



# ERC Newsletter

1/2016

April 2016

## Content

PAST WORK.....	1
nanoArt.....	1
Paintings by Affandi.....	2
Conservators without Frontiers .....	2
Mould on book and graphic art .....	3
ARTIKELS .....	3
Investigating the Effect of Oil Medium on the Paper Supports of Works of Art. A Discussion on Factors, Mechanisms and Effects involved .....	4
Discovering the Layers of Time, Meaning and Material. Conservation-Restoration of a Wall Hanging from the Wilanow Collection.....	13
UPCOMING EVENTS .....	25
„Interdisciplinary Methods in Graphic Art, Book and Document Conservation“ (MA) .....	25
"Understanding Historical Book Binding Techniques as Pre-condition for conservation-restoration action" .....	25
IMPRESSUM .....	25

## PAST WORK

We have been granted two projects:

### *nanoArt*

The first one lead by University Graz, concerns the deacidification of written heritage on wood pulp paper using molecules with nano particle core, which is currently undergoing patenting procedure. The method will facilitate building alkaline reserve and buffering, like other existing methods, but will, in addition also restabilize the paper. We have managed to develop the molecule in the framework of the DEACIMIC project and now the PRIZE project "nanoArt" will help us upscale the method's application.

Please find information at the following literature

Amornkitbamrung, L.; Mohan, T.; Hribernik, S.; Reichel, V.; Faivre, D.; Gregorova, A.; Engel, P.; Kargl, R.; Ribitsch, V. "Polysaccharide stabilized nanoparticles for deacidification and strengthening of paper" in: RSC Advances, 5/2015, pp. 32950–32961

## ***Paintings by Affandi***

The second project is about rescuing art of Affandi, a contemporary Indonesian artist. This is an ASEA Uninet project carried out together with Technical University Vienna.

We take a comprehensive approach in this case: TU Vienna is responsible for the museum building, while ERC is tasked with developing methods for rescuing the graphic art, which is a valuable heritage of Indonesia.



Working on Affandis paintings on paper in the museum Affandi in Yogyakarta;

Right Kartika Affandi, Affandis daughter.

## ***Conservators without Frontiers***

was founded in January 2016.

ZVR-Zahl 395491973

The Association is established as a non-profit entity with the aim of rescuing written and graphic heritage using the most advanced methods available technologically and practiced in the conservation-restoration profession.

This aim is achieved by both intangible and material input, including:

- coordination of international co-operation

- establishing and maintenance of an infrastructure to be able to rescue written and graphic heritage in an efficient way from risks it may face and afford it proper first response treatment.
  - consultancy services
  - planning as implementing first response measures
  - conducting professional events, such as presentations, conferences, workshops, training
  - carrying out relevant research projects
  - issuing publications, including printed matter
- The requisite financial funds will be obtained, in particular, by:
- inviting support from public institutions;
  - mobilizing funding via research projects;
  - offering fee-based consultancy services;
  - receiving donations.
- Collecting Membership fees

## ***Mould on book and graphic art***

We got funding by the Lower Austrian government for publication of a book on mould on book and graphic art. It is printed by Berger.

<https://www.verlag-berger.at/de/alle-produkte/fachliteratur/detail/v/isbn-978-3-85028-751-7.html>

Older publications are available under

[https://www.verlag-berger.at/de/autoren/produkte-fuer-autor.html?tx\\_shop\\_pi1%5Bfilter%5D=Engel%2C%20Patricia&backPid=185&cHash=24ae3f68005af781d0d38c355d1bda54](https://www.verlag-berger.at/de/autoren/produkte-fuer-autor.html?tx_shop_pi1%5Bfilter%5D=Engel%2C%20Patricia&backPid=185&cHash=24ae3f68005af781d0d38c355d1bda54)

ERC is sponsored by Druckerei Berger, WD Austria and KRAuP GmbH



## **ARTIKELS**

**This newsletter contains 2 articles.**

# Investigating the Effect of Oil Medium on the Paper Supports of Works of Art. A Discussion on Factors, Mechanisms and Effects involved

PENELOPE BANOU,\* ATHENA ALEXOPOULOU\*\* AND BRIAN W. SINGER+

\* General State Archives of Greece

\*\* Department of Conservation of Antiquities and Works of Art, TEI of Athens, Greece

+ Analysis for Conservation, UK

## Abstract

Seed oils have been widely used as binding media in various works of art on paper and they have been associated with certain problems, indicating possible effects on the cellulosic support. The random appearance of these problems and the fact that their occurrence has not been attributed to specific factors, combination of materials or conditions have raised a complex issue.

Assuming that the occurrence of these problems requires the absorption of the oil binder by the support, the various factors that could encourage this function are being discussed. The potential alterations of the visual and physical properties of the support caused by the absorption of the oil binder and the chemical effects and mechanisms that might be involved are also considered. The phenomenological approach of the effect of oil substances on paper is supported by the examination of different case studies and the preliminary results of scientific investigation on mock ups.

## 1 Introduction

Oil binders have been widely used in various works on paper supports, such as sketches, studies, drawings and paintings executed with oil colours, as well as, images in black and white and coloured prints and texts in books printed with traditional oil based inks. Certain problems that occur in these works appear to be related to the presence of the oil binder. The problems include: absorption and diffusion of the oil medium, discoloration and alteration of mechanical properties leading to the embrittlement of the paper support. The degree and the intensity of the phenomena vary from local and limited, to overall and extended occurrences.

The effect of oil based media on paper has become an issue of concern when conservators have to deal with cases of works that present severe discoloration related with oil absorption and diffusion, along with severe embrittlement, sometimes causing the support to fail locally or break into pieces, giving the impression that the paper cannot hold the weight of the work. These extreme cases have strongly indicated that oil medium affects the paper, suggesting the oxidation of the support.<sup>1</sup> However, non-destructive examination methods carried out in surveys on museum collections or research in the academic research field, in an attempt to indicate the degradation of the cellulosic support, have been inconclusive.<sup>2</sup>

Moreover, these problems were random, in the sense that they did not occur regularly in certain types of works, neither in cases of use of particular materials for the execution of the works, i.e. particular papers types, pigments, or oil binders, nor indeed with particular combinations of materials. In addition, surveys have indicated that the majority of these types of works are often in an acceptable condition presenting no severe problems.<sup>3</sup> At the same time, these problems have often been recorded in very diverse cases, regarding materials and techniques involved, overthrowing possible assumptions regarding the identification of factors, for instance the paper quality, which might influence the occurrence of the phenomena. There are references for oil works both on manila envelope paper and handmade rag paper which are preserved in a very good condition, while both inferior quality papers and good quality linen or cotton rag papers have presented discoloration and embrittlement.<sup>4</sup>

Thus, the issue of the potential effect of oil substances on paper, taking into consideration the various factors involved, is complex and wide. The associated phenomena can be visual and can be attributed to mechanical and chemical causes, which could be interrelated. The investigation of this issue is paramount for the interpretation and the evaluation of the condition of the works, as well as for the determination and application of the appropriate conservation and preservation policies.

## 2 Methodology of Research

In an attempt to approach the issue of the effect of oil substances on paper, a phenomenological and theoretical interpretation has been employed, supported by the examination of different case studies of works and the

---

<sup>1</sup> McAusland (1989), p. 1; James et al. (1997), p. 85

<sup>2</sup> Kosek/Green (1992), p. 101; Sian (1995), pp. 125-128

<sup>3</sup> Kosek/Green (1992), p. 101; Millard et al. (2011), p. 164

<sup>4</sup> Engram (1991), p. 13; Kosek/Green (1992), p. 98; Millard et al. (2011), p. 164

preliminary results of scientific investigation on mock ups. Observations of the optical and mechanical properties, and some preliminary results of chemical analysis carried out on the works and mock ups caused by the presence of oil are also discussed.

For the investigation of the effect of oil substances on paper a research project has been carried out through the operational program "Archimedes III: Funding of Research Groups in TEI of Athens", organised and conducted by the Lab of Physical Chemical Methods for Diagnosis Documentation in the Technological Educational Institution (TEI) of Athens, with the collaboration of scientists and professionals, such as conservators, conservation scientists, chemists and chemical engineers, specialised in various fields, from the TEI of Athens, the National Gallery-Alexandros Soutzos Museum in Athens, the National Technical University of Athens and the General State Archives of Greece.

Works of the research project included a survey in the National Gallery-Alexandros Soutzos Museum in Athens to record the types of oil works on paper supports, such as oil sketches, oil studies and oil paintings in the collections, and their condition<sup>5</sup>, including a set of prints of a particular Greek artist (G. Economides). This provided case studies and examples that contribute to the investigation over the various factors in discussion. This was supplemented with printed material, text and prints, from the collections of the General State Archives of Greece. Within the framework of the same research programme and a previous pilot project funded by J. F. Costopoulos Foundation<sup>6</sup>, sets of mock ups have been prepared in order to examine and analyse the effect of oil substances on the paper supports. The same amount of cold pressed linseed oil has been added to mock ups of different types of paper<sup>7</sup>, which have been air dried for two months in dark conditions and then have undergone close environment artificial aging in 90 °C both in dry and humid conditions in the dark. Specifically, aging was carried out in conditions of 0% and 100% RH for the mock ups in the research project founded by Costopoulos Foundation, referred as Series (I) of mock ups, and 78% RH for mock ups in the Archimedes III research project, Series (II) of mock ups. Observations and results derived from our preliminary work on pure cotton paper mock ups are being referred to, for the purpose of this paper.

### 3 Common problems

The most common problems associated with the presence of the oil binder in paint or printing media on the works of art on paper support are the following.

- Absorption of the oil medium by the paper support, sinking on the verso side of the work, locally and overall.
- Diffusion of the oil medium beyond the limits of particular areas of colour or printed lines or letters of ink, either b/w or colour.
- Discoloration of the support related to the absorption of the oil medium Loss of mechanical strength, fragility and embrittlement.

In some cases of oil sketches, oil studies or oil paintings whose composition does not cover the whole surface of the paper support, a common phenomenon is the appearance of discoloration beyond the limits of the areas of paint generally or locally beyond specific colour areas, due to the diffusion of the medium. The discoloration is also evident on the verso of the work. Usually, oil absorption and discolouration appear solely on the verso of works, often corresponding to certain areas of the composition.

In works where the paint layer covers the whole surface of the paper support on the recto, discoloration is only apparent on the verso. Discoloration of the support varies from case to case. It could be general, varying in intensity locally, rarely uniform, usually responding to areas which are more worked, executed in thicker paint layers, or certain colours.

The discoloured paper support, gradually loses its mechanical strength, becomes weak and brittle and breaks locally or in parts. This condition seems to be aggravated by the presence of wood in the fibre content of the support.

All the aforementioned problems have been recorded in works of art on paper and not in those on paper board, where they are less apparent and of moderate intensity. The oil medium appears not to penetrate the thickness of the heavy weight boards. In addition, the method of manufacturing of paper boards (multilayer or laminates with or without the addition of adhesive, pulp boards) possibly alters the absorption behaviour of the support.

However, non-destructive examination, performing UV fluorescence colour photography, has shown presence of

---

<sup>5</sup> Banou et al. (2010), pp. 1-2

<sup>6</sup> The project was entitled "Physicochemical study and documentation of five oil paintings on paper belonging to the National Gallery and Alexandros Soutzos Museum" and accomplished with the co-operation of the University of Northumbria (UK), Department of Conservation of Antiquities and Works of Art (TEI of Athens) and the National Gallery - Alexandros Soutzos Museum in Athens, Greece.

<sup>7</sup> The parameters of selection of these particular types of paper and oil binder do not refer to the subject matter of this paper.



oil on the surface of the support, beyond the limits of the colour areas or within the brushstrokes, not evident to the visible light.<sup>8</sup>

A typical problem of oil works executed on paper boards is the support's tendency to delaminate. Loss of cohesion between the paper layers has an effect on the stability and rigidity of the support resulting in planar distortions, intense creases and tears on the board that cause cracking, flaking or even loss of the paint layer. Nevertheless, the potential effect of oil medium absorption in the cohesion of the paper layers cannot be investigated, since access on the intermediate paper layers of the support is practically unfeasible.

Printed text in books, as well as the black and white and colour prints, present similar problems, which are attributed to the oil binders in the traditional printing inks.<sup>9</sup> The problems recorded on the survey are the following:

- Fine diffusion of the oil beyond the limits of the printed text or printed lines.
- Discoloration of the support due to the diffusion of the oil medium to the verso side, corresponding to the text or printing, especially on heavily inked areas (they do not correspond to certain colors).
- "Offsetting" of the oil medium, not of the pigment, to paper supports in contact with the work have been recorded in books, folded maps, etc.

The aforementioned problems have been noticed in works belonging to all the traditional printing techniques.

#### 4 Oil Absorption

The key question that is being raised is, when do these problems happen? What is the main factor that determines their occurrence? Absorption of the oil medium by the paper support is the most obvious answer. Problems are more evident when the oil medium sinks into the verso of the paper support. Apparently, it requires an amount of oil binder to be absorbed by the support and to penetrate the core of the paper to the verso. As it was ascertained, the larger the quantity of oil absorbed by the paper, the more intense the problems that occur.

Accordingly, oil painting and oil works on paper present more intense and extended problems in comparison with those on prints, since in paintings the oil colour paint layers and the application of subsequent layers of colour involve larger quantities of oil binder, whereas in prints less binder is present in the much lighter applications of ink.

Traditionally, oil colours are made by mixing and subsequently grinding pigment powder with drying oil, most commonly linseed oil.<sup>10</sup> Every pigment requires a different volume of oil to bring it to the desired consistency, since it depends on the physical and chemical nature of the pigment particles.<sup>11</sup> In oil painting, the quantity of oil binder in the oil colour provides more or less transparent paint layers, or adds gloss. So, the addition of an extra quantity of oil binder to prepare the oil colour to paint serves the scope of the artist.

The quantity of the oil binder also depends on the thickness of the paint layer a thick paste of colour contains larger quantities of pigment powder and oil binder than thinner layers. Oil painting, as a technique, gives to the artist the ability to apply several successive layers of paint, so as to achieve the desired result. This means accumulation of oil binder in areas that are more worked.

Taking all these in consideration, the concentration of oil binder varies among the areas of a composition, depending on the oil paint layers application and the quantity of the oil binder involved respectively. This could provide an explanation to the occurrence of oil absorption and discolouration locally on the verso of the support, or the variations in intensity (Fig. 1 and Fig. 2).

---

<sup>8</sup> Banou et al. (2010), p. 7; Kaminari et al. (2014)

<sup>9</sup> Stijnman (2000), pp. 64-66

<sup>10</sup> Smith (1987), p. 182

<sup>11</sup> Gettens /Stout (1966), pp. 45-46



Fig. 1 Sewing Studio, oil study by N. Gysis, detail of recto



Fig. 2 Sewing Studio, oil study by N. Gysis, detail of recto. Discoloration corresponds to areas where the oil paint layer is thicker or thinned with the addition of oil.

*Works of art in Fig. 1, Fig. 2, Fig. 3 and Fig. 4 belong to the collections of the National Gallery-Alexandros Soutzos Museum in Athens, Greece.*

Thinning of the oil colour with solvent, such as turpentine, gives a paint layer with different properties. Solvents (or diluents) are added to oil paints to temporarily change the way they work, keeping low proportion of oil binder, and are designed to evaporate evenly and totally as the oil paint dries.<sup>12</sup> Addition of solvents has as a result the thinning of the paint up to a wash, which is commonly used in the first layers of the composition, for instance as an under drawing, or in oil sketches and studies to sketch or to roughly cover an area. In the case studies examined, oil absorption or diffusion has not been recorded in areas of the support responding to paint layers thinned with solvents.

Oil absorption could be related to the drying of the oil colour. The mechanism of drying is the consequence of free radical-chain reactions, which are influenced by many factors, such as: the availability of oxygen, thermal treatments, the influence of light, the thickness of the oil film, the presence of metallic ions from the pigments, the presence of driers and antioxidants, etc.<sup>13</sup> Drying time of the paint layer also depends on the type of the oil binder. Some oil mediums are slower in drying than others e.g. the poppy seed oil dries slower than linseed oil.<sup>14</sup> The method of production also influences the drying and flow properties of the oil medium<sup>15</sup>, e.g. heat treated linseed oil, such as stand oil used in printing inks, has increased viscosity and decreased drying times. It is also known that certain pigments speed up drying, e.g. lead and zinc containing pigments, whereas others will reduce the drying rate, e.g. black pigments such as ivory black, or lamp black.<sup>16</sup> Slow drying of the paint layer could encourage the absorption of the excess oil by the paper support.

In traditional printing techniques, ink has to be prepared in a density that allows the fixed transfer of the subject from the plate to the paper support in a fine layer, which sets and dries on the top of the fibres. This is the reason the oil diffusion or sinking is detected less often in prints, usually appearing in limited extent. It can be also assumed that oil diffusion and absorption in prints can be related to the viscosity of the ink and the excess of oil medium in the ink. The viscosity of the ink depends on the printing technique<sup>17</sup>, but according to printers, sometimes addition of an extra small quantity of oil binder is required during the preparation of ink (grinding of pigments), so as to achieve the desired viscosity and flow of the mixture, so as to be manipulable, e.g. in cold temperature conditions. Variations of the thickness of the ink layer locally on a print could cause the diffusion of the oil medium to the paper, for instance, in a black and white woodcut in the collection of the National Gallery of Athens (Mykonos, by G. Economides), oil diffusion and discolouration were recorded on the limits of printed areas, where excess of ink concentration was observed (Fig. 3). However, problems, such as diffusion and sinking of the oil binder to the verso, usually appear in heavily inked areas, where the concentration of the oil binder is higher.

<sup>12</sup> Mayer (1991), p. 402

<sup>13</sup> Mills/White (1996), p. 36

<sup>14</sup> Mayer (1991), p. 175

<sup>15</sup> Bonaduce et al. (2012), pp. 11-12

<sup>16</sup> Berg (2002), p. 43

<sup>17</sup> Stijnman (2000), p. 63

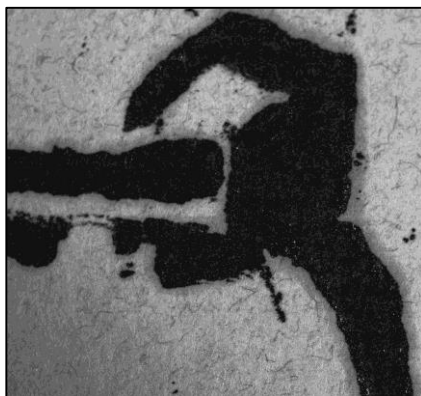


Fig. 3 Mykonos, b/w wood cut by G. Economides, detail of recto. Oil diffusion appears beyond the limits of the printed areas with the higher concentration of ink along the edges.

Accordingly, offsetting of the oil binder to the opposite pages in contact happens in cases of books or albums, appearing like a brown discoloration. In the case of colour lithographs in a book from the GSA collections (*The Military Costumes in Turkey, 1818*), both sinking and offsetting of the oil binder, and not of the pigments, responded to the darker colours of the print that require multi layer printing.

Analysis of a brown stained area caused by the offsetting of a printed image has confirmed the presence of non-drying oils.<sup>18</sup> Heat treatment of the oil for the ink manufacture and the state of oxidation of the oil have been considered responsible for the offsetting of the ink.<sup>19</sup> Offsetting of the oil binder to the opposite pages in contact could be also attributed to a possible slower drying rate of the oil binder within the pages of the book, where oxygen is lacking. Absence of driers in the ink would contribute to a slower drying. Offsetting of the oil binder to the opposite pages in contact or to guard papers could happen without having diffusion or sinking of the oil to the verso, e.g. in the case of a handmade album with black and white woodcuts in the collections of the National Gallery (*Sächsische Schweiz*, by G. Economides), in every work, there was offsetting of the oil binder to the opposite page in contact presented as intense discoloration, while there were no signs of diffusion or absorption of the oil binder on the support of the print (Fig.4).



Fig. 4 *Sächsische Schweiz*, album with b/w wood cuts by G. Economides. Oil binder's offsetting-discolouration is evident on the opposite page

On the other hand, the nature of the paper support appears to be another critical factor that determines the oil absorption. Method of manufacture and fibre content do not seem to influence the oil absorption. On the survey in the National Gallery's collections, problems have been recorded both in hand-made and machine made paper supports, wove and laid, of European, Eastern or other provenance, with linen, cotton or wood fibre content (mechanical, semi-chemical and chemical woodpulp).

The thickness (weight), the density and the porosity of the support are the obvious properties of the papers that could influence the oil absorption by the paper. The problems usually appear in light weight papers and less in those of heavier weight. Additives and fillers in the paper pulp might also retard the absorption of the oil. During mock ups preparation, the absorption of the same quantity of oil substance was slower and less uneven in thicker papers or papers with fillers.

Sizing content of the paper support appears to influence the absorption of the oil by the support. Especially in the prints from the National Gallery's collections, the problems were recorded in cases where the paper appeared to be

<sup>18</sup> Daniels (1988), p. 95; Banou et al. (2014)

<sup>19</sup> Daniels (1988), p. 95



very soft, without rattling, indicating limited sizing of the support. Without doubt, lacking of sizing encourages the oil absorption by the porous fibre net. It could be suggested that diffusion of the oil binder beyond the limits of the paint layers or the printed lines/areas occurs in supports with limited sizing, by capillary action.

On the other hand, high sizing content or the impregnation of the paper support with oils, gums or resins to increase transparency, would prevent the absorption of the oil binder. In a case of a bilateral oil study on a tracing paper (Angel by N. Gyzis, National Gallery collections), there was no absorption of the oil binder, neither in areas of thick impasto, not in those of thinned paint.

Problems associated with the absorption of oil colour do not occur in the cases where the paper supports are prepared with a non-oil based priming layer or a ground, that can act as a barrier.

Assuming that the paper support absorbs the oil binder, what are the possible effects on the paper support? Optical, mechanical or chemical?

### *Optical Effect*

The absorption of the oil medium by the paper support has an immediate effect on the opacity of the support. Opacity is the measure of impenetrability to electromagnetic radiation and especially to visible light. Different types of paper supports, with varying opacity, become less opaque, after the application of oil on them (Fig. 5). This is more apparent when the oil penetrates the paper support. This is due to the difference in value between the refractive indices of the components of the system. The value of the relative refractive index of the cellulose fibres in paper is much higher than that of air leading to opacity in a plain sheet of paper, where the fibres are surrounded by air. However, the much smaller difference between the refractive index of cellulose fibres and oil means less diffusion of the incident light in a system where paper is impregnated with oil, thus the system appears to be more transparent.

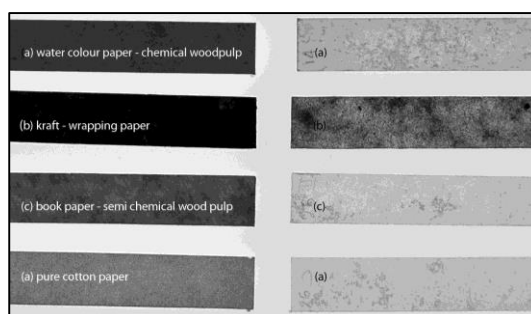


Fig. 5 Mock ups of four different papers on the left hand side and the same papers impregnated with linseed oil, on the right hand side. Photograph in transmitted light indicates that oil application reduces the opacity of the paper.

The refractive index value of a solid film of linseed oil rises slightly with age, causing lowering of tone, which subsequently means that the paper would allow less light to pass through.<sup>20</sup> Accordingly, when the oil medium is diffused into the "blank" areas of paper within a work and/or sinks to the verso, the light refraction differs on these areas, altering gradually the optical behaviour of the support locally upon aging. This is not so evident when the paint layer covers the whole surface of the work, since the paint layer (traps the light and) does not permit the light to pass through.

Aging and, mostly, oxidation of the oils results in the yellowing and darkening of the drying film. The extent to which this occurs depends on the kind of oil substance, as well as any pre treatment (mechanical or chemical) used during manufacture.<sup>21</sup> Even ignoring any potential chemical effect of the oil on the cellulosic support and any consequent discoloration to the paper itself, the change of colour of the absorbed oil would result in a gradual change of colour-discoloration of the support. Darkening of the oils is accelerated in dark conditions, which are the most common storage conditions for these works, especially for sketches and studies not intended to be displayed.<sup>22</sup>

The hypothesis that the oil absorption has an effect on the optical properties of the support is supported by the behaviour of the mock ups during aging. Mock ups of linseed oil on cotton paper were prepared and aged at 90 °C, 78% RH for 1, 4, 7, 14, 21 and 28 days<sup>23</sup>. They gradually appear to become darker and less translucent during this humid ageing process over a period of 28 days (Fig. 6), observed in visible light and transmitted light with naked eye. Darkening of the oiled paper mock ups upon ageing was confirmed by colorimetry measurements (Tab. 1). It is assumed that colour change of the mixture of oil on paper or discoloration of the support is related to the changes of the refractive index of the oil and the chemical changes in the oil and in the paper during aging.

<sup>20</sup> Laurie (1926), p. 179

<sup>21</sup> Gettens/Stout (1966), p. 46

<sup>22</sup> Gettens/Stout (1966), p. 46

<sup>23</sup> Series (II) mock ups

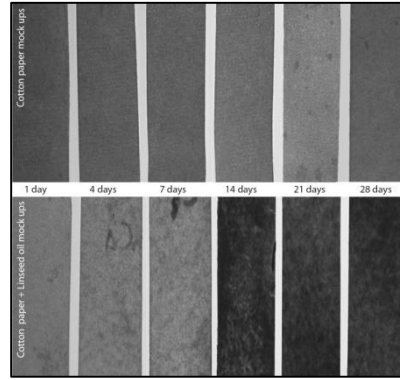


Fig. 6 Photograph in transmitted light indicates that opacity of the mock ups with linseed oil increases upon aging.

### Colorimetry - CIELAB

Days of ageing	0	1	4	7	14	21	28
<b>L* (w)</b>	<b>79.98</b>	<b>71.71</b>	<b>62.72</b>	<b>54.76</b>	<b>42.41</b>	<b>40.67</b>	<b>35.10</b>
<b>a* (w)</b>	<b>7.51</b>	<b>14.83</b>	<b>21.59</b>	<b>24.28</b>	<b>14.84</b>	<b>13.89</b>	<b>15.10</b>
<b>b* (w)</b>	<b>55.83</b>	<b>56.68</b>	<b>51.78</b>	<b>45.05</b>	<b>24.47</b>	<b>20.37</b>	<b>16.81</b>

Tab. 1 Average L\*a\*b\* measurements of the pure cotton +linseed oil mock ups upon aging stages, on white reference background.

### Mechanical Effect

Linseed oil during drying converts from a liquid to a clean, elastic, semi-solid film in fine layers.<sup>24</sup> The absorption of sufficient quantity of oil to the point of soaking a paper support, either locally or overall, has consequently an effect on the mechanical properties of the support after drying. The oil penetrates the fibre net of the paper support in liquid form and then converts to a dense elastic polymer that fills the porous material after drying.

The fibres are "bonded" with the elastic polymer of the dried oil, providing different mechanical characteristics of the support. The mock ups of oiled paper after drying become more firm, showing that the absorption of the oil had an effect on the stiffness (flexural rigidity) of the support. This could imply differences in mechanical behaviour between the areas of paper where oil has absorbed and the "blank" areas in a work of art. This could provide an explanation of the planar distortions which are localised in areas of paper with thick impasto oil colour, which has been usually attributed to the resistance of the solid paint layer, although paper is considered to respond well to paint layers of oil colours<sup>25</sup>. The higher quantity of the oil binder in the impasto areas, if absorbed by the paper support, could cause the development of tensions with the "blank" areas or areas that have not absorbed oil. It could be suggested that the behaviour of the paper support during changes in relative humidity in the surrounding atmosphere, would be altered by the presence of the hydrophobic oil in its core. Non destructive investigation of the effect of oil binder on the cellulosic support (Russelgraphs) has come up with results indicating that drying oils by forming a cross linked structure reduce the permeability of the paper.<sup>26</sup> This hypothesis, again, would imply a different rate of absorption and release of moisture between the oiled and not oiled areas. It could also be suggested that the absorption of the oil by the paper support influences the moisture content of the cellulosic material. This would have both chemical and mechanical effect on the paper support.

It could also be suggested that absorption of the oil medium, locally or overall, results in the application of forces on the support. In contrast with the water based colour media, oil binders do not evaporate during the drying process, so they apply more weight to the support, especially when excess oil is absorbed. The weight difference of the cotton based paper mock ups before and after the application of the oil substance and drying, was almost equivalent to the weight of the oil added.

Although, the molecular weight of the oil mediums increases at the first stages of drying, due to the reactions with the atmospheric oxygen, and reduces with aging and degradation reactions, due to volatile organic compounds giving off<sup>27</sup>, it would be difficult to imply that this behaviour has mechanical effects on the support. However, weight difference of the mock ups before and after the various aging stages was insignificant.

Finally, mock ups<sup>28</sup> became less flexible, showing a considerable reduction of their mechanical strength upon aging.

<sup>24</sup> Gettens/Stout (1966), p. 38

<sup>25</sup> Jones (1992), p. 116

<sup>26</sup> Kosek/Green (1992), p. 101

<sup>27</sup> Church (1915), p. 52

<sup>28</sup> Series (II) mock ups

### Chemical Effect

Discolouration and embrittlement of the paper support, associated with oil binder absorption, are assumed to be due to the oxidation of the support, enhanced by the free radicals produced during drying and ageing of the oil. Indications for the oxidation of the cellulosic support, locally or generally, were initially provided by the pH measurements on works of the National Gallery. Surface pH measurements were taken from several oil works on paper and b/w prints that presented the associated problems, on their verso side. In every case, the pH value of the discoloured areas was lower than the ones that did not bear oil paint layer on the recto (average pH difference 1.5). pH measurements on the mock ups<sup>29</sup> at the several aging periods were more indicative. Although that small difference of the pH values of the pure cotton mock ups with and without oil, before aging, was expected, the pH measurements on the oiled pure cotton mock ups showed a dramatic fall from the first day of aging, while those without oil showed a minor reduction of the pH value throughout aging. The pH values of the oiled mock ups were reduced gradually as the days of aging increased (Tab. 2). The dramatic change in pH may be due in part to free fatty acids being produced from the oil by hydrolysis as well as acids being produced in the paper by oxidation of the cellulose and hemicelluloses.

### Surface pH Measurements

Days of ageing	Cotton	Cotton + oil
0	6.9	6.7
1	6.3	2.5
4	6.3	2.2
7	6.6	2.3
14	6.6	2.3
21	6.2	2.0
28	6.3	2.3

Tab. 2 The average surface pH measurements of the pure cotton and pure cotton + linseed oil mock ups upon aging stages.

In order to investigate whether the presence of oil may increase the rate of cellulose oxidation in paper in such works of art, some initial tests were carried out on pure cotton paper. Samples of cotton filter paper with and without linseed oil applications were, after allowing the oil to dry for three months, submitted to dry and humid ageing for various lengths of time ranging from 1 day to 28 days, at 90 °C and 100% RH<sup>30</sup>. Each sample was then investigated by Head Space Solid phase Micro Extraction coupled to Gas Chromatography-Mass Spectrometry.<sup>31</sup> Preliminary results from these pilot applications, described elsewhere<sup>32</sup>, have shown that oil accelerates the rate of cellulose degradation, as indicated by emission of furfural and other furan based degradation products which are produced as paper oxidises but not as oil oxidises. In addition, emission of volatile oxidation products is accelerated in humid conditions compared with dry ageing. Further work is being carried out on this aspect of the research, involving more paper types and different aging conditions, and will be reported elsewhere. High temperature and increased humid conditions possibly promote the hydrolysis of oil that then propagates the rate of oxidation of the by-products. This implies that storage conditions could influence the chemical effect of the oil on paper, therefore the intensity of the problems.

Others<sup>33</sup> describe how discolouration and embrittlement occurs more in paper supports with lignin content. In those cases, the possible increase in the rate of oxidation caused by the absorption of the oil binder would hasten the inevitable acidic nature of the support. It is possible that increased acidity hastens the hydrolysis of the oil leading to even greater acidity as free fatty acids are produced in this process.

## 5 Conclusions

Approaching the absorption of the oil binder by the paper supports through the oil painting and traditional printing techniques, the properties and the behaviour of the materials engaged, sensible explanations about the intensity and the extend of the associated problems were delivered.

Observations on the mock ups, supported by a theoretical approach, suggested that discolouration and mechanical alterations of the paper support cannot not necessarily associated with the degradation of the support, but they are

<sup>29</sup> Series (II) mock ups

<sup>30</sup> Series (I) mock ups

<sup>31</sup> Banou et al. (2010), pp. 5-6

<sup>32</sup> Banou et al. (2010), p. 9

<sup>33</sup> Tumosa et al. (2008), pp. 22-23; Strlic/Kolar (2003), p. 82

related with chemical changes of the oil binder during drying and ageing and its interaction with the cellulosic fibrous net. Preliminary results of analysis have indicated that oil has shown that oil accelerates the rate of degradation of cellulose, which is also influenced by the relative humidity conditions. Without a doubt, this affects the optical and mechanical characteristics of the support.

The various factors that influence oil absorption by the paper supports explain the randomness of the occurrence of the associated problems, while the simultaneous mechanisms involved makes the reasonable evaluation of the condition of the works difficult. Further research and experimental work are required to provide answers to this complex matter.

## References

Banou et al. (2010)

Banou, Penelope; Kaminari, Agathi; Moutsatsou, Anna; Alexopoulou, Athena; Singer, Brian W.: Investigating of the conservation problems of oil paintings on paper supports. In: *Works of Art & Conservation Science Today November 26-28, 2010*, Aristotle University of Thessaloniki/University of Ecclesiastical Academy of Thessaloniki, Greece (2010)

Banou et al. (2014)

Banou, Penelope; Alexopoulou, Athena; Chranioti, Chraikleia; Tsimogiannis, Dimitris; Terlix, Agni-Vasilias; Zervos, Spyros; Singer, Brian W.: Oil based media on paper. Investigating the effect of oil medium on the paper supports via VOC emission analysis. In: *11<sup>th</sup> International Conference on Non-Destructive Investigations and Microanalysis for the Diagnostics and Conservation of Cultural and Environmental Heritage*, 11-13 of June 2014, Madrid, Spain - Contribution ID33 in the full paper CD.

Berg (2002)

Berg, Jorrit D. J. van den: Analytical chemical studies in traditional oil paints - Chapter 2: Oil paint: developmental stages from an oil to a hard dry film, University of Amsterdam 2002. - <http://dare.uva.nl/document/61461> [20<sup>th</sup> June 2014]

Bonaduce et al. (2012)

Bonaduce, Ilaria; Carlyle, Leslie; Colombini, Maria Perla; Duce, Celia; Ferrari, Carlo; Ribechini, Erika; Selleri, Paola; Tine, Maria Rosaria: New Insights into the Ageing of Linseed Oil Paint Binder: A Qualitative and Quantitative Analytical Study. In: *PLOS ONE*, 7 (2012) 11, pp. 1-14. - *PLoS ONE* 7(11): e49333. doi:10.1371/journal.pone.0049333

Church (1915)

Church, Arthur H.: *The chemistry of paints and paintings*, 4<sup>th</sup> edition, London 1915

Daniels (1988)

Daniels, Vincent: The discolouration of paper on ageing. In: *The Paper Conservator*, 12 (1988), pp. 93-100.

Engram (1991)

Engram, Chelsey: Oil Painting on Paper and Board Supports. In: *AICCM Bulletin*, 17 (1991) 3<sup>rd</sup>, pp. 13-20.

Gettens/Stout (1966)

Gettens, Rutherford J.; Stout, George L.: *Painting Materials. A Short Encyclopedia*, New York 1966

James et al. (1997)

James, Carlo; Corrigan, Caroline; Enshaian, Marie Christine; Greca, Marie Rose: *Old master prints and drawings. A guide to preservation and conservation*, Amsterdam 1997

Jones (1992)

Jones, Rica: Paint versus paper? A few notes on the risks posed to oil paint by high humidities and by movement in the support. In: *The IPC Conference papers Manchester 1992*, edited by Sheila Fairbrass, Worcester 1992, pp. 116-118.

Kaminari et al. (2014)

Kaminari, Agathi Anthoula; Moutsatsou, Anna; Banou, Penelope; Alexopoulou, Athena: The contribution of imaging techniques to non-destructive testing of oil paintings on paper supports. In: *11<sup>th</sup> International Conference on Non-Destructive Investigations and Microanalysis for the Diagnostics and Conservation of Cultural and Environmental Heritage*, 11-13 of June 2014, Madrid, Spain - Contribution ID16 in the full paper CD.

Kosek/Green (1992)

Kosek, Joanna; Green, Lorna R.: A survey of oil paintings and sketches on paper in the collection in the British Museum: an assessment of stability. In: *The IPC Conference papers Manchester 1992*, edited by Sheila Fairbrass, Worcester 1992, pp. 96-102.

Laune (1926)

Laurie, A. P.: On the Change of Refractive Index of Linseed Oil in the Process of Drying and Its Effect on the Deterioration of Oil Paintings In: *Proceedings of the Royal Society of London, Series A*, 112 (1926) 760, pp. 176-181. - <http://rspa.royalsocietypublishing.org/content/112/760/176.full.pdf+html> [20<sup>th</sup> June 2014]

Mayer (1991)

Mayer, Ralph: *The artist's handbook of materials and techniques*, 5<sup>th</sup> edition revised and expanded by Steven Sheehan, New York 1991

McAusland (1989)

McAusland, Jane: Problems with works of art in oil on paper and their support. A paper conservator's viewpoint. In: *General Meeting of the Association of British Picture Restorers*, Kew (1989), pp. 1-6.

Millard et al. (2011)

Millard, Tanya; Le Cornu, Emma; Smith, Rachael; Hasler, Eleanor; Cowdy, Helen; Chisholm, Rebecca; King, Elanor: The conservation of 830 oil paintings on paper by Marianne North. In: *Journal of the Institute of Conservation*, 34 (2011) 2, pp. 159-172.

Mills/White (1996)

Mills, John S.; White, Raymond: *The organic chemistry of museum objects*, 2<sup>nd</sup> edition, Oxford 1996

Sian (1995)

Sian, Perry: The Conservation of Two nineteenth century oil sketches on paper, attributed to Josephine Bowes with scientific investigation into the effects of the media on paper. MA. Dissertation at the Northumbria University 1995

Smith (1987)

Smith, Ray: The artist's handbook, London 1987

Stijnman (2000)

Stijnman, Ad: Oil-based printing ink on paper. Bleeding, browning, blanching and peroxides. In: *PapierRestaurierung - Mitteilungen der IADA*, 1 (2000), pp. 61-68.

Strlic/Kolar (2003)

Strlic, Matija; Kolar, Jana: Evaluating and enhancing paper stability - needs and recent trends. In: *Cultural heritage research: a Pan-European challenge*, edited by Roman Kozłowski, Krakow 2003, pp. 79-86.

Tumosa et al. (2008)

Tumosa, Charles S.; Erhardt, David; Hufford, Kathy; Quas-ney, Evan: The Deterioration of Newsprint and Implications for Its Preservation. In: *WAAC Newsletter*, 30 (2008) 3, pp. 21-24.

## Discovering the Layers of Time, Meaning and Material. Conservation-Restoration of a Wall Hanging from the Wilanów Collection

DOROTA DZIK KRUSZELNICKA

Academy of Fine Arts, Warsaw/National Museum in Warsaw

### Abstract

Different aesthetics and different techniques, which are attractive and incomprehensible at the same time, constitute unusual material for in-depth analysis.

It is a long, complex journey that requires the use of tools offered by both the humanities and the art and science of conservation. The methodological process of 'fathoming' a work takes place as one gets to know its history as well as collecting information related to its provenance and iconography. The object's material substance is gradually revealed through technological studies, by recognising the technique that was used to make it, as well as through work on the object itself.

The project deals with an object from the Wilanów Palace Museum's collection which is a long panel with a centrally placed, Chinese-made representation of a *nianhua* type. The image's border depicting painted vases and a valance was probably made later, in Europe. The object bears traces of former conservation work.

The multi-layered (both in terms of technology and chronology) whole was relined on canvas and mounted on stretcher bars. This large object combines Eastern and Western cultures with all the semantic load that they carry. Its detailed history is not known. In the background there is the Wilanów Palace, with its love for collecting *chinoiserie* which lasted for two centuries.

The project entailed the conservation of this object which forms part of a set of Chinese wall hangings. The conservation was preceded by archival research as well as a range of specialist studies. It will serve as a model for future conservation projects carried out by the Museum.

The object belongs to the Wilanów Palace Museum which keeps a unique and diverse collection of Chinese paintings and woodcuts on paper, dating from the second half of the 18<sup>th</sup> century and turn of the 18<sup>th</sup>/19<sup>th</sup> centuries. The majority of these works originally served as wall decorations of the 'Chinese Apartment' created by Count Stanisław Kostka Potocki at the beginning of the 19<sup>th</sup> century. After the Second World War, they were removed subsequent to the discovery of underlying 18<sup>th</sup> century frescoes by Rossi and Palloni and Sobieski-era ceiling polychromes when it was decided that they would be restored to their original appearance. The *chinoiseries* were dismantled from the walls, underwent conservation and have since been kept in the Museum storage. Their exact history is unknown. At the background is the Wilanow Palace with its two centuries of continuing affection for things Chinese, from the 17<sup>th</sup> century fascinations of King John III Sobieski, through the tastes of the houses of Wettin, Czartoryski, and Lubomirski, to the 19<sup>th</sup> century passions of Count Stanisław Kostka Potocki and his ancestors.



## Time: Origins of the Wilanów Palace *Chinoiserie* Collection

*Chinoiserie* was a phenomenon reflected in a wide range of fields - from clothing, through art, to philosophy. Western Europe's fascination with Far Eastern aesthetics had been made possible by geographical discoveries and the ensuing trade exchanges with the formerly unknown lands<sup>34</sup>. As a trend, *chinoiserie* arrived in Poland due to demand for 'novelties' from Western Europe, among which were also objects of Far Eastern origin.

Long-time studies<sup>35</sup> of the phenomenon of European *chinoiserie* have resulted in various periodisations<sup>36</sup>. Most applicable to the Wilanów collection seems to be the three-partite division suggested by Dawn Jacobson (*Chinoiserie*, London 1999, p. 67). The 'imitative period', when King John III Sobieski's Chinese Cabinet is created, is followed by the 'fantasy period', when the trend booms both in Poland and elsewhere in Europe, and then the 'Neoclassical-Romantic' period, when the phenomenon gradually declines in Europe but sees its climax in Poland. The last phase was marked by skilful ornamentation solutions underpinned by an admiration for the distant culture and a desire to get to know it. It could be said that while the early 18<sup>th</sup> century fashion for Chinese imports was driven by little more than a fascination with exoticness, during the age of Enlightenment *chinoiserie* develops a deeper ideological and cultural background. Such is the background of the Potocki collection<sup>37</sup>. Count Stanisław Potocki's apartments were created in stages, as the collection grew. The rooms of varied character were decorated with original works from the Far East as well as with European *chinoiserie* imitations. Genuine works of art, collections of Chinese and Japanese porcelain, lacquer objects, and stone sculptures were displayed next to curiosities such as ivory objects, tree roots, pipes, spittoons etc. All these were exhibited against the background of richly decorated walls lined with Chinese paintings or prints, fascinating in their dazzling array of forms and colours. Strong colours dominated: yellows, reds, greens, gildings. The wall decorations served as background for movables. In 1805, the Wilanów Palace was open to the public. Colourful and exotic, the Chinese rooms were both an attraction for the artistic and intellectual elites of the era and a source of knowledge about Far Eastern art.

The character of European writing on China changed over time. From the mid-18<sup>th</sup> century onwards, the earlier fantastic accounts were gradually supplanted by more reliable political, social or geographical analyses of the Middle Kingdom. Stanisław Kostka Potocki had a large and constantly expanding library, divided into 69 thematic sections.<sup>38</sup> He translated Johann Joachim Winckelmann's highly valued *Geschichte der Kunst des Alterthums* [The History of Art in Antiquity] into Polish, adding his own chapters on Far Eastern art, which he thought were missing from the original. Showing all aspects of Far Eastern art, crafts, and culture, the Wilanów collection served as a vivid illustration of the book. Potocki presented a science-popularising and encyclopaedic approach typical for the age of Enlightenment. Collecting passion was subjected to scientific rigour here, the collection receiving a low-key setting of regular harmonies and neoclassical character. This is a late - yet creative - development of a dominant fashion, the result of work to which Potocki devoted the late years of his life. The combination of Far Eastern elements with their often nonchalant European travesties makes the collection particularly attractive, with wallpapers playing a special role here (Fig. 1). The currently preserved collection of paper-based objects includes a total of fifty five different works.<sup>39</sup>

---

<sup>34</sup> Łakomska (2008), p. 8.

<sup>35</sup> The *chinoiserie* style played a significant role both in the development of the decorative arts and modern Enlightenment thought. The extensive history of exhibitions that analyse this theme dates back to 1910 and the Parisian *Le goût chinois en Europe au XVIIIe siècle* (Musée des Arts Décoratifs). The first such presentation in Poland, entitled *Osobliwości Dalekiego Wschodu w historycznej kolekcji Wilanowa*, was staged in 1993, Zaslawska (2000), pp. 65-103.

<sup>36</sup> According to Erich Kollmann, the trend can be divided into three main phases. The first of these, dated 1670-1730, is marked by an admiration of exoticness and peculiarity, while the symbolism remains obscure; the time of the *Kunstkammer* and *Wunderkammer*. The second phase, which continued for the following three decades, is a period of Far Eastern imports and the style's gradual expansion all over Europe. The collecting of Louis XIV of France, Augustus II the Strong, or Frederick the Great fuels the development of European arts and crafts. European porcelain production flourishes, and so does the production of ware imitations of lacquer or of pseudo-Chinese painted wallpapers. The period sees plenty of reckless fantasising about all things 'Oriental'. The third phase, lasting roughly from 1760 to 1820, is the 'Romantic' one.

Another division, proposed by Hugh Honour, analyses the phenomenon from the perspective of the Baroque (dazzling collections, mainly of porcelain, reflecting the period's love for extravagance and luxury); Rococo (instead of leading to serious study, the century-long fascination turns into a light farce about distant lands / fantastic interpretation of forms); and Neoclassicism (the order and harmony of Neoclassical forms linked up closely with Chinese motifs), Zaslawska (2000), pp. 65-103.

<sup>37</sup> The collection included both the Chinese Apartment and Potocki's private rooms, decorated between 1820 and 1830. Though the original decor has not survived, we know much about it from an 1832 inventory, an 1837 *Chinoiserie Inventory*, and Potocki's contracts with decorators, painters or gilders. Another invaluable source is the *Business Diary of Stanisław Kostka Potocki, Senator and Voivode*, written from 1797 to 1812, listing the Count's expenses and purchases, including during his numerous foreign trips, such to Paris in 1808.

<sup>38</sup> Zaslawska (2000), p. 97.

<sup>39</sup> Various aspects of the object's historical background have been discussed in greater detail in a paper published by China's *Nian Hua Journal* as part of a series entitled 'The New Year prints from abroad'. 波兰 ) 多洛塔·德兹克·克鲁斯泽尔尼卡·维拉诺夫宫“中国风”壁纸艺术试析, 《年画研究》第三辑, 北京: 中国戏剧出版社, 2013.



Fig. 1 Chinese cabinets; a photograph from 1955 (archive of PKZ, ul. Solec 103, 00-382 Warszawa, tel. +48 226226409)

### Meaning: Analysis of Iconographic Layer

The subject of my analysis is a vertical panel with a centrally inset Chinese representation showing a lady with two boys (Fig. 2). The border, with painted vases and a lambrequin, was probably made in Europe at the beginning of the 19<sup>th</sup> century. The (technologically and chronologically) multilayered object was lined onto canvas and mounted on a stretcher.



Fig. 2 A Woman with Two Children, Wilanów Palace Museum; photo by T. Rizov-Ciechański

The panel was secondarily framed, probably by Wojciech Kiciński,<sup>40</sup> by a painting border consisting of two semicircular niches arranged symmetrically at the top and bottom, which visually bound the composition. In the upper semicircle, on a uniform light-blue background, a porcelain pot (vase) with flowers can be seen. Mannerist in form, the vessel is rather European in character. In the lower semicircle there is a censer, definitely a Far Eastern motif. Its form alluding to the archaic *li* tripod, a bronze vessel used originally for cooking and later as a decorative art motif.<sup>41</sup> The whole composition has been placed against a cinnabar-red background, with a strip of yellow running alongside the side margins. Bounding the composition from above is a gold-brown valance and two fringes. At the bottom of the composition is an ornament in the form of a uniform floral pattern.

In the centre of the composition is a woman, slim, as was the fashion at the time, her head shown frontally, tilted slightly to the right. She has dark almond eyes, symmetrical and delicate eyebrows, a long and slender nose, and her mouth, cupped in a slight smile, has been rendered according to the Qing-dynasty mouth-painting convention.<sup>42</sup> The woman is fair-skinned, her smouldering gaze directed towards the viewer. Her dark hair is kept

<sup>40</sup> This assumption can be made based on the contract entered into between Potocki and Kiciński on the 30<sup>th</sup> August 1821 (Central Archives of Historical Records AGAD in Warsaw, *Anteriora* 305).

<sup>41</sup> Jakoby et al. (2009), p. 354.

<sup>42</sup> Hua (2010), p. 47.

in place using a *touzan*-style half-crown diadem. There are earrings in her eyes. She is dressed in a two-part costume inspired by the traditional *ruqun* dress (upper garment *ru*, waist-tie skirt *qun*), known from the Qing dynasty onwards as *aoqun*, with the upper garment much lengthened. The model's blue *ao*<sup>43,44,45</sup> cape is adorned with a floral pattern featuring one of the favourite decorative motifs of Chinese art, the peony flower. Known as *fuguihua*,<sup>44</sup> the 'flower of wealth and happiness', it symbolises spring, *chonghua*, as one of the symbolic 'flowers of the four seasons', or *sijihua*. The robe's wide sleeves *bai*,<sup>45</sup> have been trimmed with a black fabric with a chrysanthemum-petal motif,<sup>46</sup> a symbol of autumn. At the woman's neck is a black decorated stand-up collar with two buttons.<sup>47, 48</sup> Thrown over the women's shoulders is a light-coloured collar featuring the decorative form of the *lingzhi*<sup>48</sup> mushroom, a symbol of longevity. Known as *yunjian*, the name of this collar, popular during the Ming dynasty<sup>49</sup> and worn by women from wealthy families, derives from *jian*, shoulders, and *yun*, cloud. The model's forearms and back are enveloped by a loose shawl. She is wearing a two-part skirt. The bottom, long, part of the *aogun* is light in colour; the upper part protrudes at the top, wrapping the woman's waist. The whole is adorned with a dark-grey sash tied in the waist, to which has been affixed an oval jade ornament (*yu*) with a blue flying ribbon (*piaodai*), its purpose being to boost the wearer's luck.<sup>50</sup> In her left arm, the woman is holding a small boy, his feet supported by her right hand. In his raised left hand, the boy holds a branch of osmanthus<sup>51</sup>. This is a wish to be the best *zhuangyuan* in the civil service exams. A *sheng* harmonica has been tied to the branch using a yellow ribbon. It symbolises the wish to have many sons.



Fig. 3 An analog representation of A Woman with Two Children, Wilanów Palace Museum; photo by T. Rizov-Ciechański

At the woman's right side is an older boy (*guizi*), shown in a dynamic jump. He raises his left hand, holding an overblown lotus flower with green head filled with symbolically rendered mature seeds. Known as *furonghua*, and later as *hehua* or *lianhua*, in Buddhism the lotus is a sacred symbol of perfection and purity. During the Ming and Qing dynasties, as a symbol of summer, a wish of fertility and good luck, it was a very frequent motif.<sup>52</sup>

The whole scene has been shown on an otherwise empty, cream-coloured paper background. The composition is framed by a dark-blue border. The frame's sharp colours, the work of a domestic artist, contrast with the subtle, delicate colours of the Chinese painting.

In its iconographic layer, the representation conveys the wish of the birth of many outstanding sons (*Lian sheng guizi*<sup>53</sup>) which, by means of the phonetic identity of Chinese characters, finds a reflection in the symbolic

<sup>43</sup> Kajdańska/Kajdański (2007), p. 459.

<sup>44</sup> Kajdański (2005), p. 189.

<sup>45</sup> Wang (2009), p. 145.

<sup>46</sup> Kajdański (2005), p. 44.

<sup>47</sup> Although buttons have been known since the Yuan Dynasty, they are, undoubtedly, the Ming Dynasty's contribution to the tradition of Chinese dress, Wang (2009), p. 146.

<sup>48</sup> Kajdański (2005), p. 135.

<sup>49</sup> Hua (2010), p. 114.

<sup>50</sup> Consultation with Dr. Anita Wang, autumn 2012, Feng Jicai Research Institute of Literature and Art, Tianjin University.

<sup>51</sup> Consultation with Dr. Lucie Olivova (Palacky University, Olomouc, Czech Republic); whereas Danuta Natalia Zasławska suggests that this is a branch of a cinnamon tree (*gui*), cf. Zasławska (2008), p. 267.

<sup>52</sup> Kajdański (2005), pp. 139-140.

<sup>53</sup> Lust (1996), p. 206.

significance of the objects held by the represented figures. The theme belongs to the category of auspicious motifs, popular among the Chinese New-Year pictures (*nianhua*)<sup>54</sup>.

It is a typical example of export painting for the European market, although representations of beautiful girls also adorned the interiors of palace pavilions and wealthy mandarin homes in China itself. In fact, such beauties charmed viewers all over the world, as demonstrated by a passage from Pu Sung-ling's collection of supernatural tales, *Strange Stories from a Chinese Studio*:

*On the east side were pictured a number of fairies, among whom was a young girl whose maiden tresses were not yet confined by the matron's knot. She was picking flowers and gently smiling, while her cherry lips seemed about to move, and the moisture of her eyes to overflow. Mr. Chu gazed at her for a long time without taking his eyes off... Mr. Chu mingled with the throng, and after a few moments perceived a gentle tug at his sleeve. Turning round, he saw the young girl above-mentioned, who walked laughing away.*<sup>55</sup>

The collection includes also a very similar object, different only in small details of the colour and pattern of the robes (Fig. 3).

## Materials: Study of the Techniques and Technologies Involved

In the fall of 2012, I went to China to confirm attribution and study aspects of the Far Eastern artists' technique. The available literature suggested that the object had been made using the technique of hand-painted contour woodcut.<sup>56</sup> I visited Huo Qing Shun and Huo Qing You's workshop in Yangliuqing, whose tradition stretches back six generations. I got to know the multistage process of print-making, from the creation of a sketch, its transfer to a properly seasoned birch-leaved pear (*Pyrus betulaeifolia*) wood panel, the engraving of the panel lines using the technique of *dui dao* and *guo dao* and of the *dian tao* surfaces, the washing of the panel, application of ink and paints,<sup>57</sup> the making of an actual print on a printer's table (Fig. 4A), then drying it and mounting on a board (*fan qiang*).<sup>58</sup> Finally, hand painting the object using Yangliuqing technique as one of the more important stages of the creative process (Fig. 4B). The latter is a unique procedure, governed by many fascinating laws, where each and every element matters: from the direction in which the colours are applied, through their sequence, determined by the rank of the given detail (eyes, mouth, and so on; there are eighteen different techniques for painting the face), through saturation (from the lightest parts to the darker ones), to proper brush pressure and controlling the amount of water used. A mixture of gluten glue and alum (*bai fan*) is sometimes spread across the paper surface prior to painting, or used as barrier between the successive painting layers. The whole process requires an arsenal of tools: *Pai Bi* and *Bian Bi* brushes, the *Pai Ban* hammer, a range of metal chisels, horse hoofshaped knives and so on. The Yangliuqing artists were convinced that the object in question originated in their circle. I also had the chance to meet Prof. Feng Jicai from the Research Institute of Literature and Art (Tianjin University) who said that the object was a valuable example of high-class Chinese contour painting from the turn of the 18<sup>th</sup>/19<sup>th</sup> centuries. It was made in northern China, probably in Yangliuqing'.<sup>59</sup>

---

<sup>54</sup> The term *nianhua* denotes pictures made on the occasion of the Chinese lunar New Year. As cult objects, such images were meant to protect against evil and ensure prosperity and luck. They were manufactured at many woodcutting centres representing formal, stylistic or technical diversity characteristic for the given region or province of China. Among the leading woodcutting centres were Yangliuqing, Wuqiang, Mianzhu, Jiayang, Zhuxianzhen, Kaifeng, Lingbao, Fengxiang. Using various techniques, the mostly anonymous artists skillfully translated the language of painting into that of woodcut. The purpose of the work dictated the choice of materials. Impermanent votive offerings, meant for ritual burning, were made using low-cost materials, whereas highly decorative, artistic woodcuts used good-quality paper. The *nianhua* images convey a broad range of themes, from the religious pantheon, through symbolic representations, to genre scenes and depictions inspired by literature and theatre, on their own or in combinations.

<sup>55</sup> Pu Sung-ling: 'The Painted Wall', In: *Strange Stories from a Chinese Studio*, trans. Herbert A. Giles, London: Thos. De La Rue & Co., 1880, pp. 8-9.

<sup>56</sup> Zaslawska (2008), p. 267.

<sup>57</sup> Artists quoted in Feng Jicai's publication (Feng, 2011) mention the former use of glues made with donkey or dog skin. Today, bone glue is used.

<sup>58</sup> For this purpose, a mixture of gluten glue and alum is applied to the entire surface of the reverse. In the past, starch paste was applied to the edges only and air was blown between the object and the base (Feng, 2011).

<sup>59</sup> This attribution was confirmed in a conversation with Prof. Feng Jicai, Feng Jicai Research Institute of Literature and Art, Tianjin University.





Fig. 4 A) Printer's table, Feng Jicai Research Institute of Literature and Art, Tianjin University B) Huo Qing Shun's and Huo Qing You's studio, Yangliuqing; photos by M. Kruszelnicki

I wondered how - if not by using a woodcut block - the artist had achieved an analogous contour in the twin representation (see Fig. 3). The answer is a technique known as *Pu Hui Nianhua* (pouncing), where a fine powder is used in the transference of the principal outlines of a drawing, usually a cartoon, to another support such a wall or another sheet of paper. Small prick-holes are made in the paper along the lines and dust (*bai e tu* or *tu fen*)<sup>60</sup> is pounced or rubbed through these holes, leaving a dotted outline of the design on the surface beneath. The colour-application process itself looked similar to the painting of woodcut prints. The *Nianhua* artists worked also for the European market.



Fig. 5 False-colour infrared photography. The difference between a part of the visible spectrum (left) and the infrared image in the range of 500-900 nm (right) indicates the presence of specific pigments; photo by E. Doleżynska-Sewerniak

I conducted a range of specialist studies.<sup>61</sup> To preliminarily ascertain the work's palette, a false-colour infrared photography analysis was carried out. The difference between the infrared image (in the range of 500-900 nm) and a part of the visible spectrum revealed the presence of Prussian blue, cinnabar, iron-containing pigment, and organic yellow (Fig. 5). Further research was recommended using microcrystalline and drop reactions to test the presence of selected inorganic ions, reflected-light microscope observation, and water smears viewed in transmitted light. Additional research using Raman spectroscopy, XRF spectrometry, and elemental analysis using a scanning electron microscope offered insight into the work's palette. Pigments were identified in thirteen locations. In the Chinese painting itself,

<sup>60</sup> The powder used in the reproduction process, called *Öäi* (*bai e tu*), is of mineral origin and contains calcium carbonate. Sometimes it is also called (*tu fen*). In one region, called Gao Mi in the Shan Dong province of China, charcoal obtained from willow wood was also used.

<sup>61</sup> These topics were discussed in more detail at a conference ICOM-CC Graphic Document Working Group Interim Meeting, Austrian National Library, Vienna 2013, Paper Conservation: Decisions & Compromises in the form of a poster presentation entitled *Conservator's investigation of the chinoiserie in the Wilanow Palace*, <http://www.icom-cc.org/54/document/paper-conservation-decisions--compromises--extend-ed-abstracts--interim-meeting-graphic-document-working-group-vienna-april-2013/?id=1185#.Ub30kfmePDs> [16.06.2013].



Prussian blue, shell white, natural cinnabar, carbon black, and organic yellow were identified. The European-made border showed Prussian blue, artificial azurite, natural red iron oxide pigment (in browns), and natural cinnabar. Stratigraphic studies in four different locations showed the number of layers ranging from four to nine (Fig. 6A).

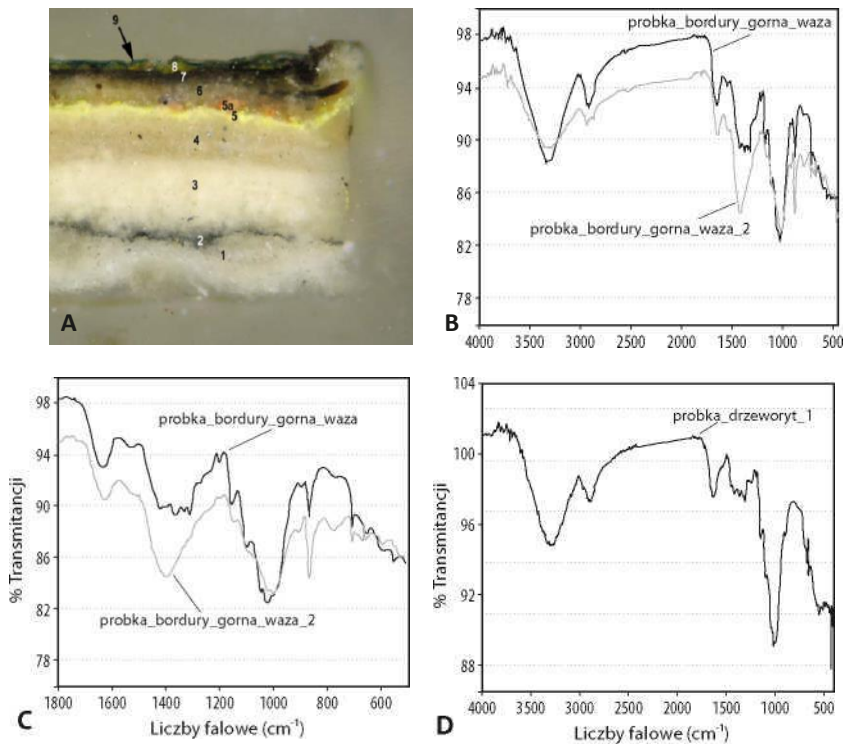


Fig. 6 A) Stratigraphic studies in four different locations showed the number of layers ranging from four to nine; B-D) Identification of binders through FTIR analysis and Raman spectroscopy (conducted by M. Eng. Z. Żukowska, PhD)

The layers are bound together by starch paste, as evidenced by reactions with Lugol's iodine. This was followed by Fourier transform infrared spectroscopy (FTIR) analysis and Raman spectroscopy (Fig. 6B-D). The binder of both the Chinese painting and the European-made border showed the presence of protein substances. An investigation of fibre composition confirmed the presence of paper mulberry (*Broussonetia papyrifera*) in the first lining layer, with an addition of *Edgeworthia gardineri* and rice straw in the second lining layer, and of flax fibres in the paper base.

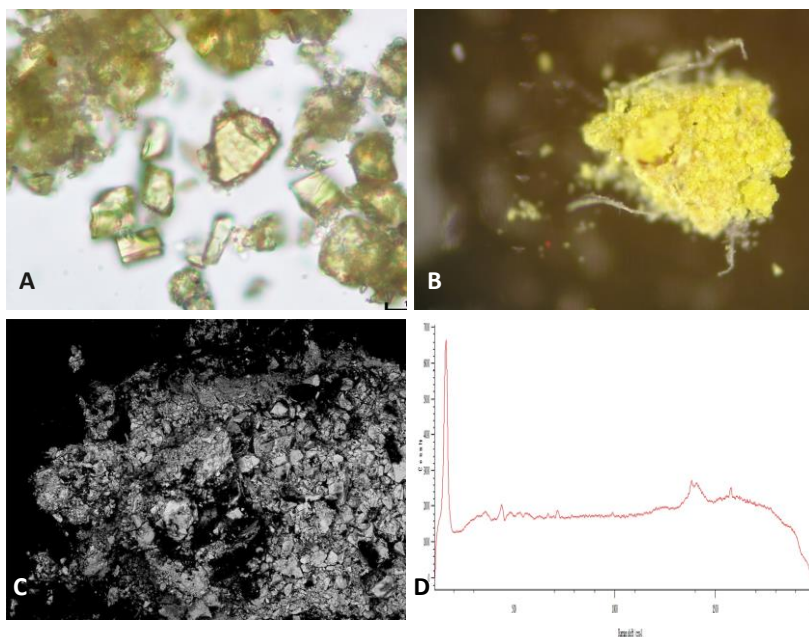


Fig. 7 A-D) Identification of pigment on the example of the border yellows. Tests, including microcrystalline and drop reactions, have shown that this is lead (II) oxide of tetragonal crystal structure. Smear grain morphology suggests it was naturally derived. A) Water smear viewed in transmitted light (photo by E. Jeżewska); B) Reflected-light microscope observation, magnification 210\* (photo by E. Jeżewska); C) Backscattered electron image, SEM-EDS analysis has revealed mostly Pb, C, O (photo by M. Wróbel, MA); D) Raman spectroscopy (carried out by A. Wesołowska, MA)

To sum up, in terms of technology the object is a multilayer structure consisting of ten sheets of flax-fibre handmade paper, lap-pasted together. The entire paper surface is covered by a yellow layer identified as a mixture of gluten glue and *litharge* (Fig. 7A-D). Into this had been pasted the Chinese painting, probably on *xuan zhi* paper, relined onto further two layers of Eastern paper. In both cases the painting layer consists probably of a mixture of pigments with gluten glue. In the 1950s, the paper surface was repaired, the painting layer reconstructed where the compensations had been made, then the whole was relined onto canvas and stretched on a stretcher. The added fragments and inpaintings are well visible in UV-excited fluorescence photography (Fig. 8)



Fig. 8 The added fragments and inpaintings are well visible in UV- excited fluorescence photography, photo by T. Rizov-Ciechański

### Practical Conservation-Restoration: Choices/Dilemmas and Decisions

The object required intervention. The extensive margin repairs caused a deformation of the original base. The fragile and thin paper of the Chinese painting was flaking and cracked in many places, and air bubbles between the paper and the lining layer posed a hazard to parts of the original. Small fragments of the painting layer were missing or abraded in many places. Poorly executed repairs of the reverse had caused the base to rise, resulting in deformations. Large fragments of the object had been 'brutally' retouched with paint to cover stains or discolorations. The painting layer, heavily abraded at places, showed numerous stains and splashes. The whole was covered by a layer of surface dirt. The object bore traces of 1950s and earlier repairs, as ascertained via archival research. Due to the negative impact of the postwar repairs on the object's stability, it was decided to remove them. This was of overriding importance given the dubious aesthetic qualities of the reconstructions performed. Since the pre-1945 repairs had not resulted in any damage, it was decided to retain them. The object was removed from the stretcher.



Fig. 9 Steps in conservation-restoration process I: A) Effects of surface cleaning, B and C) Removing from the wooden stretcher bars, D) Removing the canvas lining using the dry method



Fig. 10 Steps in conservation-restoration process II: A) The lower part required local water soaked compresses to remove the canvas. The reverse was mechanically cleaned of the remnants of glue, B) Removing the old repairs, C) Fragment of the front of image after removing former reconstruction, D) Reparations of torn fragments

The moisture sensitivity of the painting layer narrowed down the range of the available procedures. Mechanical dry cleaning using various kinds of rubbers<sup>62</sup> produced surprisingly good results (Fig. 9A). The fragile basis meant that the procedure required utmost caution. The canvas on which the object had been relined was then removed (Fig. 9B-D). For most of the layers which were bound together by starch paste, this was done using the dry method, and only the lower, most damaged, part required local compresses using swabs delicately soaked in hot water, applied to the reverse. In this case, the binding agent between the paper and the canvas was a mixture of gluten glue and starch glue (Fig. 10A). Following

<sup>62</sup> Wallmaster®, Pentel Hi-Polymer®.



the removal of the canvas, the reverse was mechanically cleaned of the remnants of glue<sup>63</sup> and the earlier repairs that 'held' the surface deformations in place were removed. Partial reconstructions of the border, which had been added on the reverse, were detached (Fig. 10B, C).

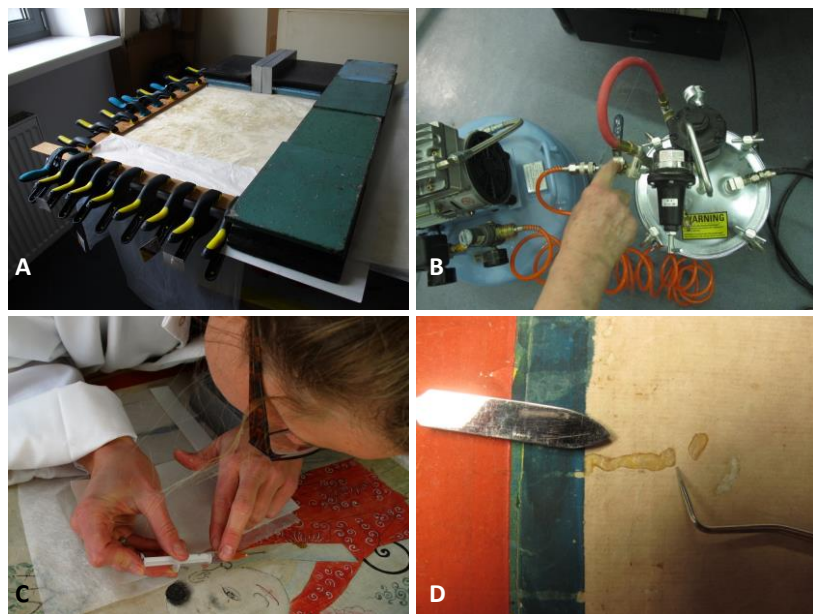


Fig. 11 Steps in conservation-restoration process III: A) Flattening of the deformed parts, B) Deacidification method using the Bookkeeper Spray System, C) Consolidation of flaking layers with injections, D) Filling of losses

Torn fragments were repaired using starch paste<sup>64</sup> and strips of Japanese paper (Fig. 10D).<sup>65</sup> After these procedures, the lower, heavily-deformed part of the object needed to be flattened (Fig. 11A). Then, using paste obtained with a solution of Tylose MH300,<sup>66</sup> former repairs were removed. The presence of Prussian blue in both the central representation and the later border meant that a safe deacidification method was required.<sup>67</sup> It was decided to spray the reverse using the Bookkeeper Spray System (Fig. 11B).<sup>68</sup> This anhydrous technology was chosen to rule out an undesirable reaction between the alkaline preparation and the painting layer, and to prevent the Prussian blue from browning. The procedure raised the reverse's pH by 1.9-3.2 whereas the obverse's pH was unchanged. Flaking layers of the thin paper base were consolidated with injections of a 1.5 % solution of Tylose MH300 (Fig. 11C).<sup>69</sup> Small losses in the Chinese part of the object were filled with a suspension of cellulose powder or *Broussonetia papyrifera*<sup>70</sup> fibres with a 2 % solution of Tylose MH300 (Fig. 11D). Larger in-fills were made with paper using starch paste. Small losses in the border were filled using a suspension of fibres<sup>71</sup> and 2 % Tylose MH300. The object was then reintegrated (loss-compensated) by making up the extensive missing

<sup>63</sup> Attempts were made to remove the glue using compresses of 2% Tylose MH300 and Laponite RD (a synthetic inorganic colloidal clay in 2% gel dispersion in water). The former was ultimately used because the Laponite RD left a glossy film. Locally, scalpel and abrasives were also used.

<sup>64</sup> Definol is modified pure wheat starch.

<sup>65</sup> Paper Nao RK 7 17 g/m<sup>2</sup> (Anton Glaser) 17 g/m<sup>2</sup>.

<sup>66</sup> A 2% solution of Tylose MH300 was used. Triammonium citrate produced good results too but, being impossible to wash away from paper, it was ultimately rejected.

<sup>67</sup> Prior to deacidification, the pH of the reverse was in the range of 5.5-5.7 and that of the face measured 6.4. After deacidification, the reverse's pH rose to 7.64-9.0 while that of the face remained unchanged.

<sup>68</sup> The Bookkeeper method uses magnesium compounds (magnesium oxide) in the form of a gaseous suspension (perfluoroheptan).

<sup>69</sup> The same procedure using 2% Klucel G dissolved in ethanol caused discolourations on the paper surface.

<sup>70</sup> Purified microcrystalline cellulose powder, partially-depolymerized and derived from fibrous plants (Lattice® NT Microcrystalline Cellulose), and fibres of Paper Nao K-148, 40 g/m<sup>2</sup> were used.

<sup>71</sup> Arbocel® BWW 40 Cellulosemehl, approx. 200 p.

fragments of the painting layer using paper covered with a gouache or gouache-water colour<sup>72</sup>, retaining the continuity of the original sheet joints. The image was reintegrated<sup>73</sup> using pastel sticks.<sup>74</sup>



Fig. 12 Steps in conservation-restoration process IV: A-D) Lining and final flattening; Photos (Fig. 9-12) by D. Dzik-Kruszelnicka, M. Supruniuk, M. Szymańska

Another stage of the work was to reline the large-format work onto sheets of handmade paper (Fig. 12A-D).<sup>75</sup> The margins this had left were used to attach the object to a support, similarly as in stretching the edges of a canvas onto a stretcher. A honeycomb panel was used as a base. This rigid yet lightweight construction secured the reverse, creating a stable support. Free space in between allows for air circulation and for safely detaching the object from the added medium.

## Conclusions

The research made possible a comprehensive study of the object and its reinterpretation on the basis of both the historical context and its material characteristics. The main task at hand was to stabilise the object's structure and reintegrate its lost formal continuity. The image was reintegrated on the basis of archival evidence yet in a distinct manner in order to reestablish important qualities. This entailed a series of difficult decisions aimed at making the object more legible and exhibitible while respecting its authenticity. A better recognition of the object's substance and background determined, to some extent, the course of the conservation-restoration work. The large format meant that longterm, systematic efforts were required. The presence of Prussian blue in the Chinese palette made possible a more precise dating.<sup>76</sup> One of the project's major advantages is that it involved an attempt to analyse the Chinese artists' technique which, due to the secrecy that still surrounds certain aspects of Far Eastern art, is seldom discussed in the context of the study and conservation-restoration of paper-based objects. Some of the issues involved require further research.

<sup>72</sup> Paper: Anton Glaser (no. 2124, 75 % cotton, 25 % linen, pH 7.8), gouaches: Winsor & Newton Designers Gouache (Flame Red, Spectrum Red, Spectrum Yellow, Orange Lke Lt, Cyprus Green, Winsor Green, Olive Green, Yellow Ochre, Primary Yellow) with a small addition of Schmincke watercolours.

<sup>73</sup> Meaning compensation of base losses and the painting layer (inpainting); image reintegration means surface procedures where the painting layer has been abraded.

<sup>74</sup> A consolidating procedure was adopted which eliminates the use of water. The inpainting layer was preceded by an isolating layer of 2% Tylose MH300. Derwent pastel sticks were used.

<sup>75</sup> Paper Nao K-38 (16 g/m<sup>2</sup>), K-32 (48 g/m<sup>2</sup>).

<sup>76</sup> The East India Company records for Canton list the earliest shipments of Prussian blue for the year 1775, Bailey (2012).



## Acknowledgments

The project was made possible by the grant N N105 359740, led by Prof. Marzenna Ciechańska, financed by the National Science Centre.

## Selected bibliography

Bailey (2012)

Bailey, Kate: A note on Prussian blue in nineteenth-century Canton. In: *Studies in Conservation*, Volume 57, Number 2 (2012), pp. 116-121

Feng (2011)

Feng, Jicai: Chinese Woodblock New Year Prints Oral History: Yang liu Qing Nian Hua, Huo Family, Wang Xueqin; Bei Jing: Publishing House of China, 2011 中国木版年画传承人口述史丛书-杨柳青年画-霍氏家族、王雪勤

Hua (2010)

Hua, Mei: Chinese clothing, Beijing 2010

Jakoby et al. (2008)

Jakoby, Marcin; Markiewicz, Joanna; Popkowska, Joanna: Sztuka chińska w zbiorach Muzeum Narodowego w Warszawie (Chinese Art In the Collection of the National Museum in Warsaw), Warszawa 2009

Kajdański (2005)

Kajdański, Edward: Chiny. Leksykon, Warszawa 2005

Kajdańska/Kajdański (2007)

Kajdańska, Aleksandra; Kajdański, Edward: Jedwab. Szlakami dzonek i karawan, Warszawa 2007

Łakomska (2008)

Łakomska, Bogna: Miłośnicy "chińskości" w dawnej Polsce, Warszawa 2008

Lust (1996)

Lust, John: Chinese Popular Prints, Leiden 1996

Wang (2009)

Wang, Yulei: History of Dress, Beijing 2009

Zastawska (2000)

Zasławska, Danuta-Natalia: Chinoiserie w kolekcji Stanisława Kostki Potockiego w Wilanowie. In: *Rocznik Historii Sztuki*, vol. XXV, Warszawa (2000), pp. 65-103

Zasławska (2008)

Zasławska, Danuta, Natalia: Chinoiserie w Wilanowie, Warszawa 2008

***Please feel free to hand in articles, we will process them in our double blind peer review.***

The peer team is interdisciplinary:

Juri Ivanovich Aristov, Marina Biccieri, Jane Colbourne, Christa Hofmann, Erni Pilch Karrer, Viviana Nicoletti, Erich Renhart, Ursula Schädler Saub, Karin Scheper, Spiros Zervos

There are no deadlines for handing in proposals for contributions. Any proposals should be sent as Mail attachment to [patricia.engel@donau-uni.ac.at](mailto:patricia.engel@donau-uni.ac.at) or [drpatriciaengel@gmail.com](mailto:drpatriciaengel@gmail.com). We kindly ask you to quote according to the author's guidelines on the webpage or ask for them please.

## **UPCOMING EVENTS**

We are working on the curriculum of a new University Chair.

### ***„Interdisciplinary Methods in Graphic Art, Book and Document Conservation“ (MA)***

Please follow the development on our webpage.

### ***"Understanding Historical Book Binding Techniques as Pre-condition for conservation-restoration action"***

Is handed in for funding

## **IMPRESSUM**

**European Research Centre for Book and Paper Conservation-Restoration**  
Rosenhügelweg 24

3550 Langenlois

Austria

Tel.: +43(0) 650 58 71 877

E-Mail [patricia.engel@donau-uni.ac.at](mailto:patricia.engel@donau-uni.ac.at)

[www.donau-uni.ac.at/paper-conservation](http://www.donau-uni.ac.at/paper-conservation)

**ISSN 2225-7853**