cases the iconography follows the more modern types of the Cretan school which was clearly influenced by Italian, namely Venetian paintings from the middle of the 16th century onwards (Bentchev 2004, 67). And also some of

the technical recipes reflect the techniques of Italo-Cretan and Italian oil painting (Bentchev 2004, 40; 67).

The technical section of Dionysios' *Hermeneia* can be traced back to about 1566, the date proposed for two anonymous treatises which were copied in a 17th century manuscript in the Library of the Greek Patriarchate in Jerusalem (Bentchev 2004, 39). *Anonymous I* quotes as references the painters Panselinos, who most probably lived in the 14th century, and Theophanis the Crete, who worked in the second half of the 16th century on Mount Athos. Dionysios also mentions Panselinos, but not the name of the more recent painter, whose recipes he however copied (Bentchev 2004, 41).

Besides, two other postbyzantine Greek treatises on painting technique are known.

In 1720, the Ionian painter Panagiotes Doxaras (1662-1729) translated Leonardo's *Trattato della pittura* into Greek, and in 1726 he wrote himself a treatise on painting *Peri zographias* (Bentchev 2004, 130). This treatise as well as Doxaras' translation of Leonardo's *Trattato* were used as references by the icon painter and engraver Christofor Žefarovič in his *Instructions for young people desiring to learn the art of painting (Koinēnou thesia ētē Hermeneia eis tous neous...)*, a work written most probably in Church Slavonic but translated also into Greek (Bentchev 2004, 154s).

Žefarovič is the most Western of these authors, besides Leonardo's *Trattato* he used the German Kunst- und Werck-Schul of 1705 and Pictorius' *Lackir-Kunst* of 1708. However, he also knew the Greek tradition of the Jerusalem treatises which was the major source for the *Hermeneia* of Dionysios of Phourna (Bentchev 2004, 156).

But how Byzantine is this later Greek tradition? The translators of the *Hermeneia* have remarked that the text of Dionysios as well as that of the Jerusalem manuscript is full of unusual terms, words of Italian, Turkish and even German origin. So the German term γόλι φάρπε (*Goldfarbe* – gold colour) is used explicitly to explain a Venetian gilding technique considered as unusual to Greek traditions.³ Turzisms are not unusual in the late Byzantine period, especially in the parts of the Byzantine Empire which were already occupied by the Turks before 1453.

Even more interesting are some of the Italianisms. In a recipe for the making of verdigris⁴ the product is not called *ios* or *ios chalkou* as it should be in classical Greek but *vardāramon* which clearly derives from the Italian *verderame*. Another recipe of the Jerusalem manuscript and the *Hermeneia* describes the production of a blue or red colour:⁵ First a lye is made from quicklime and potash. Then wool shearings are put into the lye and cooked until the colour is extracted. Afterwards alum and a little glair are added to the filtered colour extract. Depending on the colour of the shearings the pigment obtained will be blue or red.

The recipe describes thus the making of an indigo pigment from blue shearings and of red lakes from the shearings of scarlet cloth. Similar recipes have often been copied in Western manuscripts from the 14th century onward (Wallert 1991). Is this a Byzantine technique taken over by the Latins? Or was a Western recipe adopted in late or postbyzantine time by the Greek? The terminology used by the Jerusalem

3. Dionysios of Phourna, §34 (BENTCHEV 2004, 92).

4. Anonymous § 35 (BENTCHEV 2004, 57); Dionysios § 42 (BENTCHEV 2004, 95).

5. Anonymous § 39 (BENTCHEV 2004, 58); Dionysios § 45 (BENTCHEV 2004, 97).

6. The edition is planned for 2010 (Wien: Österreichische Akademie der Wissenschaften).

Anonymous and Dionysios points to the latter: the shearings are called *tzimarismata*, a word so uncommon in Greek that it has led to some confusion in the various translations of the *Hermeneia*. Even Bentchev who recognised the meaning of the recipe translates it inexactly as *Stofflumpen* (rags). The word clearly derives from the Italian *cimatura* (shearing), therefore most probably the recipe is a translation from the Italian. Whether this was done already in the Byzantine period or only by the Anonymous of the 16th century cannot be decided.

Byzantine texts on manuscript production

These few examples show that the *Hermeneia* of Dionysios of Phourna and the earlier Jerusalem Anonymous should not be taken without restrictions as sources for painting techniques of the Byzantine period. The immense gap between the 3rd century papyri and the postbyzantine treatises still remains open.

But at least a small number of recipes have survived which give us some isolated information on art technology in mediaeval Byzantium. A few instructions for making vermilion are transcribed in alchemical manuscripts (Berthelot 1887). Some ink recipes have been published by Zerdoun Bat-Yehouda in 1983. A major finding was done by Peter Schreiner, former chair of Byzantine Studies at the University of Cologne, when he discovered the first known small treatise on manuscript production from the Byzantine Period, written in the early 15th century by Isidor of Kiev (Schreiner 1988, 116-125). The problem to understand the techniques described, often with ambiguous or unusual terms, led to an interdisciplinary project with Professor Schreiner as Byzantine philologist and myself as an expert for art technology. The aim of this project is not only the publication of the small text compiled by Isidor of Kiev, but a commented edition of all available Byzantine recipes on the techniques related to writing and book illumination.⁶ Purely alchemical treatises are not part of the project. For practical reasons, the search had to concentrate on catalogues so that libraries without or with very old catalogisation are not considered. Therefore new findings will be possible when more libraries are made accessible by useful catalogues.

Nevertheless the number of recipes concerned with the art of manuscript production could already be increased to about 80, and furthermore, with Isidor's of Kiev text there is a first indication for the existence of more or less systematic art technological recipe collections in Byzantium. The earliest texts date from the 12th century, most of them were written in the 14th and 15th century.

Compared with the abundant Western tradition the number is still very meagre. It seems that art technology plays an extremely smaller role in the surviving Byzantine manuscripts than in their Western counterparts. It is difficult to decide what the reasons are. Was there less interest in the practical arts by the literate people in Byzantium? Or got the manuscripts simply lost after the fall of Byzantium because the Western collectors were more interested in luxurious codices or in literary and

scholarly pretentious texts than in recipe collections of doubtful literary quality and perhaps even «bad» Greek?

At least, there are some arguments for the latter hypothesis: First, there was a tradition of technical texts in Greek Antiquity – as documented in the papyri – which must have been still well known at least in the early Byzantine period, when the group of recipe texts known as *Mappae Clavicula* was translated into Latin (Oltrogge 2006, 555). The two translations of this text – the version of the late 8th century Lucca manuscript with its numerous graecisms and the philologically more correct *Mappae Clavicula* version which became the standard for later Latin copies – document the great interest of the Carolingian West in Greek technological literature which would be difficult to understand if this tradition would have been already interrupted in contemporary Byzantium. A second argument for the assumption that the scarce number of texts is mainly a question of survival are the few documents which have come down to us, especially the treatise of Isidor of Kiev.

Topics

The main interest of the scribes was their writing material, first of all iron gall inks. Another large group of recipes deals with chrysography, that is gold script; the recipes describe the production of gold ink, but also the application of gold leaf. Both techniques are also appropriate for illumination. Remarkably smaller is the group of colour recipes. The production of vermilion is either described in alchemical manuscripts or related to its use for writing. A number of recipes deals with the red lakes *lachas* and *barzion*. Instructions for other pigments are extremely rare, one for the refining of lapis lazuli, one for a green ink, another for dyeing bones with copper green. Information can also be found on glues for sizing paper, but also on casein glues for other purposes. Very few recipes do not belong to the art of manuscript production: oil varnishes, a recipe for an artificial steatite and a unique description of a pseudo-sgraffito.

The recipes are found in rather different types of manuscripts. The most comprehensive recipe collection is that of Isidor of Kiev with 14 recipes (an extremely small number compared to Western manuscripts). Isidor begins with chrysography, gold inks and grounds for gold ink and gold leaf, he continues with iron gall inks, vermilion for the rubrication and starch glue for sizing the paper. At the end he returns to chrysography with three recipes for a gold ground made from brazil wood. The compilation was not written continuously, at a later date, Isidor added two recipes for chrysography on a blank space on fol. 2r, just after the iron gall inks. The interest of Isidor is clearly the interest of a scribe. Isidor, born about 1380/90 in Monembasia (Peloponnes) was highly esteemed for his erudition, his political and rhetorical qualities; he became monk, greek ambassador at the Conciles of Bale and Ferrara, Roman Cardinal and finally Unionist Patriarch of Constantinople. After the fall of Constantinople he had to exile to Rome where he died in 1463. Despite his

7. Oxford, Bodleian Library, ms. Canon. gr. 39.

brilliant career he was an industrious copyist and compiler whose scholarly interests included theology, philosophy, rhetorics, natural sciences and – as we see – also the technological aspects of writing materials. (Schreiner 1996) The Codex Vaticanus graecus 914, which contains our small treatise, is a good example of Isidor's occupations, the contemporary binding unites the recipe collection with rhetorical texts, medical excerpts, geometrical and metrological treatises and some alchemical notes by Hermes Trismegistos. Isidor must have collected recipes over a certain period, because he copied one of the recipes on iron gall ink and the instruction for making vermilion also on the last, blank leaf of an older manuscript with the works of Xenophon.⁷ To these notes he added also another recipe for iron gall ink and for paper size which are not found in the Vatican codex.

In other cases we are not so well informed on the compilers. Moreover are the recipes usually more isolated. Instructions for iron gall ink often stand on fly leaves or are added on blank spaces of pages with completely different content: patristic, rhetoric, law, literature. The recipes for pigments and chrysography are more often found in miscellaneous manuscripts on nature sciences: medicine, astronomy, astrology and alchemy. Sometimes but not necessarily they are embedded in alchemical texts. But even in this context we find seldom more than five recipes in a sequence.

Recipes and workshop practice

Inks

As said before, one of the main topics are writing inks. There is one recipe for a gall nut ink, the other 22 instructions deal with iron gall ink. Most of them are very common: a mixture of gall nuts, vitriol and gum together with a liquid, which can be water, vinegar or wine. Variations are given by the quantities of the ingredients and the heating or not heating of the ink. Additions like nutshells or the fruits of cypresses occur in two recipes. On the whole, the group of iron gall ink recipes seems not to be very different from their Western counterparts, even if up to now no exact parallel could be found. But it is striking, that the Greek scribes were more interested in different colours of their inks. A number of recipes explicitly state that the ink should become black or light, and sometimes recipes of both types stand in a sequence. The black inks are always genuine iron gall inks without any additions of carbon black. Nevertheless carbon black inks or mixtures from iron gall inks and carbon black were used in some Byzantine scriptoria, especially in the Greek monasteries in the Arabian countries or in the border areas to the Muslim world. An interesting example is a New Testament, written in Syria in 1273 (Rome, Vatican Library, Cod. Borg. gr. 18). The iron gall ink which had first been used did not adhere well and was obviously too pale on some places. Therefore the scribe overwrote his text partly with another iron gall ink mixed with carbon ink. With the same ink he added the initial which was embellished with gold powder sprinkled upon the wet ink. This sprinkling technique as well as the carbon ink are characteristic for Arabian

scriptoria. From the Arabian countries also a number of recipes for carbon inks are known (Schopen 2004). Comparable recipes have also survived from Armenia, where carbon inks and mixtures with iron gall inks were common writing materials (Eliazane & Engel 2006). It is amazing that in the *Liber Illuminarum* and some other German manuscripts of the 15th century the production of a carbon ink is explicitly called *incaustum graecum*, «Greek ink». (Bartl et al. 2005, 92). But up to now no written Greek source is known. And the practice to use a carbon ink for writing was restricted to very few scriptoria, the common writing ink of Byzantine scribes was the iron gall ink which is rather good documented in the recipes.

Chrysography and gilding

The next large group of Byzantine recipes concerns the gold writing, chrysography. This technique was highly esteemed in the Byzantine culture, golden – and silver – script was usually written by specialists, the chrysographers. It is therefore not amazing, that more than 35 recipes are related to this topic. They describe the production of gold inks, and the application of gold inks and gold leaf on grounds.

Three different methods for the preparation of gold powder can be distinguished. The most simple is the mechanical grinding of gold leaf. Grainy additives like salt pulverise the tender gold leaf and can afterwards easily be diluted in water. But also viscous materials like honey, gum or glue are suited to disperse the gold powder. These methods are already described in the late antique Greek papyri. It is amazing that none of the Byzantine recipes is copied from these older texts, the method is comparable but the text of the recipes is new!

In practice the grinding with salt must have been rather common because in a number of manuscripts with silver ink the presence of silver chloride could be proved. When silver is ground with salt it reacts easily with the sodium chloride to silver chloride. Gold on the other hand is inert so that the use of salt is more difficult to prove. In the Greek Psalter in Zürich, written in the 7th century, on some places pure sodium chloride could be analysed in the gold ink – obviously the gold powder had not been washed carefully after grinding (Fuchs & Oltrogge 2007, 84).

Another, more sophisticated method is the preparation of gold powder with the help of an amalgam. Gold leaf or gold filings are ground together with mercury, the amalgam is heated, the mercury evaporates and a very fine gold powder remains. Also this method was already described in the 3rd century papyri but again none of the Byzantine recipes is a direct copy from these ancient models. There is no information on the diffusion of this method in practice, to my knowledge residues of mercury have so far not been detected in any gold ink. But this may be also a question of analysis.

Six recipes describe a third method to prepare gold powder: gold is mixed with sulfur and mercury, then heated at a rather low temperature. At first sight this recipe looks like a confusion of the amalgam method with the production of vermilion. The alchemical terminology of some of the recipes makes it even more conspicuous. But a more detailed analysis gives sense to the instruction. The addition of sulfur to gold

8. The analysis was done with spectrophotometry with which it is not possible to distinguish between the lakes of the different scale insects, lac lake, Kermes, Polish or Armenian cochineals.

9. Fuchs, Oltrogge (forthcoming).

and the heating at low temperature is one possible process of cementation, a process to remove impurities from gold. Silver and copper – which are often present as impurities in gold – react at low temperatures with sulfur to silver respectively copper sulfide, gold does not react. The best results are obtained when the gold is already pulverised. This seems to be the reason for the addition of mercury, even if the description in the recipes is not always very clear. It seems that first a gold powder is produced with help of the amalgam and after the mercury has evaporated the gold powder is cementated with sulfur. Craddock (2000, 67) supposed that the cementation with sulfur was already known in Antiquity even if the first precise description is found in Agricola. Our six Byzantine recipes, all in 14th century manuscripts, add precious information on the diffusion of this technical knowledge.

Red lakes

About 20 recipes deal with the application of gold on a ground or with the preparation of this ground. Most often it is made from a red lake (*lachs* and *barzion*). The *lachs* can be produced from a material called *lachs* or from brazil wood (*barzion*). Some recipes mention, that both materials should give a red colour. The preparation of *lachs* from *lachs* is always described in a similar manner: the *lachs* is crushed, then heated with soda, alum and water. Afterwards the red liquid is filtered and dried. It can be cut to pieces and warmed with a little water for painting.

The term *lachs* is derived from the hindi *lakka*, the name of the Indian lac insect. The red dye is embedded in a resinous matrix and cannot be extracted in pure water. On the other hand it can be easily extracted in alkaline solutions. A soda solution gives a deep red purple extract, from which a purple red lake can be precipitated with alum. This is the process described in the Byzantine recipes. We can therefore conclude, that the *lachs* material is the crude lac. The red lake produced with this method still contains some resins, so that the powder can be dispersed in water and painted without another binding medium.

Crude lac was also known in the Latin West where it is documented as very expensive raw material for dyeing textiles and leather and for the preparation of red lakes for painting. It is possible that *lachs* was also a rather precious pigment in Byzantium. At least it is striking that the term *lachs* which originally meant a material could also be used to designate a red lake in general. The earliest example for the use of *lachs* in the sense of red lake is found in a 13th century recipe for a brazil lake.

Brazil wood is the second base material for red lakes mentioned in Byzantine manuscripts. The colorant is extracted with glair, vinegar or red wine, and stabilized with alum. Interestingly both, the recipes for the lac lake and for the red lakes from brazil wood are never intended for illumination or other painting but always for gilding and writing. The red lake should be written as underlayer for chrysography or painted as ground for gold leaf. A red underlayer for chrysography can often be observed in Byzantine manuscripts (Mokretsova 2003, 217). It could be identified as a scale insect lake⁸ for example in a patristic manuscript from the 11th century in Weimar (Herzogin Anna Amalia Bibliothek, ms. Q 741; fig. 1).⁹



FIG.1 WEIMAR, HAAB, Q 741, FOL. 1R (11TH CENTURY): THE RED LAKE USED AS UNDERLAYER FOR THE GOLD INK IN SCRIPT AND KEPHALION IS MADE FROM SCALE INSECTS. THE YELLOW IS LEAD TIN YELLOW. (ROBERT FUCHS, CICS, 2009)



FIG.2 WEIMAR, HAAB, Q 743, FOL. 39 (11TH CENTURY): A RED LAKE FROM SCALE INSECTS IS USED AS UNDERLAYER FOR GOLD LEAF AND TO PAINT THE RED DECORATIONS. (ROBERT FUCHS, CICS, 2009)

Grounds for gold leaf made from red lakes can be observed in initials or in the kephalia – the ornamental head pieces – in a number of Byzantine codices (Mokretsova 2003, 224). Certainly these red lakes could also be used in illumination, even if the recipes do not mention this. In an 11th century Gospel Book in Weimar a lake insect dye was used as rose colour in the decoration (Herzogin Anna Amalia Bibliothek, ms. Q 743; fig. 2).¹⁰

In few cases it is not explicitly stated that gold should be laid on top of the red lake script and it is possible that the rubrication is meant. Rubrics in Byzantine manuscripts are often written with vermilion but also with red lakes. There are still too few analysis to know if the one or the other material was preferred in certain periods or scriptoria. But at least in the 15th century there were scribes who used both, lakes and vermilion, for example, Isidor of Kiev in the Vatican codex gr. 914.

Gold grounds

Red lakes were not the only gold grounds mentioned in the recipes. There are also some other pigments, mainly red: vermilion, armenian bole, red ochre, but also yellow ochre. Again, they were thought both as underlayer for gold inks and for gold leaf. This is different from most of the Western recipes where usually coloured grounds

10. Fuchs, Oltrogge (forthcoming).

are only described for gold or silver leaf and not for metal inks. An exception is Theophilus (I, 29) who mentions a mixture of red lead and vermilion as underlayer for gold inks. This mixture on the other hand is not described in our Byzantine texts. In the Byzantine recipes only the gesso grounds – for which two examples are known – are restricted to gold leaf. They are coloured red-rose with either vermilion or armenian bold. Coloured grounds seem to have been typical for gilding in Byzantine manuscripts (Mokretsova 2003, 224).

In the already mentioned Gospel Book in Weimar, yellow ochre is used as an underlayer for the gold leaf in the miniatures, whereas in the kephalia the gold leaf is put on top of a red scale insect lake, the same red lake is the underlayer for the gold ink of the script. Because of these differences in materials and techniques between the miniatures and the decoration of the script it is most likely that both were executed by different painters.

Pigments

Besides iron gall ink and gilding there are few recipes on proper colours, most of them dealing with the making and tempering of vermilion and with its use either as gold ground or as rubrication. As mentioned vermilion was used as one of the rubrication materials by Isidor of Kiev who also copied a recipe for grinding and tempering the pigment.

Only one recipe describes the refining of lapislazuli. The pigment powder is mixed with resin, colophonium and linseed oil and than thrown into hot water. The process is repeated twice so that at the end three fractions are produced. This 14th century instruction is comparable to many Western texts even if up to now no exact parallel could be found. Lapislazuli has been proven in Byzantine illumination (Mokretsova 2003, 213), but also scribes like Isidor of Kiev wrote sometimes initials or did some decoration with it. Isidor does not transcribe a recipe for the refining.

It is amazing that up to now no recipe for the making of verdigris could be found, a process already described in Greek in the 1st century by Dioskurides. Sure, there exist Byzantine copies of Dioskurides but these copies were probably done only for literary purposes. There is one recipe using verdigris, it is a translation from an Italian text, using also Italian terms like *verderami*, but in this case verdigris is not produced but put into vinegar to dye bones. The only Byzantine recipe to produce a green colour describes a mixture made from indigo and a yellow colorant.

Besides the production of vermilion, no Byzantine recipe for any artificial pigment is known up to now. But certainly other artificial pigments were well known to Byzantine painters. In the already mentioned patristic manuscript in Weimar most of the pigments analysed are artificial: red lead, lead white, a copper green – which presumably is an artificial pigment but amorphous and thus not identifiable in the X-Ray-diffraction – and even lead tin yellow. This proves that in Byzantium the technique for the production of lead tin yellow was already well known in the 11th century – about 150–200 years before the earliest occurrences in the West. But no Byzantine recipe for this process is known.

Resume

It is possible to fill the gap between the late antique papyri and the postbyzantine Hermeneia at least with a small number of recipes. They concern mostly the art of writing: inks, chrysography, pigments for rubrication. The recipe are also useful to illuminators even if this is not explicitly stated. But they do not give the whole palette for illuminators and scribes. Other arts are occasionally touched. The information dates mostly in the Palaeologan period, that is the 14th and 15th century, no recipe was written before the 12th century.

To the contrary to what one would expect direct copies from the papyri are extremely rare. The relationship to the Western recipes is very loose in the beginning, but in the 15th century we find translations and adaptations of Latin and Italian recipes easily to recognise because of their terminology. In some cases we can prove that the scribes were sitting in Italy as exiles from the already Turkish parts of Byzantium. Up to now no Byzantine recipe was found which could have served as a model for a translation into a Western language. ●

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