



University of Antwerp
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A multi-technical study on the materials of The Pink Bows (1937), a Flemish Masterpiece by Paul Delvaux in the collection of the KMSKA

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Academic year 2021-2022

2016FOWCOR: *Masterproef met inbegrip van stage*
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28 August 2022

Short summary

In the following study, the study practice of Belgian modernist painter Paul Delvaux (1897-1994) has been explored by a multi-technical analysis of *The Pink Bows* (1937). The build-up, materials and working process were analysed by means of descriptive research, invasive and non-invasive techniques. Special attention was given to the use of transparent layers and their (visual) impact on the painting. We found that Delvaux used a traditional paint palette and mainly used transparent oil layers to even out the saturation of the colours.

Acknowledgements

This dissertation starts somewhere in 2015 in Ghent. The lovely owner of a newsagent gave me some magazines on art auctions, casually mentioning that the field of restoration would really suit me. Little does she know how large the flame would grow that she instilled in me that day. After saying goodbye to a teaching career, I took the plunge and moved to Antwerp, enrolling in conservation-restoration at the university. It has been a journey with many struggles. As a first-generation student, I wasn't always sure how to navigate the tertiary education life. A lot of the time I have doubted myself and felt I wasn't cut out for this. But ... I have finally reached the finish line and I couldn't be more proud of myself! The effort was not singularly mine, however, and I would like to express my thanks to the people who have contributed to the endeavour of this thesis, but also to those who stood by me these past couple of years.

| A dream you dream alone is only a dream. A dream you dream together is reality.
Yoko Ono

First, I would like to thank my supervisors. Although I am not the most communicative student, Prof. Dr. Geert van der Snickt has provided me with great assistance and feedback. I am particularly grateful to him for encouraging me to write a proposal to access the MOLAB-Iperion facilities.

I would like to thank Gwen Borms, head of the conservation lab at the KMSKA, for the opportunity to research the Delvaux painting and for the internship. It was not always easy, but she has been a trusting support, while also giving me the freedom to follow my own path. I want to extend my gratitude towards her team, including but not limited to Lies Vanbiervliet, Johan Willems, Mariane Van Obbergen Pérez, Drs. Céline Talon, and Masayuki Hinoue. Each in their own way, they have improved my conservation skills. It truly was an honour to help treat the objects! Special thanks to Beatriz Lorente and Paula Alexandre, the conservators of *The Pink Bows*, who provided me with the initial information for this project.

I also gratefully acknowledge the financial support by Iperion, and the MOLAB-teams for performing a range of scientific methods. They are Dr. Aldo Romani, Dr. Letizia Monico, Drs. Sara Carboni Marri, Dr. Francesca Sabatini, Prof. Dr. Piotr Targowski, Dr. Magdalena Iwanicka, Prof. Dr. Haida Liang, Dr. Chi Shing Cheung, Drs. Patrick Atkinson, Dr. Christine Andraud, and Dr. Aurélie Tournie.

Gert Nuyts and Drs. Nina Deleu are acknowledged for performing SEM-EDX and Ma-XRF. Also, thanks to Nina for providing me with kind and supportive words whenever I felt too overwhelmed. Laura Van Eyck, thank you for the starting point on the theoretical framework of the oiling out-issue. Sabine Cauwberghs, I want to thank for advising me on how to approach archival photographs.

Thanks to Lieven Gerard and his colleagues for receiving me in the Museum of Fine Arts Ghent so I could investigate *The Staircase* from up close.

The KIK-IRPA played an important role in the gathering of information. Their library provided me with several restoration files on Delvaux paintings and some archival photos of *The Pink Bows*. Additionally, Dr. Louise Decq performed the analysis on the samples for identifying the transparent materials.

To Prof. Dr. Jan Klaas van den Berg, Joost Derks and their colleagues I want to express my sincere thanks for their enthusiasm for my research, and for providing me with some fundamental information on

Talens' products. No question was too much, and I got to fully appreciate the materiality and history of products not only used by artists, but which I have also worked with since childhood.

I could not have survived my journey at the University of Antwerp without the presence of some important people. Mie Robbe has been my mentor since day one. She provided me with never-ending support, both on a professional and personal level. I hope I can continue to make her proud. The same goes for Charles Indekeu. I promise *nooit op te houden met mezelf in vraag te stellen*. I will forever cherish the wise words of this wise man. And to Enya Denies and Dr. Kristel De Vis, thank you for trying to keep my sanity and let me believe in my capabilities.

To Karl Kirkham, I couldn't have done it without you. Thanks for your unfailing support, especially when you had to explain the same scientific concept over and over again. Your Oxford dictionary on chemistry will always keep its special place on my bookshelf.

To my Joker-fam, thank you for *de voetjes onder de grond* in the big, scary city that Antwerp was in the beginning. You made Antwerp my home and I'm not going anywhere anymore. A special shout-out needs to go to Erika Wulff! Not only has she helped me through university with her mastery of logic and structure, but she is also my tower of strength.

Jeroen Seeuws and Michiel Roos, words are not enough to describe how grateful I am for having you in my life for all these years.

To Ivan: thank you for surprising me with everything Delvaux-related, your shoulder to cry on, and especially for being a proud husband!

And to Maya Martens: **We did it, girl!**



Abstract

The Royal Museum of Fine Arts, Antwerp (KMSKA) holds an extensive collection on Belgian modernist painters. *The Pink Bows* by Paul Delvaux (1897-1994), created in 1937, is one of its key pieces.

Delvaux's work makes up an important part of Belgian art history as his oeuvre spans from the early Interwar period to the end of the 20th century. However, no systematic research has been conducted yet on the studio practice or build-up of Delvaux's paintings. The information that is currently available on his work consists mainly of biographical books, (video) interviews, and photographs of his (later) workspace. Therefore, the KMSKA sought assistance from master thesis research, dovetailing with ongoing conservation treatments, to initiate research on Delvaux.

The main goal of this thesis is to investigate the *modus operandi* of the painter by characterising the painting materials and reconstructing the build-up of *The Pink Bows*. Additionally, the application of transparent layers, such as varnishes and oil layers, is explored. To this end, an extensive research campaign consisting of non-invasive methods was set up. Results were compared with those of previous analysis on samples. The combination of (chemical) imaging techniques, analytical research, experiments on mock-ups and descriptive research provided a comprehensive view on how the painting was build-up and what materials the artist used.

Results show that Delvaux applied a traditional palette, concurrent with the time of creation. Examples of colours are iron-based earths, ivory and carbon black, vermillion red, Prussian and ultramarine blue, and a red lake. They have been applied either dry-on-wet or wet-in-wet, depending on the artists' intent. Wet-in-wet was mostly applied to mix colours or soften the edges of shapes. Several findings indicate the paint was created by Talens, a Dutch manufacturer of artists' materials. However, further research is needed for more clarity.

The paint layers were applied on top of an industrially prepared ground, containing zinc and lead white, followed by an underdrawing or lay-in. The presence of an underdrawing could not be confirmed conclusively. A pentiment was found under a transparent layer, indicating Delvaux changed his mind at a certain point in his working process.

Additionally, the study proposes to distinguish the transparent layers based on their function, by employing a clear terminology: A top varnish was applied, some time after the paintings' creation, to protect it from environmental conditions, an intermediate layer was added to act as a base, after a change in composition, and several oil layers were employed to resaturate the colours which appeared matte upon drying. This *oiling out*-technique provides an overall even gloss but does not have the capacity to behave as a protective layer.

KEY WORDS: CONSERVATION SCIENCE, NON-INVASIVE IMAGING, MODERN ARTIST OIL PAINT, CHEMICAL ANALYSIS

Contents

SHORT SUMMARY	2
ACKNOWLEDGEMENTS	3
ABSTRACT	5
CONTENTS	6
INTRODUCTION	9
ABBREVIATIONS	12
CHAPTER 1 - CONTEXT	13
1 SHORT LITERATURE REVIEW	14
2 PAUL DELVAUX: SUMMARISED BIOGRAPHY	16
2.1 HIS LIFE	17
2.2 HIS WORK	21
2.2.1 PERIOD 1: THE REALISM PERIOD (UNTIL CA. 1924)	22
2.2.2 PERIOD 2: THE TRANSITION (1924-1936)	23
2.2.3 PERIOD 3: THE SURREALISM PERIOD (1937- CA.1959)	24
2.2.4 PERIOD 4: LATE WORK (CA. 1960-1980)	27
3 THE PINK BOWS: STATE OF THE ART	28
3.1 PROVENANCE	29
3.2 ART-HISTORICAL AND ART-TECHNICAL CONTEXT	29
3.3 SITUATION IN THE OEUVRE	31
3.4 INTERPRETATION	32
4 VARNISH: A COMPLICATED MATTER	33
4.1 IT'S FUNCTION AND COMPOSITION	33
4.2 IT'S COMPLEXITY	34

CHAPTER 2 - EXPERIMENTAL RESEARCH.....	36
1 OVERVIEW OF THE METHODOLOGY	37
2 NON-INVASIVE RESEARCH ON THE PAINTING.....	40
2.1 DESCRIPTIVE RESEARCH.....	40
2.2 IMAGING TECHNIQUES.....	40
2.2.1 VISUAL LIGHT PHOTOGRAPHY (VIS).....	40
2.2.2 ULTRAVIOLET-INDUCED VISIBLE FLUORESCENCE PHOTOGRAPHY (UIVFP).....	41
2.2.3 INFRARED PHOTOGRAPHY (IRP)	42
2.2.4 FALSE COLOUR IMAGING (FC).....	42
2.2.5 OPTICAL COHERENCE TOMOGRAPHY (OCT).....	43
2.3 CHEMICAL ANALYSIS – MOBILE	44
2.3.1 TOTAL REFLECTION MID/NEAR FTIR SPECTROSCOPY	44
2.3.2 MICRO-RAMAN SPECTROSCOPY.....	46
2.4 CHEMICAL IMAGING TECHNIQUES.....	47
2.4.1 MACRO X-RAY FLUORESCENCE (MA-XRF).....	47
2.4.2 HYPERSPECTRAL IMAGING (HIS).....	48
3 INVASIVE RESEARCH ON SAMPLES	49
3.1 SAMPLE PREPARATION.....	49
3.1 VISUAL RESEARCH: MICROSCOPY.....	50
3.2 CHEMICAL ANALYSIS.....	50
3.2.1 PY-GC/MS AND THM-GC/MS.....	50
3.2.2 SEM-EDX.....	51
4 MOCK-UPS.....	53
4.1 MATERIALS.....	53
4.2 RECIPES.....	53
4.3 APPLICATION.....	54
CHAPTER 3 - RESULTS.....	55
4.1 BUILD-UP AND PAINTING MATERIALS	56
4.1.1 AUXILIARY SUPPORT: STRETCHER	56
4.1.2 PRIMARY SUPPORT: CANVAS.....	58
4.1.3 PREPARATION LAYER.....	59
4.1.4 UNDERDRAWING	61
4.1.5 LAY-IN LAYER	63
4.1.6 PAINT	64
4.1.6.1 Manufacturer	64
4.1.6.2 Binding medium	66
4.1.6.3 Whites	66
4.1.6.4 Blues.....	67

4.1.6.5	Reds.....	69
4.1.6.6	Yellows	70
4.1.6.7	Blacks.....	71
4.1.6.8	Browns and earth colours	72
4.1.7	VARNISH	73
4.1.7.1	Top varnish	73
4.1.7.2	Intermediate varnishes	76
4.1.7.3	Oil layers.....	77
4.1.8	FRAME.....	77
4.2	TECHNIQUES AND WORKING PROCESS OF THE ARTIST	79
4.2.1	WORKING TOOLS	79
4.2.2	PAINTING TECHNIQUE	81
4.2.3	OILING OUT	83
4.2.3.1	Application	83
4.2.3.1	Effect on colours.....	85
CONCLUSION		88
THE FUTURE		91
LIST OF FIGURES AND TABLES.....		92
BIBLIOGRAPHY.....		95
APPENDICES.....		105
APPENDIX 1:	IDENTIFICATION SHEET	106
APPENDIX 2:	KEY ELEMENTS.....	110
APPENDIX 3:	RELEVANT PAINTINGS.....	114
APPENDIX 4:	PROPOSAL IPERION HS.....	117
APPENDIX 5:	ARCHIVAL FOOTAGE.....	129
APPENDIX 6:	VISIBLE PHOTOGRAPHY.....	133
APPENDIX 7:	UIVFP.....	135
APPENDIX 8:	IRP	137
APPENDIX 9:	UVIFP-FC.....	138
APPENDIX 10:	IRP-FC	140
APPENDIX 11:	MA-XRF SCANS	141
APPENDIX 12:	REPORT SAMPLE ANALYSIS	147
APPENDIX 13:	IDENTIFICATION OF TALENS PAINT TUBES	164
APPENDIX 14:	FTIR SPECTRA	165
APPENDIX 15:	μ -RAMAN SPECTRA (532 NM).....	168
APPENDIX 16:	PICTURES OF THE MOCK-UPS.....	171
APPENDIX 17:	SATURATION ASSESSMENT ON THE MOCK-UPS BEFORE COATING	175

Introduction

When visiting a museum, we only get one impression of an artwork. Not considering any conservation-restoration work afterwards, it is left in the stage that the artist wanted it to be perceived by the spectator. Sometimes the artwork is accompanied by a brief art-historical context or explanation of what is depicted. Rarely do we get more information on how the object came to be or what materials were used, while they offer the chance for more engagement by the viewer. After all, art is created to evoke emotions and create experiences.

This dissertation aims to provide a comprehensive material-technical analysis of *The Pink Bows* by Belgian artist Paul Delvaux (1897-1994). In the following paragraphs, the research will be explained by providing some background on the painting and its creator, and the motive for this research. It is followed by placing the study in its context and formulating the objectives and research question. It is concluded by the dissertation's structural overview.

The Pink Bows is part of the collection of the Royal Museum of Fine Arts in Antwerp (KMSKA). It shows us a dream-like world in which recognisable elements are placed in a way the scene becomes something surreal. Several of the painters' favourite ingredients are included, from naked females, over ancient buildings, to living skeletons. It was created in 1937, a time turbulent for both society and Delvaux personally. The war just loomed around the corner, with the Nazi regime expanding their territory. For the artist, it marked the death of his father and the start of an unhappy marriage. Career-wise it was a pivotal period. Delvaux cut ties with his previous work, evolving from impressionistic and expressionistic works, towards artistic freedom. *The Pink Bows* is an early expression of this growth, which is recognised by its protection as a Masterpiece by the Flemish government. Only one other Delvaux painting, from the same year, was given that honour.

Delvaux's work makes up an important part of Belgian art history as his oeuvre spans from the early Interwar period to the end of the 20th century. However, no systematic research has been conducted yet on the studio practice or built-up of his paintings.¹ The information that is currently available on his work consists mainly of biographical books, (video) interviews, and photographs of his (later) workspace. While this provides extensive information on the artist's life and oeuvre in general, it disregards the materiality of the artworks. This is important to consider, if we want to understand the object, but also to preserve it in the best way possible: degradation phenomena can be studied, resulting in better-tailored treatments or preventive conservation actions. In an attempt to fill this gap, the KMSKA initiated research on Delvaux by seeking assistance from master thesis research, dovetailing with ongoing conservation treatments.

Before treatment, the painting was considered to be in bad condition.² It suffered cracks, losses in the paint layer, loss in tension, but most importantly, the painting was obscured by a heavily and irregularly applied varnish, which had yellowed over time. This layer significantly decreased the value of the painting.³ It failed to let the viewer engage with the painting, as the colours were not perceivable as the artist intended and details were muffled under the thick layer. This varnish turned out not to be applied by the artist, so it could be removed without interfering with the artists' intent. Under the varnish,

¹ During this research, it became apparent that the University of Liege started a project aimed towards researching Delvaux's studio practice. However, results were not yet published by the time this dissertation was finished.

² Condition is defined by Fredheim and Khalaf as 'a measure of past damage and vulnerability to damage in the future'. See Fredheim and Khalaf, 'The Significance of Values: Heritage Value Typologies Re-Examined', 11.

³ *Value* is a widely contested concept since the emergence of the critical heritage studies-movement. Here, value is considered the possibility to engage spectators, evoke emotions, memories are other experiences. See Smith, *Uses of Heritage*. for more in-depth information.

however, locally applied transparent layers were found. Despite their discolouration in some areas, these are thought to be original, and therefore preserved by the conservators. Debates continue to exist on whether such material should be removed from paintings, as the discolouration has an influence on their appearance, which was probably not intended by the artist.⁴ The question on originality of these layers formed the start of this research project.

The painting has been studied from a *technical art history* point of view, an interdisciplinary field which combines science, conservation, and art history. It has become increasingly popular to investigate the creation context of artworks. The study of the materials and creative process is not only done by using analytical tools on the object itself, but also by e.g., visiting archives and digging through (historical) documents to reconstruct their context. While the build-up of paintings has largely been studied in the past by taking samples, recent developments in the field now allow to look through the object without touching it. The latest research techniques combine imaging techniques with chemical analysis to investigate layers and identify their materials. Several case-studies have found their way to the public, making the results more widely accessible. Recent examples close to home are the extensive research on the *Adoration of the Mystic Lamb* by Jan van Eyck (Ghent, Belgium) and *Operation Night Watch*, the project by the Rijksmuseum (Amsterdam, Netherlands) that investigates the famous painting by Rembrandt.

Given the lack of understanding of Delvaux's studio practice, the aim of this study is to provide a comprehensive material-technical analysis of *The Pink Bows*, from the ground layer up until the varnish layer. Its objectives are to identify the build-up, to characterise their materials, and to explore the local application of transparent layers. The thesis will try to answer the following questions:

- Which layers does *The Pink Bows* contain?
- Which pigments did Delvaux use in the painting?
- What were Delvaux's tools for this painting?
- Is there a (functional) difference between the transparent layers in *The Pink Bows*?
- Does the locally applied varnish have an impact on the appearance of the paint layer?
- Is there a link between the pigments and the local transparent layers?

This study will contribute to the body of knowledge surrounding the artwork of Paul Delvaux, by employing a multitude of tools and techniques, which complement each other. Additionally, it will provide a basis for comparison with other paintings in his oeuvre, leading to a general framework for better contextualisation. Furthermore, it will provide a clearer understanding on the application of transparent layers. This can be used to better inform or tailor future conservation treatments of paintings containing such layers.

Some limitations need to be considered, however. This dissertation was constructed in the aftermath of COVID-19. This severely limited access to resources, due to health and traveling restrictions. Moreover, as the Delvaux archive was not accessible, first-hand information that could provide more detailed or accurate information, was probably missed.

While an extensive number of tools were used, most of them provide information locally. Imaging techniques could only analyse a part of the painting, and other tools provided results on local measuring points. Furthermore, while Delvaux's work spans a period of artistic avant-garde, he was quite

⁴ Castiello, 'Lucien Pissaro and the Diffusion of a Matte Aesthetic to London, 1880-C.1921', 248.

conservative in his materials and approach. Therefore, my results should not be extrapolated to contemporaries without hesitation. Time constraints also prevented me from covering the condition of the painting and the effects of the materials on degradation phenomena. Lastly, the experiment on the varnishes was limited in its scope. Only one paint brand and varnish were tested, and several factors that might have an influence (e.g., particle size of the pigments, production manner of the paint, colour mixes ...) were not considered. Further research could expand the experiment for more comprehensive results.

The research is presented in three chapters. The first one starts with a short literature review, summarising the existing information on the studio practice of Delvaux. For a good understanding of the painter and his work, a short biography is given. This includes a classification of his oeuvre in significant periods, which I have derived from several sources like books, interviews, and videos.

After this background information, *The Pink Bows* is presented. Details around its provenance, its context and its place in Delvaux's oeuvre are explored. This section is written from an art-historical point of view. Information was obtained from the KMSKA archive and biographical books.

As the literature proved to be ambiguous in regard to varnishing and transparent layers, I concluded this chapter with an elaboration on this matter. It provides a neutral as possible terminology on the different transparent layers found in *The Pink Bows*.

The second chapter contains the methodology of this research. After giving an overview, I have divided the methods in three sections: non-invasive research on the painting, invasive research on samples, and mock-ups. The first two sections describe the different tools and methods, their advantages, and limitations, and how they have been applied on the painting. The last section provides a detailed account on the preparation of mock-ups, used to investigate the visual impact of varnishes and oils on paint layers.

In chapter 3, the results are bundled. It breaks down the painting in several layers. It starts with the support (canvas and stretcher), and preparatory layers, proceeds with the paint layers and varnish, and concludes with the frame, which is original to the painting. The materials have been characterised as extensively as possible.

After that, the techniques and working process of Delvaux are explored, including his working tools. This chapter is finalised with the experiment on mock-ups, to understand the practice of oiling out and its impact on the paint layer.

This dissertation ultimately ends with a conclusion on the results and some suggestions for future research.

Abbreviations

ARBA	Royal Academy of Fine Arts Brussels
BEI	Backscattered electron image
CPVC	Critical Pigment Volume Concentration
FC	False colour
FTIR	Total reflection mid/near FTIR spectroscopy
HIS	Hyperspectral imaging
KIK-IRPA	Koninklijk Instituut voor het Kunstpatrimonium - Institut Royal du Patrimoine Artistique
KMSKA	Koninklijk Museum voor Schone Kunsten Antwerpen
KMSKB	Royal Museum of Fine Arts of Belgium
Ma-XRF	Macro x-ray fluorescence
MET	Metropolitan Museum of Art
OCT	Optical coherence tomography
POL	Polarised light
PVC	Pigment Volume Concentration
Py-GC/MS	Pyrolysis Gas Chromatography/Mass Spectrometry
RPFAB	Royal Palace of Fine Arts Brussels
SEM-EDX	Scanning Electron Microscopy & Energy Dispersive X-Ray Spectroscopy
SOP	synthetic organic pigments
THM-GC/MS	Thermally assisted Hydrolysis and Methylation Gas Chromatography/Mass Spectrometry
UIVFP	Ultraviolet-Induced Visible Fluorescence Photography
UV	Ultraviolet light
VIS	Visual light

Chapter 1 - Context

1 Short literature review

The documentation on Delvaux includes not only written sources. There are also video interviews, and photographs of his (later) workspace. The material is spread over two distinctive periods, namely before and after his death. In the former period, oftentimes Delvaux collaborated on projects, which make them crucial sources to gain insight in his life and work.

Many of the sources focus on the biographical aspect of the artist, sometimes combined with broader art-historical aspects. Examples are Paul-Aloïse De Bock's *Paul Delvaux: L'homme, le peintre, psychologie d'un art* from 1967⁵, *Paul Delvaux* by Barbara Emerson (1985)⁶ and *Paul Delvaux: Sa vie* by Guy Van Deun and Charles Carels (2004)⁷.

Despite Delvaux's hesitation to explain his work, several sources make an attempt. The more recent ones are about words⁸ and symbols⁹ in Paul's paintings. While they make an interesting read, they do not contribute to the material-technical analysis of artworks.

Other publications try to clarify the art-historical context of the paintings. Camille Brasseur, head of the Paul Delvaux Foundation, uses Delvaux's love for trains as a starting point for describing his work in her recently published book. She mentions that her publication wishes to serve as a scientific framework. Therefore, Brasseur used a multitude of sources, e.g., books, movies, letters, and interviews. She not only tells a story from an art-historical point of view, but also gives insight in Delvaux's technique. For instance, she argues that the use of an underdrawing would become an established working method.¹⁰ She does not explain however, how she came to this conclusion.

The main collaborative written source is *Wandelingen en gesprekken met Paul Delvaux* by Maurice Debra (genealogy unknown). They met each other in 1945 in Saint-Idesbald. From 1989, they went on walks through the city, as Debra needed the physical activity and Delvaux lost connection with his ill and bed-ridden wife Tam.¹¹ The two spent their mornings together every day until Delvaux died in 1994. Debra took notes of their conversations and reworked them into a publication. The book is a very interesting source as Delvaux mentions some of the colours he worked with. When he first attended the academy of Brussels, he had to seek out advice for a colour palette from a fellow student, Jules Payró (1899-1971). This palette, consisting of "black and white, plus English red, yellow ochre, ultramarine blue and emerald green" (own translation) was the basis for Delvaux's paintings for a long time. According to Debra, it was way later when three other paint tubes were added: cadmium yellow, vermilion red and cobalt blue. Debra also mentions that the artist used cobalt violet at one point, but that he found it too overpowering.¹²

The book also brings up the creation of *The Pink Bows*. Delvaux recalls that a female lost her bow, causing her not to feed it anymore, hence the less vibrant pink colour of the bow on the floor. Debra asked him if the 'sombre colours' were to do with the death of his father, as it was the first painting he completed after the event. The artist answered that he did not think so, and that the bows did not have

⁵ Bock, *Paul Delvaux : l'homme, le peintre, psychologie d'un art*.

⁶ Emerson, *Delvaux*.

⁷ Guy Carels en Charles Van Deun, *Paul Delvaux: Sa vie* (Wommelgem: Fondation Paul Delvaux, 2004).

⁸ Scott, 'Words in the Paintings of Paul Delvaux'.

⁹ Batur Çay, 'Symbols in the Paintings of Surrealist Painter Paul Delvaux'.

¹⁰ Brasseur, *Paul Delvaux. De Man Die van Treinen Hield*, 17.

¹¹ Maurice Debra en Paul Delvaux, *Wandelingen & gesprekken met Delvaux* (Tielt: Lannoo, 1991), 10.

¹² *Ibid.*, 31.

a meaning.¹³ *Wandeligen en gesprekken met Paul Delvaux* is the only consulted source giving account to Delvaux's thoughts on *The Pink Bows*.

In the documentary *Paul Delvaux: The Sleepwalker of Saint-Idesbald* (1986), the artist talks about his life and work. He explains how memories act as the sources of his oeuvre. The artist is shown while painting, which confirms mentions in books that he continuously hums music while working. The footage also shows a box of *Talens* paint tubes, which are described further.¹⁴

Other interesting sources include conservation treatment reports. For *The Pink Bows*, only sparse information is available (apart from the most recent treatment, which was well documented¹⁵). There are no historical records in the archives of the museum and an invoice for the 2000 treatment only describes the interventions (strip lining on two sides and re-stretching).¹⁶ The Royal Institute for Art Heritage in Brussels (KIK-IRPA) however, has a library in which treatment reports for other Delvaux paintings are to be found. These documents provide mostly information on the condition of the paintings before treatments, but more recent reports also give account to pigments used. A comparison of findings will be discussed in Chapter 3 - Results.

The only published scientific analysis found is an article that describes how organic pigments in a sample can be identified by screening a library of Raman spectra with an algorithm.¹⁷ A sample of Delvaux's *Faubourg* (1956) was used as a means of testing the system. As an outcome, the authors mention both organic and inorganic pigments: carbon black, ultramarine, chalk, massicot, realgar, anatase (inorganic), and a blue copper phthalocyanine pigment (organic). While these finds are interesting and can give clues about the pigments Delvaux used, the creation of the painting in this case is outside the relevant time frame of *The Pink Bows* and no conclusions can be drawn from it.

During the course of writing this thesis, a research project titled *Paul Delvaux: palette et pratique d'atelier* was brought to my attention. This project, funded since 2021 by the *Koning Boudewijnstichting*, is led by Catherine Defeyt and David Strivay from the University of Liege, in collaboration with the Royal Museum of Fine Arts Brussels. Its aim is to gather knowledge on his working principles, underlying compositions and why his paintings are fragile, by analysing 14 paintings.¹⁸ As it is in its early stages, results have not yet been published. However, Defeyt and Strivay have presented some of their results in a poster on the conference MUNCH2022. There are some similarities for *The Pink Bows*. For example, the macro-X-ray fluorescence scans and optical coherence tomography results show evidence of a change in composition of the hair area. Furthermore, the paintings were executed with similar pigments. However, the researchers found outlines for faces in paintings from 1928 to 1939.¹⁹ This could not be confirmed with the currently employed analysis techniques for *The Pink Bows*.

Clearly, the current documentation gives an extensive insight into the life of Paul Delvaux and the art-historical context of his paintings. However, not taking into consideration the project of the University of Liege, no systematic research has been conducted on the material aspects of his work. They only provide limited hints in their identification or use.

¹³ *Ibid.*, 83.

¹⁴ Adrian Maben, "Paul Delvaux: The Sleepwalker of Saint-Idesbald," (Arthaus Musik, , 1987).

¹⁵ Beatriz Lorente, 'Treatment Report'.

¹⁶ Postec, 'Factuur 2000/06 - Schilderijen Klaarmaken Voor Bruiklenen van Het KMSKA Voor Tentoonstellingen', 2.

¹⁷ Vandenaabeele et al., 'Evaluation of a Principal Components-Based Searching Algorithm for Raman Spectroscopic Identification of Organic Pigments in 20th Century Artwork'.

¹⁸ Koning Boudewijnstichting, 'UNIVERSITÉ DE LIÈGE - Paul Delvaux : Palette et Pratique d'atelier'.

¹⁹ Defeyt et al., 'Paul Delvaux: The Gesture Behind the Images Study of Eleven Oil Paintings by Non-Invasive Techniques'.

2 Paul Delvaux: Summarised biography

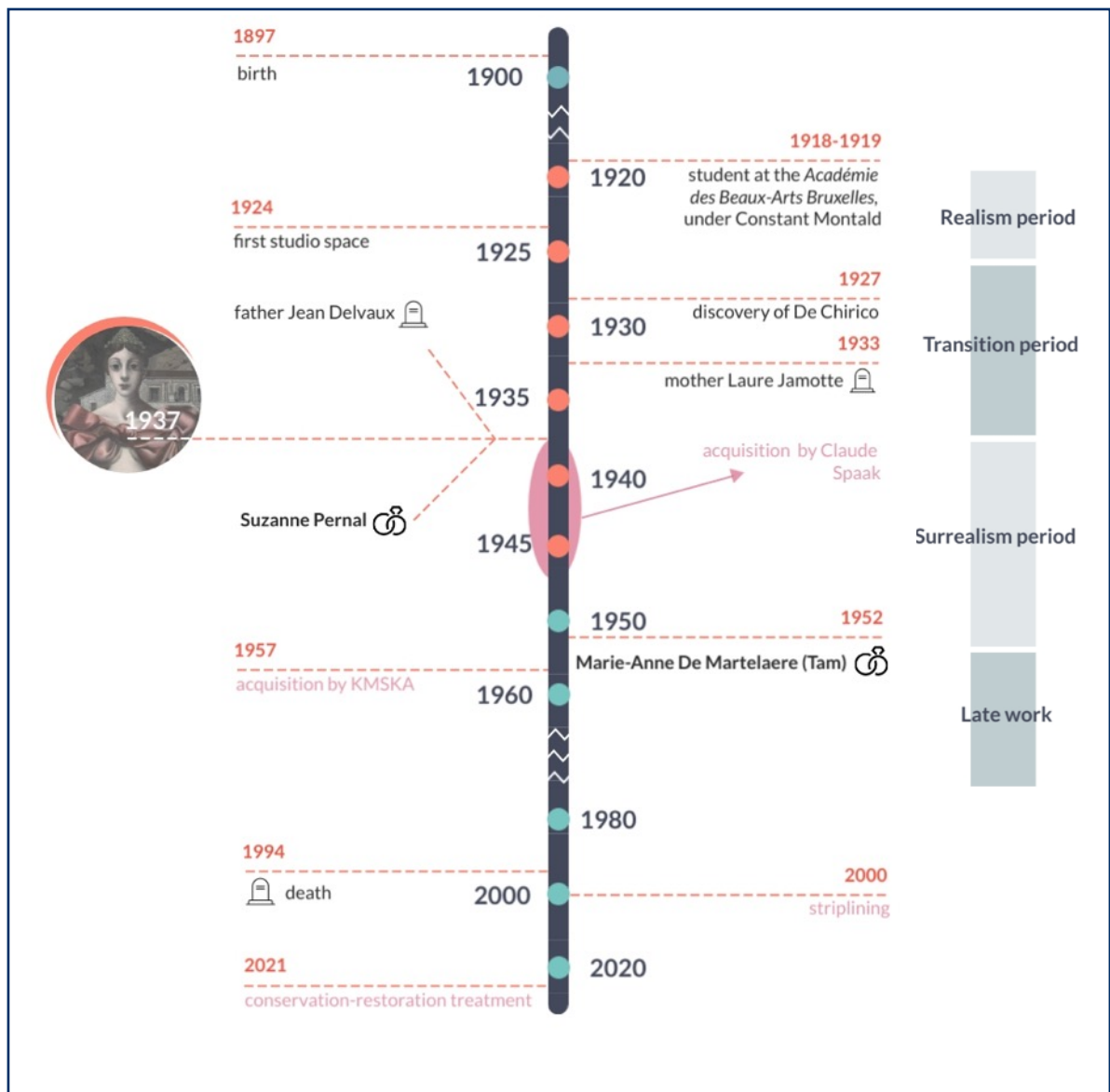


Figure 1: Timeline concerning Paul Delvaux and The Pink Bows (shown in pink).

2.1 His life

In September 1897, the pregnant Laure Jamotte travelled back to her parental home in Antheit, Belgium. There, on the 23rd, she gave birth to her first son, Paul François Ernest Delvaux. Her husband, Jean Delvaux, was a lawyer and due to his success, the family soon moved to Brussels.²⁰

Paul's earliest memories stem from his upbringing here. Aged 3, he already showed great interest in modern transportation. He used to watch the vehicles attentively, but also played *tram* with a broom.²¹ His fascination for these trains and trams never diminished and are often the subject of his paintings (Figure 2).

Early on, it was also apparent that Delvaux had an artistic spirit. Since his childhood years, he had a profound love for music, shown through his talent for the accordion and piano.²² Other art forms left a profound impression on the artist as well. In 1907, Delvaux read books by Jules Verne, which were an inspiration for his artwork. Later, in 1910, he started his education at the Atheneum of Sint Gillis, enrolling in Greek and Latin courses. There he learned of the *Odyssey*, written by Homer. The art of the ancients would become a recurring theme in Delvaux's paintings.²³

Despite their son's love and talent for painting, Laure and Jean did not deem the arts important and pressured him into pursuing a career in law. His younger brother Andre (1904-?) complied and followed in their father's footsteps. Paul, however, was only a mediocre student, who failed to connect with his peers. As he was not allowed to study art, he only painted as a pastime. He often gifted the results to his friends.²⁴

In 1917, after finishing his secondary studies, Paul's parents compromised and let him pursue architecture studies at the Royal Academy of Fine Arts Brussels (ARBA). There, he learned the rules of perspective by drawing after Italian manor houses. This was a short-lived adventure, however, and Paul never finished this course after failing the exams. Meanwhile, he was summoned for obligatory military service. Being found unsuitable, he was able to keep attending drawing classes at the academy.²⁵

During a vacation in Duinbergen in 1919, the Delvaux family encountered Franz Courtens (1854-1943), a Flemish painter. He was deeply impressed by Paul's talent and convinced Laure and Jean to let him attend decorative painting classes at the ARBA, under the tutorship of Constant Montald (1862-1944) (Figure 3).^{26, 27} However, they only agreed under the condition that Paul supported himself through painting from the age of 25. This meant he could explore his artistry without any financial burdens for the next three years.²⁸



Figure 2: Delvaux in his studio at Bosvoorde, behind a train door (1976) © Paul Delvaux Foundation-SABAM

²⁰ Barbara Emerson, *Delvaux* (Mercatorfonds, 1985), 15, 19.

²¹ Carels and Van Deun, *Paul Delvaux: Sa Vie*, 25.

²² *Ibid.*, 27–28.

²³ Brasseur, *Paul Delvaux. De Man Die van Treinen Hield*, 230.

²⁴ Debra en Delvaux, *Wandelingen & gesprekken met Delvaux*, 16.

²⁵ Emerson, *Delvaux*, 29.

²⁶ *Ibid.*, 31.

²⁷ Phil Mertens, "Académie royale des beaux-arts de Bruxelles, 275 ans d'enseignement," (Gent: Gemeentekrediet, 1987), 158.

²⁸ Carels and Van Deun, *Paul Delvaux: Sa Vie*, 43.



Figure 3: The class of Montald in 1918. © Paul-Aloïse De Bock, 1967

Montald taught his students the principles of colour mixing and composition and made them proficient in applying the rules of perspective.²⁹ He gave his pupils obligatory subjects to paint, but also allowed them the freedom to come up with their own ideas. For Delvaux, this was a chance to indulge in depicting massive battle scenes from Roman times. Additionally, the students were encouraged to use their free afternoons painting *en plain air*, outside, like the impressionists.³⁰ Several influential painters were taught by Montald. Magritte, Delvaux's contemporary, was one his other notable students.³¹

Later, in 1950, Paul was asked to be a teacher himself. He accepted a position at La Cambre until retiring in 1962. He did not confide to the passing of knowledge to students within the borders of the academic institution. He was also a teacher or mentor on a more informal level to artists like Walter Vilain (1938-2019) and Florient De Bramignies (1969).^{32, 33}

In 1923, Delvaux went on a trip to Awirs. He was asked by abbot Nestor Reymen (1872-1952), a friend of Paul's father, to accompany him on performing the last rites for an elderly lady. The use of a lantern, lighting a dark room, left a lasting impression on the painter.³⁴ While no sources trace it back to this memory, Delvaux used the lamp in many of his artworks.

When coming home from this trip, Paul found the family house attic turned into a painting studio. As he now had a devoted space for his practice, his outside painting adventures decreased.³⁵ Paul was excited with his studio. It was quite large and overflowing with light coming from the window in the roof. Delvaux painted there for the next 13 years, until his first marriage.³⁶

Already in primary school, it became apparent that Paul was not the most communicative person. He was bullied because of his shyness and quiet character. Moreover, he inherited his dad's anxious nature. All this led Laure Delvaux to believe her son was not capable to function in society. She did not want him to ruin the *good family name* because of this and therefore became very protective. In trying to protect Paul from the *bad world*, she instilled in him a fear of women. She made him believe she was the only one he was safe with. Her strong-willed nature and repressive upbringing tactics led to lots of tension in the Delvaux household, which only increased by the events of World War I.³⁷

This anxiety would follow Paul for the rest of his life and is most prevalent in his amorous relationships. For instance, he met Anne-Marie de Martelaere (Figure 4) in 1929. She was 29 at the time and Delvaux, being madly in love with her, affectionately called her *Tam*. However, she was the daughter of a grain

²⁹ Bock, *Paul Delvaux : l'homme, le peintre, psychologie d'un art*, 38.

³⁰ Brasseur, *Paul Delvaux. De Man Die van Treinen Hield*, 11–12.

³¹ S.N., 'Rene Magritte (1898-1967)'.

³² Vilain, 'Walter Vilain - 80 jaar'.

³³ Vanneville and Declercq, 'Veurne krijgt schilderijen als eerbetoon aan Delvaux'.

³⁴ Carels and Van Deun, *Paul Delvaux: Sa Vie*, 59.

³⁵ *Ibid.*, 60.

³⁶ Debra and Delvaux, *Wandelingen & Gesprekken Met Delvaux*, 49.

³⁷ Emerson, *Delvaux*, 23–24.

broker in financial difficulties. Paul's parents did not believe he could make a living as an artist, and marrying a girl without financial stability herself, would be just asking for trouble. Under their pressure, Paul promised to never marry her, not even after their deaths, and broke off their relationship in 1930. His parents never met her once.³⁸

In 1935, Paul met Suzanne Purnal (1900-1993)^{39, 40}. She worked at a gallery in the Royal Palace of Fine Arts Brussels (RPFAB, now known as *BOZAR*) and knew of Paul's work through exhibitions. She later became the assistant of Claude Spaak, then director of the RPFAB. As an art lover, she followed Paul and his evolution. In return, the artist trusted her and told her openly about his doubts and loneliness. Their friendship grew, but as Suzanne was a divorcée, Paul did not dare tell his bourgeois father about her.⁴¹ They did marry eventually, in 1937, a couple of months after the completion of *The Pink Bows*. Their honeymoon sent them to Rome, where Paul wanted to see with his own eyes what fascinated him since his childhood. After their trip, the newlyweds moved into their new home. Paul's brother André gave them their family home, along with a house further down the street. It was a part of their father's legacy, who died in January 1937.⁴²



Figure 4: Anne-Marie Tam De Martelaere © Pierre Ghêne, 2000

Annex to the Note of André Delvaux concerning the sale of paintings:		
1938	Fine arts exhibition	10,000
1940	Fine arts exhibition	5,000
	'City Street' to Giron, Sr	3,500
	'Entrance to the City' to Pierre Giron	5,000
1942	'The Prisoner' to Van Hecke	3,300
	'Village of Mermaids'	5,000
	'Red Courtesans' to Theo Léger	5,000
	'Skeletalus'	4,500
	'The Temple' to René Micha	13,500
	'The Meeting'	12,000
1943	'Dawn' to Ms. Von Esterghem	15,000
	'The Scholars' to Mr. Granier	15,000
	Four watercolours of Ostend	
	'Worried Town' to Mr. Gaffé	7,000
	'The Forest' to Ms. Geomans	10,000
1944	Various sales	37,000
1945	Various sales	76,000
1946	Various sales	40,000
	Bel Ami competition in New York	20,000
1947	Contract with Spaak, Salkin, Merckx 18 months at 15,000/month	270,000
1948	New contract for a year reduced by half half was given to Suzanne Purnal for seven months	24,000
1949	Sales of paintings in New York	
	US\$900 taken by Suzanne Purnal	-1,500
	Net Takings	610,000

Figure 5: A list of painting sales. Note the mention of the contract. © Carels and Van Deun, 2004

Although Delvaux said about Suzanne that she was "not just anybody", being intelligent and cultivated, he found their marriage a disaster. For instance, they would occupy different floors in their home: Suzanne invited high society people like artists and intellectuals on the ground and first floor, while Paul would withdraw in his studio on the third floor. According to Pierre Ghêne, Suzanne and Paul found in each other what they required. Delvaux needed a strong woman, the mirror image of his mother, after he recently lost his father and Suzanne found in Delvaux a man who she could dominate. It should be said however, she saw his potential and was a strong supporter of his art.⁴³ Thanks to her, Paul had no worries at all, except for painting. After all, she took care of a contract between her husband and Claude Spaak, which provided him with a regular income of 15000 BEF⁴⁴ per month (Figure 5). Additionally, Suzanne oversaw the sale of Paul's paintings and drawings.⁴⁵

³⁸ Debra and Delvaux, *Wandeligen & Gesprekken Met Delvaux*, 60.

³⁹ Thonon, 'Birth certificate'.

⁴⁰ Bertouille, 'Suzanne Marie Henriette PURNAL'.

⁴¹ Debra and Delvaux, *Wandeligen & Gesprekken Met Delvaux*, 81.

⁴² *Ibid.*, 83-84.

⁴³ Ghêne, *Paul Delvaux de besloten wereld*, 45-46.

⁴⁴ In today's currency, this would amount to 371,84 euro. Considering the inflation, this would be worth ± 2000 euro (earliest inflation rate was found from 1956)

⁴⁵ Carels and Van Deun, *Paul Delvaux: Sa Vie*, 133.

Their marriage lasted 12 years. Paul told his friend Maurice Debra, during their walks in Sint-Idesbald (Veurne), that the last years of this union were the darkest of his life.⁴⁶ They eventually divorced in 1949. It was also in Sint-Idesbald that Paul met again with Tam, by chance. This time, he let love prevail and the pair married in 1952, five years after their second encounter.⁴⁷ They settled in Bosvoorde, close to Brussels.⁴⁸

In 1958, now being a recognised painter, Paul joined the Royal Academy of Sciences and Fine Arts. It was only one of the many praises he would receive. Others include, but are not limited to, the Quinquennial Prize for Career Dedication (1965), a nomination as President of the Royal Belgian Academy and Director of the Class of Fine Arts for 1965-66, and the Administrative Council of the *Academia Belgica de Rome*.⁴⁹

The painter kept on working throughout the years and many exhibitions were held in his honour. In 1967, a retrospective was opened by Paola, the then crown princess of Belgium, and drew a lot of attention. It proved to be a significant year on a number of levels, both positive and sombre. A monograph by Paul-Aloïs De Bock was published, but it also marked the death of René Magritte, Marcel Duchamp, and his good friend Robert Giron, who he met at the academy. The people who had inspired Paul through his life and work were no longer there. He himself remained in good health, as he led a sober life, dedicated to his paintings.⁵⁰

At a certain moment, Paul was introduced to Veurne. He was so mesmerised by her silence and her buildings' charm that he bought a house there in 1969.⁵¹ Delvaux and his wife stayed there several months a year, alternating with their home in Bosvoorde. In the summer, Paul painted in the morning, before going out with his wife and friends in the afternoon.⁵²

Around this time, a museum for modern art was set up in Brussels. However, it was not finished by the time Delvaux's nephew, Charles van Deun, tried to convince Paul he needed his own museum. With Tam supporting this idea, the Paul Delvaux Foundation was established in 1979. It was managed by close friends, who also oversaw the plans to build a museum along the seaside, in Sint-Idesbald, Koksijde. Because the couple wanted to see the museum created during their life, not much time was left. Therefore, the Foundation changed course and decided to buy an existing fisherman's house and turn it into a Delvaux Museum. In the summer of 1982, it opened its doors (Figure 6).⁵³ As it only had one small exhibition room, it was enlarged in 1988.⁵⁴ Today, after a large renovation project in 2021-2022, the museum holds over 1000 cm² space to display Pauls' works.⁵⁵



Figure 6: The Paul Delvaux-museum today. © Benny Proot, 2022

⁴⁶ Debra and Delvaux, *Wandelingen & Gesprekken Met Delvaux*, 121.

⁴⁷ Brasseur, *Paul Delvaux. De Man Die van Treinen Hield*, 231.

⁴⁸ Carels and Van Deun, *Paul Delvaux: Sa Vie*, 178.

⁴⁹ *Ibid.*, 195, 206.

⁵⁰ *Ibid.*, 211.

⁵¹ *Ibid.*, 238.

⁵² Emerson, *Delvaux*, 185–86.

⁵³ *Ibid.*, 216.

⁵⁴ Carels and Van Deun, *Paul Delvaux: Sa Vie*, 256.

⁵⁵ Foundation Paul Delvaux, 'Foundation Paul Delvaux Museum'.

With Tam's health declining, the couple decided to move to Veurne permanently. They settled into a larger house in July 1984, that housed a dedicated studio space for Paul. Unfortunately, his eyesight worsened, making him lose his palette or stepping on tubes of paint after dropping them on the floor. After a couple of months in their new home, Paul stopped painting. However, he did keep on drawing.⁵⁶ Ultimately, Tam's health deteriorated so much that she was bed-ridden for the last years of her life. She died in 1989. From this day on, Paul ended his artistic activities.⁵⁷

Delvaux said, even towards the end of his life, that he always doubted and still doubted. Nonetheless, he quoted Jan van Eyck to say he received fulfilment from knowing he always tried his best: "Als ich can" (As best as I can⁵⁸).⁵⁹

While his mind stayed sharp, his body started to fail.⁶⁰ In 1993, he suffered from a heavy fever and even fell into a coma for a short while. Since then, he became weak, finally exchanging the temporary for the eternal on the morning of 20 July 1994. He was laid to rest beside Tam, at Veurne cemetery, under an oak tree.⁶¹



Figure 7: Burial site of Tam and Paul Delvaux. © Harvey Kneislapper, 2019 (cropped)

It is now 125 years since he entered this world, and his legacy remains. As Andy Warhol once said:

I like his approach to life. He is a great artist, one of the most famous in the world. He has been lumped in with the surrealists. That is fine, but over and above that he is an exceptional painter.⁶²

2.2 His work

As he lived for close to a century, not only Delvaux's life was rich, the same can be said for his oeuvre. Most of it can be found nationally. The Paul Delvaux Museum in Sint-Idesbald has the largest collection of paintings and other artworks like sketches, etches and sketchbooks.⁶³ Other works are in the collections of The Royal Museums of Fine Arts in Brussels and Antwerp, as well as in private collections. Delvaux's work is also recognised internationally. Notable institutions who show his work include the Museum Boijmans Van Beuningen (Rotterdam, The Netherlands), the Metropolitan Museum of Art (MET) and the Guggenheim in New York (United States of America).

While his existing oeuvre is extensive, several paintings were destroyed by the artist. His artistic development was met with periods of doubts, causing him dissatisfaction towards his work. Sometimes, traces of these disappeared paintings are still present. On the back of *Dawn over the city* (1940, Belfius

⁵⁶ Carels and Van Deun, *Paul Delvaux: Sa Vie*, 254.

⁵⁷ *Ibid.*, 260.

⁵⁸ Interpretation by Panofsky (Panofsky and Norton, *Early Netherlandish Painting, Its Origins and Character*, 179.)

⁵⁹ *Paul Delvaux. The Sleepwalker of Saint-Idesbald.*

⁶⁰ Debra and Delvaux, *Wandelingen & Gesprekken Met Delvaux*, 10, 15.

⁶¹ Carels and Van Deun, *Paul Delvaux: Sa Vie*, 265.

⁶² *Ibid.*, 268.

⁶³ Foundation Paul Delvaux, 'Foundation Paul Delvaux Museum'.

Art Collection), there are parts of such an early work visible.⁶⁴ According to Emerson, the destruction of the paintings was necessary for Delvaux to find other ways of expression.⁶⁵

Delvaux didn't become a recognised painter overnight, however. He rather took the scenic road to artistic freedom. Paul started drawing from the age of 12 or 13 and made his first watercolour in 1919. Debra mentions that from 1923 onwards, Paul worked in his own style, dictated by a sober colour palette. Colour was only used when needed for the subject of the painting.⁶⁶ However, Paul underwent several influences and experimented for a long time, before making the art his own. These influences can be attributed to a specific period, of which there are four (cf. infra).

However, not only he was influenced, but Delvaux's artwork also served as inspiration for others. Nowadays, his paintings are found now and again as a visual for other artists of different fields. For instance, Hubert Lampo (1920-2006) loved his work and used it for his book covers⁶⁷ (Figure 8), and rock band *Sisters of Mercy* put one of his paintings on a limited-edition LP (Figure 9).



Figure 8: Book covers of Hubert Lampo. © Jan Venderickx



Figure 9: LP cover of Live at Brixton Ace - third edition (1983). © SistersWiki.org

2.2.1 Period 1: The realism period (until ca. 1924)

The first period consists of Delvaux's early work, influenced by his education and meetings with other artists. In these paintings he depicted his surroundings. It was very much an expression of what he learned at the academy. The focus was on landscapes, seascapes, and figures, resulting in the use of earth colours like greens, browns, oranges, and yellows.^{68, 69} Although he painted the scenes realistically, the influence of impressionism is not to be neglected. After all, this was the dominant art movement at the time of his education. Barthelman and van Deun name Paul's insecurity as a person as a cause for the quite rigid nature of his paintings: He would observe everything in minute detail before putting paint to the support, as opposed to let a painting grow spontaneously.⁷⁰

⁶⁴ Meuris, *Dawn over the City*, 60–61.

⁶⁵ Emerson, *Delvaux*, 41.

⁶⁶ Debra and Delvaux, *Wandelingen & Gesprekken Met Delvaux*, 40, 41, 49.

⁶⁷ [Lampo, December 2021](#).

⁶⁸ Brasseur, *Paul Delvaux. De Man Die van Treinen Hield*, 13–14.

⁶⁹ Saurat, 'Paul Delvaux', 124.

⁷⁰ Barthelman and van Deun, *Paul Delvaux: Odyssee van Een Droom*, 9, 18.

The first steps towards Delvaux's own world were already taken during this time. A first defining element for his oeuvre Delvaux shared with the impressionists: a fascination for new technologies and industrialisation. This is not only expressed through his love for trains, but also in the early work *The Zinc Factory of Corfalie* from 1921 (Figure 10). Moreover, he often painted outside, which explains the smaller sizes of works from this period. The ever-changing environment surrounding Delvaux, were like poetry to him. The memories he connected to this time would eventually lead to the creation of his own poetic dream world.⁷¹



Figure 10: *The Zinc Factory of Corfalie*, 1929, oil on canvas, 80x100 cm, collection Foundation Paul Delvaux.

2.2.2 Period 2: The transition (1924-1936)



Figure 11: *Robert Giron in Delvaux's studio*. The paintings in the background give a glimpse of Paul's painting style back then. © Paul-Aloïse De Bock, 1967

In the transition phase, we can see Delvaux taking on a more figurative approach. It is also the first time that he incorporates things that stem from his imagination, like human figures.⁷² It altered the appearance and psychological content of his paintings.⁷³ This marks the transition of 'learning to paint' to expressing himself as an artist.⁷⁴

In 1925, Delvaux held his first exhibition in *Galerie Breckpot* in Antwerp. He showed together with Robert Giron (1897-1967) (Figure 11), his former classmate from the Brussels academy. In his encounters with Debra, Paul recalls the exhibition as a disaster on multiple levels. He tried, to no avail, to sell a painting. Additionally, the following years proved empty and meaningless.⁷⁵

Delvaux said himself that, artistically, he owed the Italian Giorgio De Chirico (1888-1978) a lot. He first discovered his work at a Paris exhibition in 1926.⁷⁶ Paul took inspiration from his use of architecture and deep perspective which tended to go on eternally, instead of ending at the horizon. Furthermore, he took the idea of using mannequins, but Paul turned them into women with almond-shaped eyes, giving them a dreamy look.⁷⁷ In his most creative years (1937-1948), almost all his paintings depict female figures. The only ones that do not, are paintings he did by observation inside a museum with skeletons (see Appendix 2: Key elements).

Delvaux found De Chirico's use of colours astonishing. They were perfect for expressing poetry and deep emotions. Paul took on this idea too, but with cold colours, reminiscent of his northern roots, rather than the warm tones of Italy.⁷⁸

⁷¹ Ibid., 16.

⁷² Ibid., 10-12.

⁷³ Saurat, 'Paul Delvaux', 154.

⁷⁴ Barthelman and van Deun, *Paul Delvaux: Odyssee van Een Droom*, 10-12.

⁷⁵ Debra and Delvaux, *Wandelingen & Gesprekken Met Delvaux*, 47, 57.

⁷⁶ James-Kester, 'Paul Delvaux: Mystery and Imagination', 16.

⁷⁷ Emerson, *Delvaux*, 241-42.

⁷⁸ Barthelman and van Deun, *Paul Delvaux: Odyssee van Een Droom*, 21, 28. Barthelman and van Deun, *Paul Delvaux: Odyssee van Een Droom*, 28.

Next, Delvaux painted women who resemble those of Modigliani. It was not until his meeting with Tam in 1929 that the expressionist influence would come to fruition. She became the subject of many paintings and drawings, expressing feelings not only of infatuation, but also of loneliness and defiance because of his parents' disapproval.⁷⁹

Delvaux named James Ensor (1860-1949) as one of his greatest inspirations at this point.⁸⁰ Because of Ensor, a whole group of *Flemish expressionists* formed, led by figures like Constant Permeke (1886-1952) and Gust De Smet (1877-1943).⁸¹ While Debra claims that Delvaux had little interest in these artists⁸², their influence on his work is rather obvious. When placed next to each other, the artists' work fit a similar style and atmosphere: e.g., look at how the eyes and the hair are shaped, but also the rather dull colours (Figure 12).



Figure 12: (A) De Smet, *Sunday, 1921*, inv. 2931 © KMSKA. (B) Permeke, *The Fiancées, 1923*, inv. 4868 © RMFAB. (C) Delvaux, *Couple with Child in the Woods, 1928-29*, inv. 11936 © RMFAB.

Delvaux remembered 1928 and 1929 as dark years. There was no interest in his paintings, so they piled up in his studio. Paul even felt hostility towards his work. He mentions destroying another 50 paintings so he could recycle their stretchers.⁸³ Most of the destroyed paintings are from his early period. In an interview with Saurat, he explains that he was not happy with how his paintings turned out. They did not meet his expectations.⁸⁴ Later on, he admitted regretting eradicating his earlier work.⁸⁵ Nonetheless, the transition period reached its peak around 1930.⁸⁶

2.2.3 Period 3: The surrealism period (1937- ca.1959)

When one notes that his oeuvre does have a clear surrealist slant, Paul says firmly that his work would have evolved in this way even without surrealism: mystery and poetry lived in him from childhood. The surrealist movement has made it easier for him to go his own way, without hesitation.⁸⁷

⁷⁹ Ibid., 21.

⁸⁰ Debra and Delvaux, *Wandelingen & Gesprekken Met Delvaux*, 21, 58.

⁸¹ Bock, *Paul Delvaux : l'homme, le peintre, psychologie d'un art*, 59.

⁸² Debra and Delvaux, *Wandelingen & Gesprekken Met Delvaux*, 58.

⁸³ Barthelman and van Deun, *Paul Delvaux: Odyssee van Een Droom*, 21–27.

⁸⁴ Saurat, 'Paul Delvaux', 124.

⁸⁵ James-Kester, 'Paul Delvaux: Mystery and Imagination', 16.

⁸⁶ Barthelman and van Deun, *Paul Delvaux: Odyssee van Een Droom*, 21–27.

⁸⁷ Debra and Delvaux, *Wandelingen & Gesprekken Met Delvaux*, 49.

The above quote by Delvaux (own translation) beautifully illustrates his hesitation to be classed as a surrealist. While it did not bother him that much, he found this analysis an invention of critics.⁸⁸ For him, the movement *influenced* him, but he did not want to mingle in the debates of artistic environments.⁸⁹ However, he did not deny there were surrealist elements in his work, but they were more a remnant of the past than a deliberate expression of an art group.⁹⁰ Delvaux's works from the late 1930's show the first surrealist aspects: he puts elements and figures together which, in that time, do not belong together. Examples are the combination of modern items like petrol lamps and ancient buildings. The artist very much took the basic ideas of the surrealist movement and used them to create his own dreamworld that radiates a poetic atmosphere.⁹¹

Emerson puts forward another important source of inspiration, namely Jean-Auguste-Dominique Ingres (1780-1867). It is his use of a specific typology (the naked female) and his emphasis on starting from an accurate drawing that are also present in Delvaux's approach. Additionally, they both create nuances in their work by contrasting colour areas, rather than thoroughly mixing them. Emerson exemplifies this influence by comparing the "sexual vulnerability", which, she says, both artists were able to express exquisitely in their paintings: Ingres in his *Great Odalisk* (1814) and Delvaux in his depictions of a *Sleeping Venus*.⁹²

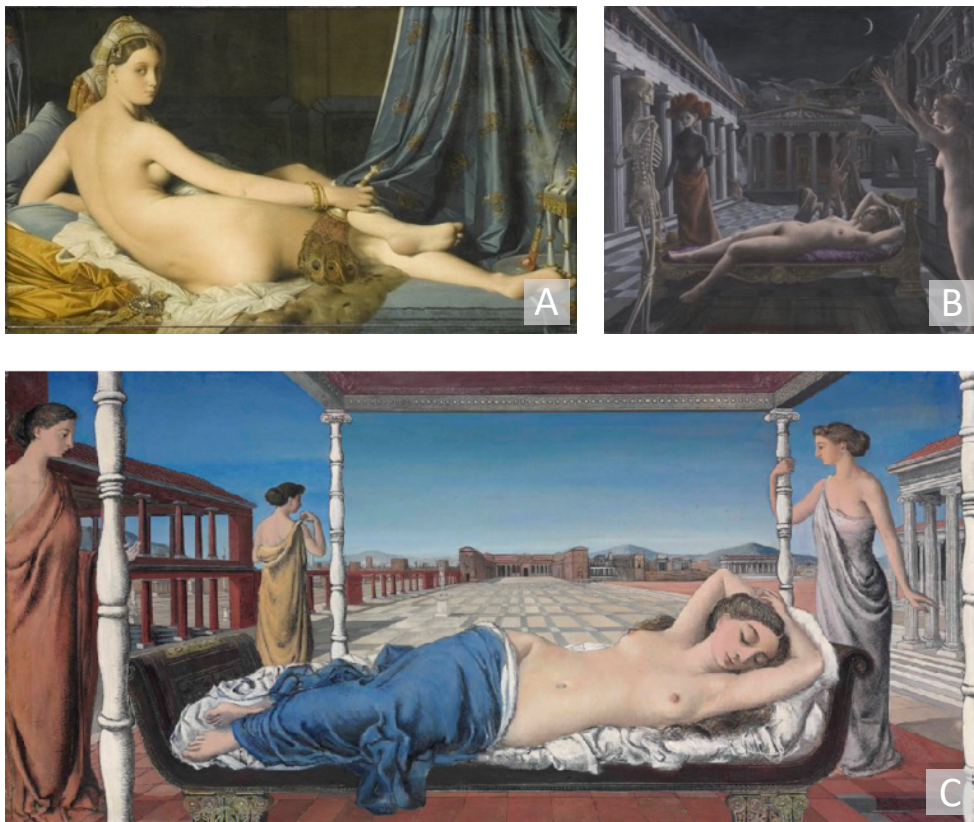


Figure 13: (A) Ingres, *The Great Odalisk* (1814), inv. RF 1158 © Musée du Louvre/Frank Raux, 2017. (B) Delvaux, *Sleeping Venus* (1944), inv. T00134 © Fondation P Delvaux - St Idesbald, Belgium/DACS, London 2022. (C) Delvaux, *Sleeping Venus* (1943), private collection © Christies London, 2014

⁸⁸ James-Kester, 'Paul Delvaux: Mystery and Imagination', 16–17.

⁸⁹ Mertens, 'Académie Royale Des Beaux-Arts de Bruxelles, 275 Ans d'enseignement', 158.

⁹⁰ James-Kester, 'Paul Delvaux: Mystery and Imagination', 16–17.

⁹¹ Barthelman and van Deun, *Paul Delvaux: Odyssee van Een Droom*, 27.

⁹² Emerson, *Delvaux*, 248, 250.

The idea of the sleeping Venus stems from a visit in 1930 to the Spitzner Museum, located in a barrack at a Brussels fairground.⁹³ This gallery acted as a forerunner of today's museums of medicine and housed a collection of wax figures, showing the effect of different diseases on the human body. Through the window, Delvaux saw a mechanically breathing Venus, surrounded by red velvet curtains. It left such an impression that she became an inspiration for several paintings and drawings.⁹⁴ According to De Bock, the museum revealed a sense of the unusual and absurdity to Paul. Here, he discovered how love and death communicated with each other.⁹⁵

The Venuses portrayed above were painted during the second World War. At this stage of his career, Delvaux was starting to become a more recognised painter, but he refused to go on show after the Germans occupied Belgium in 1940. In an interview with Johan Swinnen (art expert and former director of the department for conservation studies in Antwerp), film maker Henri Storck mentioned that the reason behind this was the Nazi's marking Delvaux's art as *entartet* (degenerate).⁹⁶ However, nothing to date traces back to a possible confiscation of his work, nor to participation at the grand exhibition in 1937 that was meant to denounce modern art.^{97, 98} One entry in the *Catalogue de l'Oeuvre Peint* mentions its destruction 'by the Germans during the war 1940-1944', however, it is unclear how this event was determined.⁹⁹



Figure 14: *The Lamps*, 1937, inv. 2018.286. © 2018 Artists Rights Society (ARS), New York / SABAM, Brussels

Nonetheless, even if it was not aimed directly at Delvaux, the feeling of being conceived a degenerate artist, shows us only a glimpse of the difficult circumstances of the wartime. Additionally, there was a shortage of supplies, meaning Paul had to work on materials of mediocre quality which caused the paintings to deteriorate quickly.¹⁰⁰ Moreover, *The Sleeping Venus* of 1944 is said to be painted when Brussels was under attack: "The psychology of that moment was very exceptional, full of drama and anguish", he [Delvaux] recalled. "I wanted to express this anguish in the picture, contrasted with the calm of the Venus".¹⁰¹

Despite the difficulties during this time, he did not destroy paintings from this period, says Debra.¹⁰² His doubts were gone and attention towards his work increased.¹⁰³ The painter found his artistic identity, Paul Delvaux reached maturity in his painting style.

⁹³ Brasseur, *Paul Delvaux. De Man Die van Treinen Hield*, 230.

⁹⁴ Museum van de Geneeskunde, 'Stap Voor Stap. Museum van de Geneeskunde', 10.

⁹⁵ Bock, *Paul Delvaux : l'homme, le peintre, psychologie d'un art*, 302.

⁹⁶ Swinnen, 'De KASKA-verzameling', 84.

⁹⁷ Freie Universität Berlin, 'Beschlagnahmeinventar "Entartete Kunst"'.
⁹⁸ Victoria and Albert Museum, "Entartete" Kunst. *Digital Reproduction of a Typescript Inventory Prepared by the Reichsministerium Für Volksaufklärung Und Propaganda Ca. 1941/1942.*

⁹⁹ Butor, *Delvaux [catalogue de l'oeuvre peint, 1975]*, 196.
¹⁰⁰ Carels and Van Deun, *Paul Delvaux: Sa Vie*, 124.

¹⁰¹ Tate London, 'Paul Delvaux. *Sleeping Venus. 1944*'.

¹⁰² *The Lamps* was considered destroyed during the London Blitz (1940-1941) in multiple sources (Emerson, 1987 and De Bock 1969). However, it is found in the collection of the Art Institute Chicago since 2018. It is unclear what happened to the painting between this period.

¹⁰³ Debra and Delvaux, *Wandelingen & Gesprekken Met Delvaux*, 98.



Figure 15: Christmas Night, 1956, private collection © akq-images / CDA / Guillemot

Delvaux himself described his evolution in an essay for the *Bulletin de l'Académie Royale de Belgique*, marking *The Lamps* (1937, Figure 14) and *The Lace Procession* (1936, collection Sprengel Museum Hannover) as significant works in this surrealism period. He names certain elements as relevant markers for this stage: a combination of Greek temples with petrol lamps or contemporary buildings, the use of skeletons as living characters, trains (Figure 15), and the naked female.¹⁰⁴

Delvaux's artistic maturity is best expressed through the following quote by the artist¹⁰⁵:

I try to get rid of the surrealistic rubbish and - that is essential - to retain nothing else than the poetry of Mystery in all its forms. From then on, I have always followed the same path. However, I have tried to be increasingly flexible with the technique and the colour palette. Painting itself became more important than in my early days, but I held on to the poetic achievements that I had made my own during my career as an artist.

2.2.4 Period 4: Late work (ca. 1960-1980)

While Delvaux's personal life between the 1930's and 1940's was filled with doubt and anxiety, topped with a disastrous marriage, the next years were much more relaxed. Paul found happiness and stability through his union with Tam. Art historians see this reflected in his art, which showed less mystery than before. Barthelman and Van Deun stress that we need to judge this evolution on different merits than we did the previous stages. Delvaux did indeed become calmer and more meditative thanks to a decreasing anxiety. However, the artist also turned blind over time, resulting in a more intuitive approach, rather than a visual one. His technique resembled that of the impressionists once again and his colour palette grew more vibrant and livelier. Notably, a considerable difference with his previous work is that Paul now let his figures interact with each other. Although his eyes deteriorated, his creativity was an everlasting constant until the end of his life.¹⁰⁶

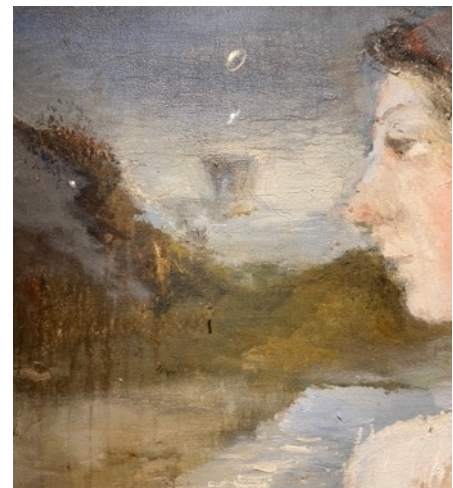


Figure 16: Calypso, 1986, collection Paul Delvaux Foundation (detail).

¹⁰⁴ Barthelman and van Deun, *Paul Delvaux: Odyssee van Een Droom*, 43.

¹⁰⁵ Delvaux, 'Ma Vie d'artiste'. Op. cit. Barthelman and van Deun, *Paul Delvaux: Odyssee van Een Droom*, 44.

¹⁰⁶ Barthelman and van Deun, *Paul Delvaux: Odyssee van Een Droom*, 57–58.

3 The Pink Bows: State of the art



Figure 17: The Pink Bows by Paul Delvaux, 1937, inv. 2850 © KMSKA, Rik Klein Gotink

Title	<i>De Roze Strikken (NL)</i> <i>The Pink Bows (EN)</i> <i>Les Noeuds Roses (FR)</i> (Also known as <i>Women of the Night</i>)
Date	February 1937
Signature	Bottom right: P. DELVAUX / 2-37
Collection	Royal Museum of Fine Arts Antwerp, Belgium (inv.nr. 2850)
Materials	Oil on canvas
Size	
H x W x D	Without frame 120,9 x 158,8 x 2,7 cm
	With frame 125,5 x 163,6 x 4,8 cm
Acquisition	Bought in 1957 from Claude Spaak

3.1 Provenance

Until it was acquired by the KMSKA, *The Pink Bows* was in possession of writer Claude Spaak (1904-1990). He was the first director of the Royal Palace of Fine Arts Brussels and Delvaux's first artistic supporter.¹⁰⁷

In 1957, Robert Giron, then head of the RPFAB and mediator for Spaak, proposed to sell the painting to the KMSKA for 70000 Belgian Francs¹⁰⁸. The museum board asked the minister of culture for permission, highlighting the importance of the painting: "Het gaat hier om een van de allerbelangrijkste werken uit het oeuvre van DELVAUX."¹⁰⁹

The sale was approved within six days (Figure 18), and on 21 May 1957, *The Pink Bows* was transported to the KMSKA.^{110, 111}

Interestingly, at the same time *Pygmalion* (1939) by Delvaux was sent to the museum. It was probably also in the collection of Spaak at the time.^{112, 113} No exhibitions around this time could be found, nor a restoration file for this painting, so the reason for transportation remains unclear. So does the reason for selling *The Pink Bows* to the KMSKA.

An important remark regarding the paintings' title needs to be made. In the *Catalogue de l'Oeuvre Peint*, the painting is entered as *Les belles de Nuit (Women of the Night)*, with a reference to *The Pink Bows* as the title which it is known best by. An earlier entry, which shows a similar composition, has the title *Les belles de Nuit* too (Figure 19). This could lead to confusion while interpreting literature which has no images of the paintings.¹¹⁴ For example, entries in exhibitions might be attributed to the wrong painting. Why these paintings are known by different names is uncertain and could be a research question on its own.

3.2 Art-historical and art-technical context

Before the 20th century, the art world was dominated by the French academy system. Artists had to be accepted to the *salons* to gain recognition for their work. Thanks to, among others, the impressionist movement, at the end of the 19th century this system imploded and made way for more freedom in the expression of an artist's view: "artists examined in their own visual language the language they used and how it could contribute to an emotional or cognitive understanding of man and world" (own translation)¹¹⁵. They were not dependent on the taste of academics anymore, but were now promoted

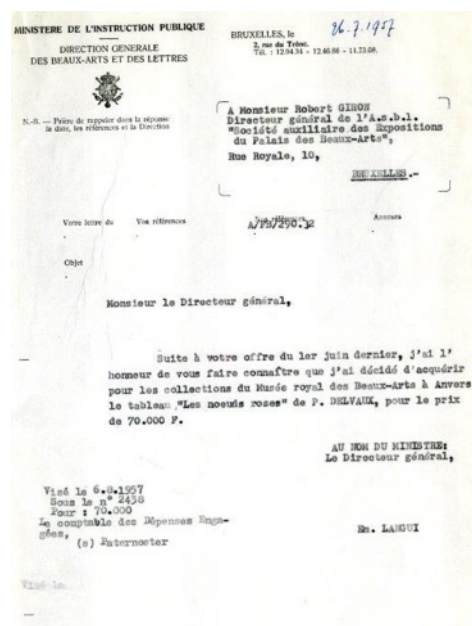


Figure 18: Approval of the sale by Emile Langui. © KMSKA archive

¹⁰⁷ Carels en Van Deun, *Paul Delvaux: Sa vie*, 77.

¹⁰⁸ About 23,5 million euro to today's standards - <https://www.inflationtool.com/euro-belgium/1957-to-present-value?amount=2823793&year2=2022&frequency=yearly>

¹⁰⁹ Vanbeselaere Walther, (KSMKA: Archive KMSKA, 1957).

¹¹⁰ Langui to Giron, 1957.

¹¹¹ Jambers n.v., 'Bordereau - Way Bill'.

¹¹² Spaak, *Paul Delvaux*, 2:21.

¹¹³ Butor, *Delvaux [catalogue de l'oeuvre peint, 1975]*, 185.

¹¹⁴ *Ibid.*, 172, 173.

¹¹⁵ Jonckheere, *Another history of art*, 114.

by gallery owners, who received a percentage of the sales made.¹¹⁶ Ambroise Vollard (1866-1939) is probably one of the most influential people in this regard.

At the turn of the century, art was increasingly used to ask questions about society and resulted in different approaches. This time, artists broke free from the writings of critics about their work, by putting their views and experiments into manifests.¹¹⁷ The first surrealist manifest was written in 1924 by Andre Breton (1896-1966), who admired and exhibited Delvaux's work.^{118, 119}

Around the mid-1930's, gallery owner Edouard Léon Theodore (E.L.T.) Mesens (1903-1971) holds a special place in the dissemination of Delvaux's work. He would prove to be a protagonist in the promotion of Delvaux in England, being responsible for expanding his name overseas. Furthermore, he would also be the creator of the artist's surrealist identity.¹²⁰ This promotion helped Delvaux conquer the (financial) uncertainty of a painter's life, which was the inevitable consequence of this new kind of art market.

The inter-war period meant an extra difficulty. The prevalent financial crisis impacted the sourcing of painting materials, which needs to be taken into consideration when studying artworks for conservation purposes. Painters without a stable financial background tried to tap into different sources by taking on illustration commissions for journals.¹²¹

The course of the 20th century not only changed the way art was made, but also marks an evolution in the chemical industry. A number of material technical innovations were made, most notably resulting in breaking the rules regarding the use of a specific medium like oils on canvas. Pablo Picasso (1881-1973) and Georges Braque (1882-1963) are among the leaders in experimenting with materials and techniques in an avant-garde way.¹²² Paul Delvaux is rather an exception since he adhered to a traditional use of materials. His aversion to be called a surrealist might also be considered an example of his more conventional ways.

Another noteworthy development from a conservation and material-technical point of view, is the introduction of synthetic organic pigments (SOP) as substitutes for their counterparts which are prone to fading. This is a largely unexplored field for paint materials of the 20th century. However, recent research by Rika Pause (University of Amsterdam) is clearing the way for raising awareness and for implementing detection methods for paintings.¹²³ Another first timer is the production of titanium white specifically for artists paints, a couple of years before *The Pink Bows* originated, namely in 1921.

The creation of this painting was concluded in a time not only disturbing for society, see for example the rise of Nazi Germany, with the organisation of the *Degenerate Art Exhibition* in 1937 as a low point for the art world. It was also a very turbulent time for Paul himself. A month before completing the painting, he lost his father. A short time after, he started a marriage that was more for convenience than love, leaving him very troubled and anxious.

¹¹⁶ Ibid., 105–6.

¹¹⁷ Ibid., 183.

¹¹⁸ Caputo, 'E.L.T. Mesens et Les Strategies de Diffusion de l'art Des Surréalistes. Le Cas Paul Delvaux En Grande Bretagne', 236.

¹¹⁹ Bock, *Paul Delvaux : l'homme, le peintre, psychologie d'un art*, 156.

¹²⁰ Caputo, 'E.L.T. Mesens et Les Strategies de Diffusion de l'art Des Surréalistes. Le Cas Paul Delvaux En Grande Bretagne', 231.

¹²¹ Jonckheere, *Another history of art*, 106.

¹²² Ibid., 110.

¹²³ Pause, Van den Berg, and Neevel, 'Synthetic Organic Pigments in Talens Oil Paint 1920–1950 – The Case of Vermillion Imit', 109.

3.3 Situation in the oeuvre

The Pink Bows could be considered a key piece in Delvaux's artistic work, as it marks a turning point in his career. It sits at the start of his surrealism period (Figure 1), or *golden years* as Pierre Ghêne describes¹²⁴, and contains many elements that are inherently connected Delvaux. The painting shows multiple female nudes, of which the centre figures feature the characteristic large, almond-shaped eyes. Other key elements are the petrol lamp on the left-hand side and the ancient-like architecture. *Appendix 2: Key elements* shows that about 32% of the paintings contain a lamp, and about 70% have some reference to ancient times.

A remarkably similar composition, with the mountains, the columns, and the night sky, is returning in *Women of the Night*, completed three months before *The Pink Bows* (Figure 19). Perhaps most notable in these paintings are the skulls (see red arrows). As mentioned in *Appendix 1: Identification sheet (distinctive features)*,

skeletons are considered used for the first time in *The Pink Bows*. However, this earlier painting shows a first introduction to skeletons.

The bows play a prominent part in the painting, but it is not the only time Delvaux depicted them. In *Phases of the Moon*, a female figure wears a bow in a similar way like the front female figure and in *The Break of Day*, as well as *The Joy of Life*, smaller bows take an eye-catching place (Figure 20). In total, eight paintings from Delvaux's most creative years contain a bow.



Figure 19: *Women of the Night* (1936). This painting has the same clear look as *The Pink Bows* after restoration. This picture from a Christies sale is the only colour reproduction to be found, as its buyer is not disclosed. © Christies Images Ltd.



Figure 20: (A) *Phases of the Moon* (1937), inv. 504.1951, MoMA collection. © 2022 Paul Delvaux / Artists Rights Society (ARS), New York / SABAM, Brussels. (B) *The Break of Day* (1937), inv. Nr. 76.2553 PG 103, Peggy Guggenheim collection. © Paul Delvaux Foundation (C) *The Joy of Life* (1938), collection unknown © Paul Delvaux / DACS

¹²⁴ Ghêne, *Paul Delvaux de besloten wereld*, 12.

3.4 Interpretation

Multiple sources mention how Delvaux disliked art critics analysing what he depicted in his paintings. When painting, he did not try to convey a message: “a painting isn’t made to be explained, it is made to be looked at”. He wanted the viewer to read into his paintings what they want.¹²⁵ He considered the elements in a painting merely as pictorial components, necessary for creating the climate and atmosphere that lived in him.¹²⁶

As clarified in the literature review, Paul did give Debra some explanation regarding the interpretation of *The Pink Bows*. Despite this explanation, Delvaux expresses firmly that the bows do not have a meaning.¹²⁷

Several descriptions of the painting can be found, e.g., in the display text of the museum, or in the Belgian Official Gazette, regarding the protection as a Flemish Masterpiece.¹²⁸ As Delvaux found the analysis of his painting’s visuals unnecessary, and it is outside of the scope of this research, it serves little purpose to go into detail about these. It is however important to mention why the Flemish government considers the painting a Masterpiece. While this is also based mainly on *interpretation*, it gives account to Delvaux’s importance to Belgian art history. After all, they based their decision on the representativeness of the painting, as it stems from his surrealism period. They also consider it to be of significant artistic value, because of the females and landscape with classical buildings, derived from renaissance and classical art. Lastly, the painting holds a hall-mark value because of the skeletons, which were added for the first time according to the commission.¹²⁹

I want to conclude this paragraph with a quote on Delvaux’s love of light.¹³⁰ It talks about how his depictions of the night are an interpretation. This citation, which is poetry in itself, can give more food for thought on how to look at *The Pink Bows*.

I have always loved the light, even at night. But my nights are not really nights. They are personifications, interpretations of the night. But not the real night. When it is really night and you are outside, you see nothing. Shadows and an occasional light stripe on the horizon. When I paint a night, all things are visible. Yet it is night.

¹²⁵ James-Kester, ‘Paul Delvaux: Mystery and Imagination’, 16.

¹²⁶ Debra and Delvaux, *Wandelingen & Gesprekken Met Delvaux*, 114.

¹²⁷ *Ibid.*, 83.

¹²⁸ Vlaamse Overheid, ‘Belgisch Staatsblad’.

¹²⁹ Departement Cultuur; Jeugd en Media, “De roze strikken,” Vlaamse Overheid

¹³⁰ *Paul Delvaux. The Sleepwalker of Saint-Idesbald.*, in the version on YouTube: *BRT-1: Docu Paul Delvaux / Sint-Idesbald (Koksijde)*, pt. 19.34’ to 20.16’.

4 Varnish: A complicated matter

Before the conservation treatment, the varnish on *The Pink Bows* was the main feature open to discussion. As it was irregularly applied and very yellowed, it considerably obscured the readability of the painting. For many paintings, the obvious choice is to remove such a layer and reveal the paint layer underneath. However, as Delvaux's painting is a Flemish Masterpiece, such a decision is not so straightforward. A treatment proposal must be discussed with the *Topstukkenraad* (Masterpiece Council), which decides on which interventions are allowed. They mainly take a conservative stance, so every proposal needs to be sufficiently substantiated. Therefore, a conservator of the team conducts a technical preliminary investigation, before presenting the results to the committee. This investigation revealed there were different varnish applications, leading to questions of originality, and the start of deeper research on the painting.

Before diving into the varnish situation of *The Pink Bows*, some background on varnish in general needs to be provided, in order to understand the complexity of the matter.

4.1 It's function and composition

From the Middle Ages to the 19th century, varnishing was a common practice to provide the painting with a protective layer. Other functions were to give the paint layer an even structure and bring out the colours and details.¹³¹ The ingredients stayed largely the same over time, with some additions in the 18th and 19th century. The increasing trade and local availability of materials made them more broadly accessible, leading to new varnish recipes.¹³²

Later, from the nineteenth century onwards, varnish intentions shifted, coinciding with the break from academic tradition. As the painting palette evolved towards brighter, but also more matte colours, a highly glossy surface coating was unwanted. Some artists were highly against varnishing, while others changed preferences on the practice during their careers.¹³³

A final coating was not immediately applied after finishing the artwork. To prevent the paint from cracking, it was advised to wait at least a year before varnishing. To protect the painting in the meantime, often a temporary varnish was applied, which was removed before the final coating.¹³⁴

Varnishes do not exclusively act as a surface coating. Some artists applied varnishes locally to re-saturate colours. Some pigments are known to absorb oil, referred to as *sinking in*, leaving a matt appearance. This effect could be enhanced, intentionally or otherwise, by using strongly absorbing grounds. Mainly black pigments and Prussian blue are known to sink in.¹³⁵ The act of re-saturating paint is called *oiling out*. It involves adding a thin layer of oil, medium or an emulsion, lubricating the surfaces, after which excess of material is removed.^{136, 137} Other instances of varnish occurrence might be due to a

¹³¹ Townsend and Phenix, 'A Brief Survey of Historical Varnishes', 252–53.

¹³² Bierings, 'Spoorloos vernist? De ontwikkeling van een analysemodel voor onderzoek naar de originaliteit van schilderijvernissen met een toepassing op zeven schilderijen van George Hendrik Breitner in de collectie van het Rijksmuseum Amsterdam.', 16–17.

¹³³ Townsend and Phenix, 'A Brief Survey of Historical Varnishes', 260–61.

¹³⁴ Bierings, 'Spoorloos vernist? De ontwikkeling van een analysemodel voor onderzoek naar de originaliteit van schilderijvernissen met een toepassing op zeven schilderijen van George Hendrik Breitner in de collectie van het Rijksmuseum Amsterdam.', 21.

¹³⁵ Townsend and Phenix, 'A Brief Survey of Historical Varnishes', 262.

¹³⁶ Talley Jr and Groen, 'Thomas Bardwell and His Practice of Painting: A Comparative Investigation Between Described and Actual Painting Technique', 67.

¹³⁷ Tapia, 'Master Painting Manual: Traditional Painting Material Methodologies for the Contemporary Artist', 102.

change in the composition of a painting. In this case, a varnish layer can be found in between paint layers.

4.2 It's complexity

The complexity of varnish is situated on different levels, namely the materials, the application, and the terminology used to describe its practice.

As stated above, the materials for varnishes more or less stayed the same throughout history, up until the 19th century. They could be grouped roughly in three categories (oil-resin varnishes, solvent-based varnishes, and water-based varnishes), and were prepared according to recipes, which were often handed down through historical treatises or artist's manuals.¹³⁸ The rise of commercially available artists' products increased the complexity of varnish compositions. Manufacturers could add unknown materials, but the artist also had less autonomy in the preparation of his product.¹³⁹

The change in autonomy is also reflected in the varnish application. While before, artists themselves decided whether to apply a coating or not, their newly acquired collaboration with dealers meant a painting was not always sold as the artist left it. The public's taste was for artworks to have a glossy sheen. Often, dealers were not aware of their artists preferences and applied varnishes to make paintings easier to sell. In other cases, the artists did decide in favour of a varnish, but left the application to colourmen, the 19th century version of an art supplies dealer. This was, for instance, customary in the preparation of paintings for exhibitions in France. Not all colourmen were experienced however, resulting in paintings coated with heavy, uneven varnish layers.¹⁴⁰ According to Karen Bonne, this activity is, or at least was at some point in the past, also practiced for exhibitions in Japan, where Delvaux was on display with several of his works.¹⁴¹ The changes in application lead to questions of originality, posing difficulty for conservators when it comes to leaving or removing a varnish.

According to Bierings, who designed an analysis model for determining the originality of a varnish, the definition should read as follows: "An original varnish is the first varnish applied to a painting, unless there is reason to assume that the application of a varnish is contrary to the artist's wishes. However, the varnish must have been applied within five years of the creation."¹⁴² (Own translation). This poses problems in the conservation of paintings which were varnished by intent of the artist much later in their career. One example is *The Oyster Eater* (1882), by James Ensor. The artist only varnished it in 1907 before trying to sell it.¹⁴³ Should a conservator remove this layer? Or to turn it around: Should other paintings, which were effectively varnished by the artist, be left with a dull appearance, caused by a yellow varnish? Would the artist have wished for that, in favour of preserving the varnish? Or do we prefer the opportunity to research its materials above the presence of a painting and the artist's intent? These are no easy questions to answer, and still impact the decision-making today.¹⁴⁴

¹³⁸ Townsend and Phenix, 'A Brief Survey of Historical Varnishes', 252–53.

¹³⁹ Bierings, 'Sporloos vernist? De ontwikkeling van een analysemodel voor onderzoek naar de originaliteit van schilderijvernissen met een toepassing op zeven schilderijen van George Hendrik Breitner in de collectie van het Rijksmuseum Amsterdam.', 19.

¹⁴⁰ Swicklick, 'French Painting and the Use of Varnish, 1750-1900', 164–65.

¹⁴¹ [Bonne, Personal communication.](#)

¹⁴² Bierings, 'Sporloos vernist? De ontwikkeling van een analysemodel voor onderzoek naar de originaliteit van schilderijvernissen met een toepassing op zeven schilderijen van George Hendrik Breitner in de collectie van het Rijksmuseum Amsterdam.', 25.

¹⁴³ Todts, *Ensor on Varnish.*, 6.

¹⁴⁴ Townsend and Phenix, 'A Brief Survey of Historical Varnishes', 260.

Lastly, the terminology surrounding varnish practices other than as final coating is ambiguous, which makes it difficult when researching the subject or communicating about it. Oiling out, intermediate varnish layer, local varnish, retouching varnish or reworking varnish are all terms used interchangeably, but not always to describe the same thing. Sometimes they are referred to for solving the sinking issue, other times they mean a layer which serves as a base for a new layer or a composition change. The most striking confusion I encountered was when I asked a professor for literature on retouching varnishes, meaning those used as an intermediate layer between paint layers. Being in the conservation-restoration department, my professor guided me towards an article regarding binding media for pigments, used during the retouching process in a conservation treatment. This does not keep in mind the possible interpretations of non-conservators, such as the people on the *Topstukkenraad*. In the results section (cf. *infra*), a clear distinction will be made when referring to the different transparent layers in *The Pink Bows*, other than the final coating. *Intermediate transparent layer* will be used for varnish between paint layers, as this is the most neutral terminology. The locally applied varnish will be referred to as *oil layer*, as there is no conclusive consensus on the reason for its application, nor its material identification.

Chapter 2 - Experimental research

1 Overview of the methodology

In the books on Delvaux, several paintings appeared to have the same varnish phenomenon as *The Pink Bows*. I selected relevant paintings, based on time (1935-1947) (Appendix 3: Relevant paintings). This period spans Delvaux's surrealist period, making it more likely that he used the same materials and applied the same working process.

However, it was very difficult to acquire information. The obstacles were manifold: either the provenance of the painting was unknown, or the institutions had no information (research or scientific imaging) to share due to not having any or to museum sharing policy. Furthermore, the Delvaux archive was not accessible during this research project. Additionally, COVID-19 prevented me from traveling overseas to look at some of the relevant paintings.

In the Museum of Fine Arts Ghent, a painting with drippings was found closer to home. Under UV-light, even more transparent layers became visible. Due to time restrictions, however, an overall UIVF-photo to get an idea of the extensiveness of their application could not be taken.

Despite the difficulties, many tools and techniques have made a thorough exploration of *The Pink Bows* possible. This was mainly possible thanks to Iperion HS, a consortium that provides access to state-of-the-art research facilities from different labs and universities around Europe, after accepting a project proposal. To this end, the BelMod-project (Belgian Modernists: A material technical study on James Ensor and Paul Delvaux) was set up in cooperation with the KMSKA. The proposal (see Appendix 4: Proposal Iperion HS) was evaluated on its scientific and technical merit, after which access was granted. Seven international teams visited the museum to investigate the paintings with their mobile equipment.

In this chapter, an overview of the research methods used is given, following the methodology proposed by Geert Van der Snickt (Figure 21).

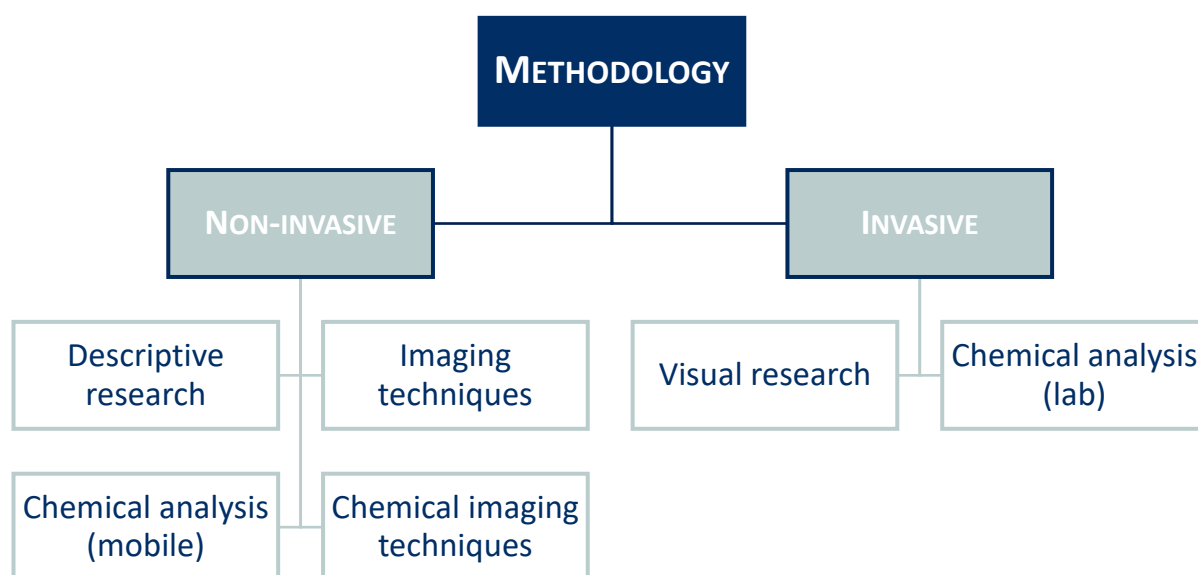


Figure 21: Overview of the methodology

Many of the methods make use of different electromagnetic radiation waves. These waves range from large lengths (e.g., infrared waves) to very small ones (e.g., x-rays), as can be seen in Figure 22. As their length decreases, their energy increases. This has implications when irradiating materials, which vary throughout the electromagnetic spectrum. For instance, waves in the infrared range, cause vibrations in the bonds between molecules, while X-rays have the ability to break those bonds, thanks to their high energy. These interactions of radiation with matter are employed by research methods in the heritage field for documenting and examining objects. Each method serves a different purpose, which are (briefly) outlined below for those that have been operated on *The Pink Bows*. For each technique, the instrumentation and procedures have been described as detailed as possible.

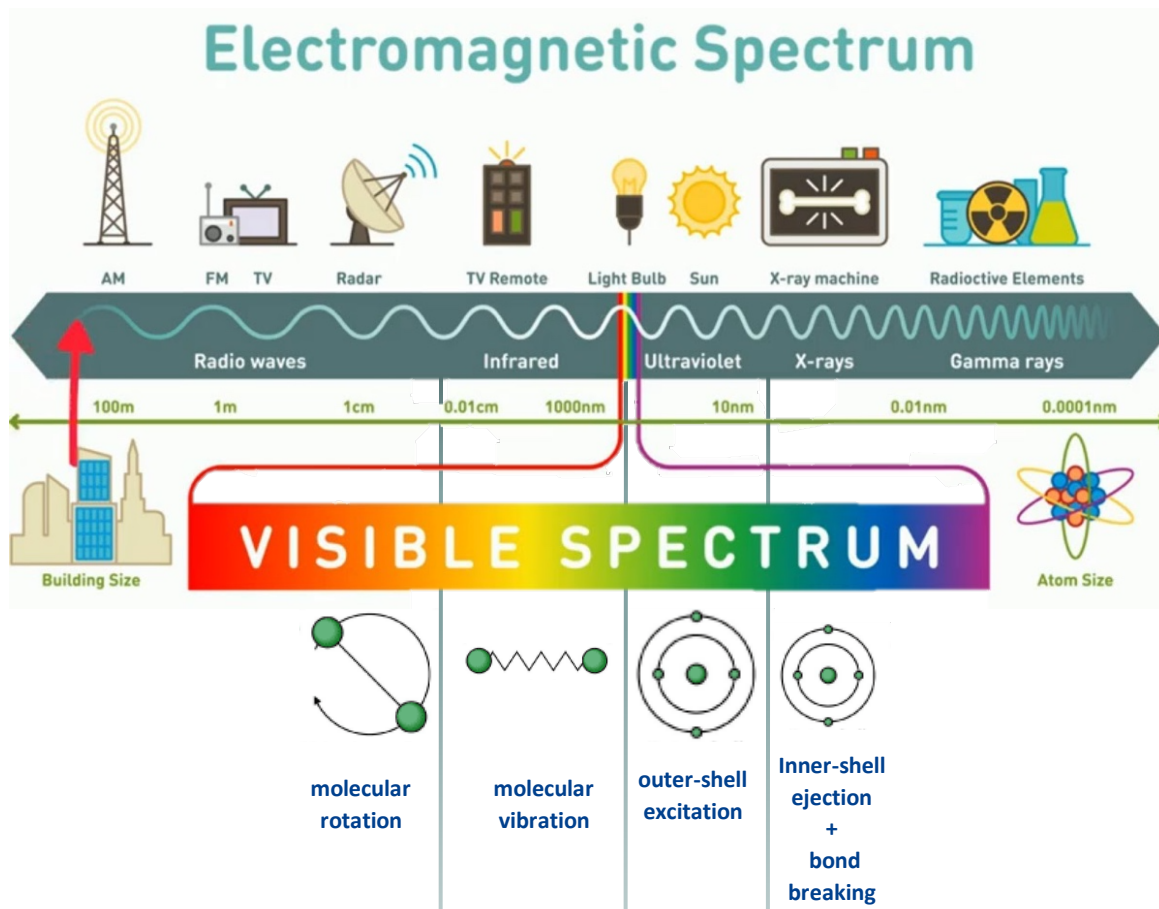


Figure 22: A visual representation of the electromagnetic spectrum with molecular interactions. ©MooMooMath and Science, IEEE

Table I on the following page gives an at-glance overview of the methods with their intended purpose for this study. The greyed-out methods were performed by Iperion, but the results were not yet accessible at the time of writing this thesis. In addition to these research methods, mock ups were made to assess the impact of transparent layers to the appearance of paint layers. Their preparation will be explained in a separate section.

Table 1: Overview of research methods

Method		Purpose
Non-invasive on the painting		
Descriptive research	Archival research	<ul style="list-style-type: none"> • Provenance • Working process
	Art-historical research	
	Visual observation	
imaging techniques	Visual light photography	<ul style="list-style-type: none"> • Documentation and comparison
	Ultraviolet-induced visible fluorescence photography	<ul style="list-style-type: none"> • Varnish presence
	Infrared photography	<ul style="list-style-type: none"> • Underpainting presence • Pigment identification
	False colour imaging	<ul style="list-style-type: none"> • Pigment identification • Varnish presence
	Optical coherence tomography (850 nm and 1960 nm) (OCT)	<ul style="list-style-type: none"> • Layering identification
Chemical analysis (mobile)	Total reflection mid/near Fourier-Transform infrared spectroscopy (FTIR)	<ul style="list-style-type: none"> • Material identification
	Micro-Raman (λ exc 532 nm)	
	Low energy x-ray fluorescence	
Chemical imaging techniques	Macro-X-ray fluorescence (Ma-XRF)	<ul style="list-style-type: none"> • Material identification • Material distribution
	Near infrared hyperspectral imaging (900-2500 nm) (NIR HIS)	<ul style="list-style-type: none"> • Identification of underdrawing
	Ultraviolet and visible induced fluorescence hyperspectral imaging (450-1000 nm) (UV-VIS HIS)	<ul style="list-style-type: none"> • Material identification • Material distribution
Invasive on samples		
Visual Research	Visual light microscopy	<ul style="list-style-type: none"> • Layering identification
	Ultraviolet-induced visible fluorescence and polarised light microscopy	<ul style="list-style-type: none"> • Varnish presence • Binding agent presence
Chemical analysis	Pyrolysis-gas chromatography/mass spectrometry (Py-GC/MS) and thermally assisted hydrolysis and methylation-gas chromatography/mass spectrometry (THM GC/MS)	<ul style="list-style-type: none"> • Varnish identification • Binding agent identification
	Scanning electron microscopy – energy dispersive x-ray spectroscopy (SEM-EDX)	<ul style="list-style-type: none"> • Layer-specific material identification

2 Non-invasive research on the painting

2.1 Descriptive research

As a starting point for this research project, the painting was studied mainly from an art-historical point of view. The short literature review (see chapter 1) shows that different types of sources were used. To retain focus on the material history of the painting, no iconographic or iconologic analysis was performed. Likewise, a stylistic study was outside the scope of this research.

The main sources for the biographical and art-historical description stem from either contemporary people (friends of the artist like Claude Spaak and Maurice Debra) or connoisseurs (Camille Brasseur, Suzanne Houbart-Wilkin, and Barbara Emerson). Other documents were obtained through the KMSKA archive, e.g., on the provenance of the painting and conservation history.

2.2 Imaging techniques

2.2.1 Visual light photography (VIS)

Rik Klein Gotink, freelancer for the KMSKA, documents all the art works of the collection photographically. He makes pictures of both the front and backside of an object.

The Pink Bows was photographed in situ, with a Hasselblad H5D-50c camera (Figure 23). A total of nine separate photos (tiles) were made separately, to be stitched together with computer software afterwards (Appendix 6: Visible photography). This allows the photographer to acquire a picture with a high resolution.¹⁴⁵ The same process was used for the other imaging techniques that Gotink conducted.

To get a more detailed look at the painting surface, a stereo microscope was used for observation and macro photography. The SZ-51 Olympus was placed on a Foba[®] column tripod and completed with a cool light source (Figure 24). They have a zoom range of 6.7x to 40x.

Pictures were taken with the digital microscope camera. The Leica Application Suite allows to capture pictures and import them onto a computer. This software also provides convenient extra's like a scale. Sometimes the sharpness of these pictures was not sufficient, so a smartphone (iPhone SE) was used instead to take pictures through the oculars of the microscope.

¹⁴⁵ Klein Gotink, 'Tiling'.



Figure 23: Hasselblad camera on a stand in front of *The Pink Bows*.



Figure 24: Stereo microscope mounted on a tripod.

2.2.2 Ultraviolet-Induced Visible Fluorescence Photography (UIVFP)

Ultraviolet (UV) rays can react with certain materials like, in the case of painting surfaces, (some) pigments, varnishes and painting media. They reflect back upon reaching the surface, causing fluorescence, which is lower in energy radiation than the UV-rays. Because materials react differently to UV-radiation, they fluoresce in a different manner too, resulting in different colours and intensities. This makes it possible to distinguish some of the objects' materials.¹⁴⁶ With a camera and UV-light sources, the fluorescence can be captured. Klein Gotink uses large blacklight TL-lamps as a UV-source. To not influence the photo with the UV-light itself, his camera filters out this light with a Tiffen UV 2E Pale Yellow Filter. He also uses an orange conversion filter 85B to reduce an excess of blue in the image.¹⁴⁷

Although this ultraviolet-induced visible fluorescence photography is a standard technique in conservation documentation, Rogge and Lough warn with their study that no definite conclusions about, e.g., varnish or pigment identification should be drawn from the images.¹⁴⁸ However, they provide valuable information on the presence of varnish and other materials and can be complementary to additional (imaging) methods. The UIVF-photograph of *The Pink Bows* can be found in *Appendix 7: UIVFP*.

¹⁴⁶ Rushfield and Stoner, *The Conservation of Easel Paintings*, 294.

¹⁴⁷ Rik Klein Gotink, 'UV-fluorescentie fotografie'.

¹⁴⁸ Rogge and Lough, 'Fluorescence Fails', 144–45.

2.2.3 Infrared Photography (IRP)

Wavelengths in the near-infrared range (NIR, 780 nm - 3000 nm) can penetrate paint layers because many pigments become transparent in this radiation. Carbon-based materials like graphite do not become transparent, but absorb the IR-radiation, allowing us to detect whether there is an under drawing or -painting present.¹⁴⁹

To obtain an IR-image, a camera with a filter, blocking the visible light, is needed. There are commercially available cameras, although it is possible to modify a standard camera to make it sensitive to IR. Klein Gotink used a modified Hasselblad 60-megapixel camera to photograph *The Pink Bows*.¹⁵⁰

A limitation of this method is that some pigments need longer wavelengths to become transparent. Images of these pigments can be obtained by infrared reflectography, using specialised cameras transmitting IR in the 1000-1700 nm-range.¹⁵¹

2.2.4 False Colour Imaging (FC)

By rearranging the colour channels of photos, false colour (FC) images can be obtained. These help in discerning the presence of certain materials that are not visible by the naked eye, e.g., retouches. Moreover, they may provide information on materials origins, helping in their identification.¹⁵² While FC-imaging may prove useful, caution is needed as highlighted by Rogge and Lough. Their experiment on UVFC-imaging of different types of varnishes demonstrates that the nature of resinous materials cannot be identified by this technique.¹⁵³ In the case of the Delvaux paintings, the FC-images have therefore mainly been used to verify the presence of materials, more than their character.

Both IRFC and UVFC images have been derived from *The Pink Bows*. The IRFC was provided by Klein Gotink, while the UVFC were obtained by adjusting the visible light photos. UVFC's from both before and after treatment were made by following a combination of the protocols provided by The Library of Congress (LoC)¹⁵⁴ and AIC¹⁵⁵. The channels of the visible picture were converted by using Adobe Photoshop®: The green channel was changed to red, the blue channel to green and the UV-image to blue. The LoC recommended to convert the UV-image to greyscale, but the green channel of the UV-image (as recommended by AIC), provided better contrast to discern the varnish layer from the paint layer. The same effect is achievable by using the unaltered UV-image. The protocol is visualised in Figure 25.

¹⁴⁹ Rushfield and Stoner, *The Conservation of Easel Paintings*, 296.

¹⁵⁰ Rik Klein Gotink, 'IR-fotografie met een gemodificeerde spiegelreflex'.

¹⁵¹ Cultural Heritage Science Open Source, 'Infrarered Reflectography (IRR)'.

¹⁵² Cultural Heritage Science Open Source, 'Infrarered False Color Photography (IRFC)'.

¹⁵³ Rogge and Lough, 'Fluorescence Fails', 145.

¹⁵⁴ Edwards and Oey, 'Digital Imaging Workflow For Treatment Documentation', 186–90.

¹⁵⁵ Lainé et al., 'False-Color Image Processing'.

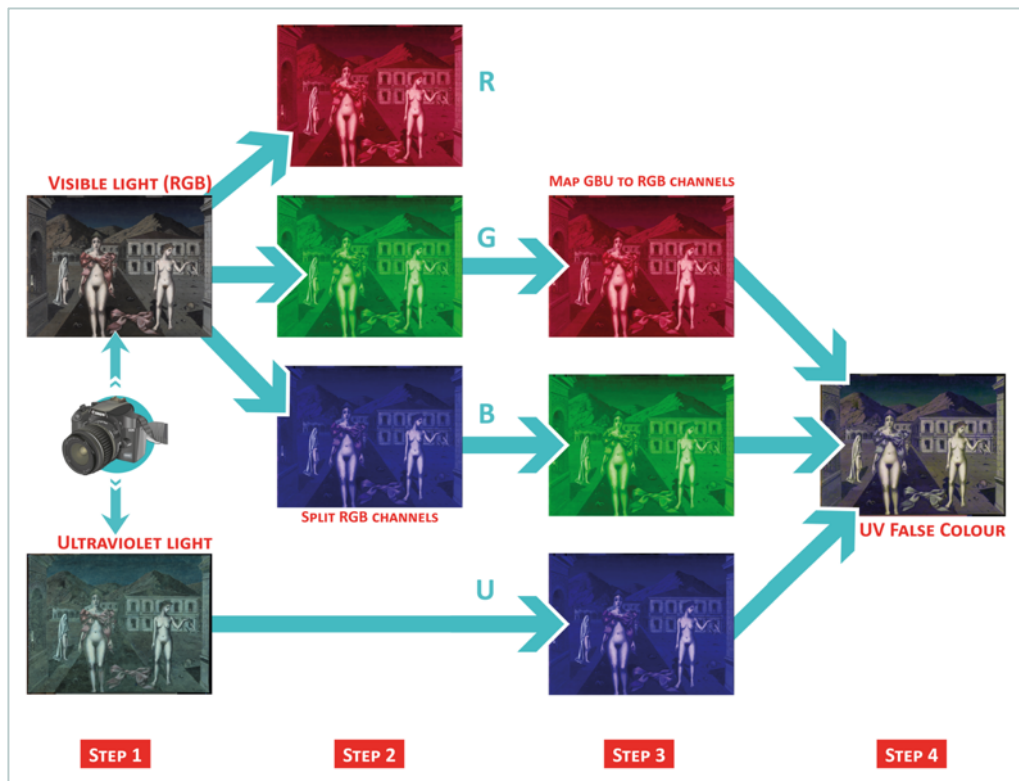


Figure 25: Process of making the UVFC-image. © Eveline Vandeputte, based on JC Wong

2.2.5 Optical coherence tomography (OCT)

Optical coherence tomography is a non-contact technique that allows to identify the stratigraphy of the upper transparent and semi-transparent layers of an object. To this end, it employs broadband infrared radiation, which is scattered or reflected by the surface, collecting interferometric information. As materials like varnishes, glazes and paints moderately absorb IR-radiation, it is a useful technique to investigate the (sub)surface structure of a painting.¹⁵⁶ The acquisition of information is quickly obtained and presented in an image that can be compared to a sample cross-section, called an OCT tomogram. Figure 26 shows how such a tomogram is parallel to the stratigraphy in a sample.

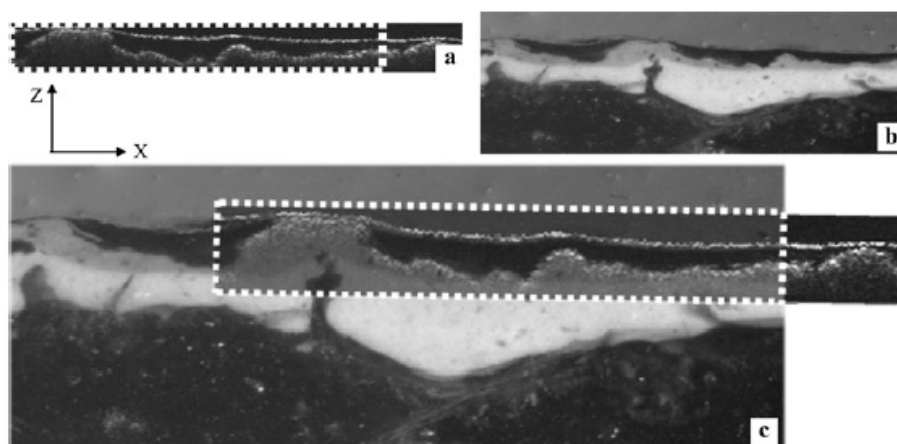


Figure 26: Comparison of a tomogram to a physical sample, taken from Targowski and Iwanicka, 2011. (a) is the OCT tomogram (280 μm x 2 mm), (b) shows the physical sample. In (c), they are combined. © Arrechi et al., Targowski and Iwanicka.

¹⁵⁶ Ford et al., 'Munch and Optical Coherence Tomography', 3.

Measurements follow a line of $\pm 1,55$ cm. Unlike a physical sample, this technique does not need preparation of the object. Moreover, thanks to its speed, a complete object can be scanned to get a comprehensive view of the objects structure.¹⁵⁷ While a light beam is needed, the intensity is so low it does not damage the artwork. A drawback, however, is that the painting materials are limitedly transparent for this light.¹⁵⁸

Tomograms are usually processed for clarity. Scattering from artefacts are reduced, and the thickness of the layers are presented on a false colour scale. Black areas show the (semi-)transparent layers, the weakly scattering or reflecting layers in cold colours (from blue to green) and highly scattering or reflecting layers are shown in warm colours (yellow to red). Additionally, the vertical scale is elongated, due to the difference in resolution. The axial resolution in the acquired images is much higher than the lateral one. An elongated vertical scale makes the tomogram better readable.^{159, 160} The tomograms for *The Pink Bows* have not yet been processed in such a way, although preliminary tomograms were provided.

A portable OCT-instrument developed by the Nicolaus Copernicus University (Torún, Poland) was used to scan the painting (see set-up in Figure 27). For this, the painting was placed vertically on an easel. The instruments' light source is made up of a super luminescent LED, emitting in a band of 750-960 nm (M-T-850-HP broadlighter, Superlum, Ireland), probing light with a maximum intensity of 1,5 mW. A set of images was obtained after selecting the areas of interest and have an axial resolution of 2,2 μm in the varnish and similar media, and a lateral resolution of 15 μm . The size of the scanned areas is 12 cm^2 and each measurement is accompanied by an IR reflectogram, showing the scanning line in yellow, and macrographs (1,5 x zoom) in both UVF and VIS.^{161, 162}

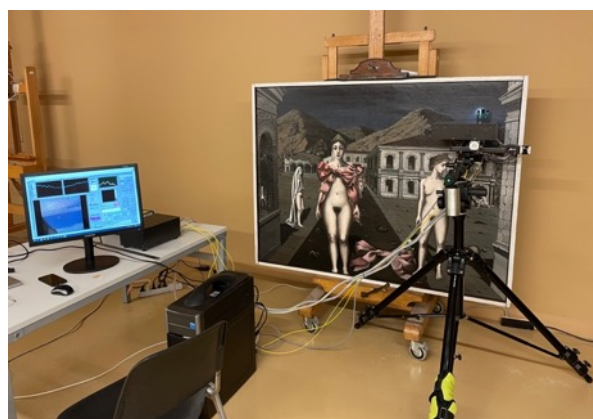


Figure 27: Set-up of the OCT-instrument in front of the painting.

2.3 Chemical analysis – mobile

2.3.1 Total Reflection mid/near FTIR spectroscopy

Fourier transform infrared spectroscopy (FTIR) can be used to identify organic and inorganic materials, by characterising their molecular vibrations. The frequency or energy of these vibrations depend on the mass of the atoms in the molecule and the strength of its bond (single, double, or triple) and is thus unique to the molecule. By irradiation, the molecules strongly absorb those wavelengths at their characteristic frequency, increasing their vibration motion. The characteristic frequencies are present in an IR-spectrum as peaks, allowing their identification by comparing them with standard spectra in

¹⁵⁷ Iperion HS, 'OCT (850 Nm)'.

¹⁵⁸ Targowski and Iwanicka, 'Optical Coherence Tomography: Its Role in the Non-Invasive Structural Examination and Conservation of Cultural Heritage Objects—a Review', 265.

¹⁵⁹ Ibid., 267.

¹⁶⁰ Targowski, Personal communication.

¹⁶¹ Iperion HS, 'OCT (850 Nm)'.

¹⁶² Iwanicka, 'Paul Delvaux, The Pink Bows. OCT – Preliminary Results', 1.

databases.¹⁶³ The mid-infrared range offers more specific spectra, while the near-infrared (NIR)-spectra are more difficult to interpret due to their broader signals.¹⁶⁴ However, their highly penetrative ability allow information on materials up to the ground layer.¹⁶⁵

Total reflectance FTIR acquires the reflected radiation, as opposed to the transmittance radiation in other techniques. Its main drawback is the difficulty of interpreting reflectance spectra in comparison to transmittance spectra, as they can show distortions of frequency, intensity and band shape. These can be caused by absorption and refraction indices and the roughness of the surface.¹⁶⁶ Additionally, spectral databases often contain spectra on pure materials, while the materials in a painting are combined into a more complex system.

Moreover, FTIR spectroscopy is best used with Raman for completely capturing a molecule's vibration, as they provide complementary information. FTIR is best employed for identifying asymmetric vibrations of polar groups.¹⁶⁷

For measurements in *The Pink Bows*, Bruker Optics ALPHA-R spectrometer with a reflection module was used, set up at a 1 cm distance from the surface. It has a Globar infrared radiation source, a Michelson interferometer (RockSolid™) and a DLaTGS detector. Its radiation covers a range from 7500 cm^{-1} to 350 cm^{-1} and a spectral resolution of 4 cm^{-1} . It was placed on a small lift, to easily change its position (Figure 28).¹⁶⁸

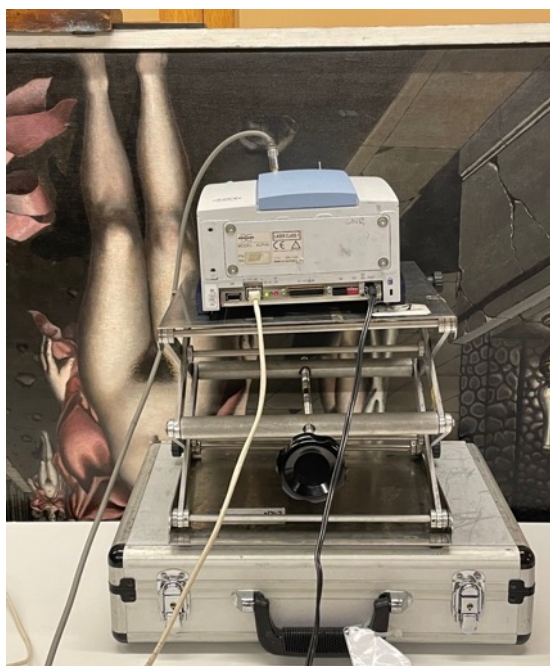


Figure 28: FTIR-setup.



¹⁶³ Larkin, *Infrared and Raman Spectroscopy*, 1, 119.

¹⁶⁴ Vagnini et al., 'Ft-Nir Spectroscopy for Non-Invasive Identification of Natural Polymers and Resins in Easel Paintings', 2108.

¹⁶⁵ Iperion HS, 'External Reflection Mid/near-FT-IR'.

¹⁶⁶ Invernizzi et al., 'Mid and Near-Infrared Reflection Spectral Database of Natural Organic Materials in the Cultural Heritage Field', 1.

¹⁶⁷ Larkin, *Infrared and Raman Spectroscopy*, 1.

¹⁶⁸ Iperion HS, 'Bruker Optics ALPHA-R Spectrometer'.

2.3.2 Micro-Raman spectroscopy

Raman uses radiation to detect molecular vibrations but is better capable to detect symmetric vibrations of non-polar functional groups than FTIR, hence its usefulness as a complementary technique.¹⁶⁹ It does not rely on molecular absorbance of infrared radiation, however, but on the inelastic scattering of photons from the molecule, known as Raman scattering. The light from the incident beam interacts with the molecules, exciting their electrons to a higher state of energy. They are in a *virtual state*, however, which means they fall back to their ground state shortly after excitation.¹⁷⁰ This original ground state is called the Rayleigh line. In this case, there is no change in energy before and after radiation. Raman scattering happens when the emitted photons contain higher or lower energy than the Rayleigh line. When electrons fall back to a vibrational state instead of the original ground state, the scattering is called Stokes scattering. The photons are then emitted in a longer wavelength than the incident light, having lower energy. An electron can also be excited from a vibrational level, reaching a higher energy. After falling down to the ground state, it emits shorter wavelengths as the photon possesses higher energy than the incident light. This scattering is called anti-Stokes.¹⁷¹ This effect is visualised in Figure 29. The shifted photons can be detected by collecting them at an angle to the incident light beam. Next to vibrations, Raman can also detect rotations and other low-frequency interactions.¹⁷²

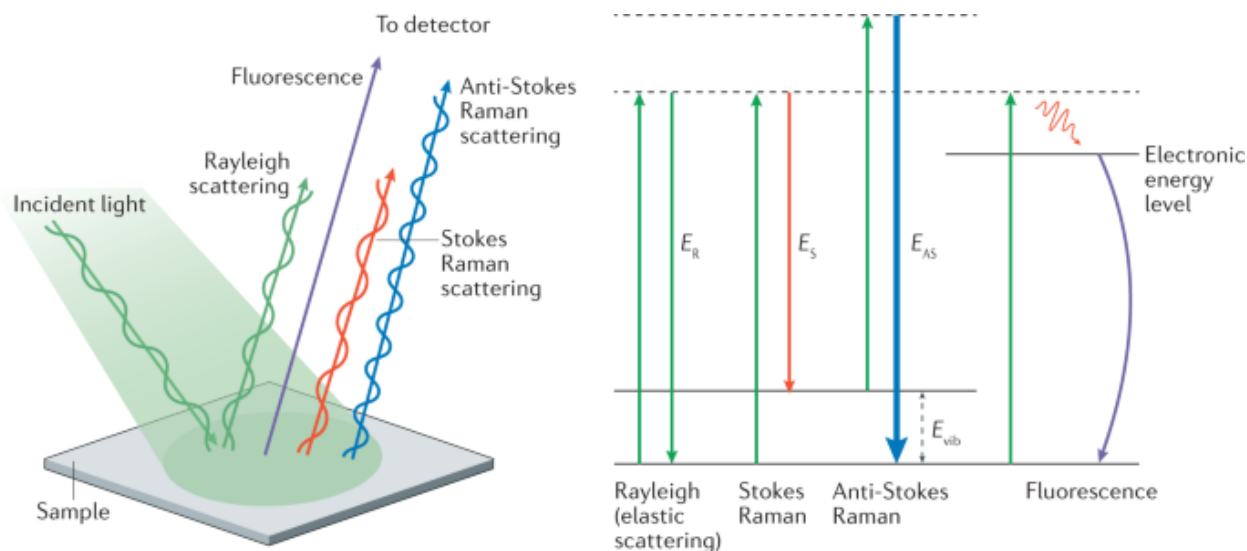


Figure 29: Visual representation of the Raman-effect, with the differences in energy levels. © Mosca, 2021

The same drawback regarding spectral interpretation occurs, as is the case for FTIR. Databases mostly contain information on pure materials, rather than paint systems. This might lead to slight differences between the referenced and acquired spectra.¹⁷³

For analysis on *The Pink Bows*, a portable JASCO Ventuno dispersive micro-Raman spectrometer was used. Its light beam source is a Nd:YAG laser, emitting at 532 nm with a power from 10 to 30 mW.¹⁷⁴

¹⁶⁹ Larkin, *Infrared and Raman Spectroscopy*, 1.

¹⁷⁰ Smith and Dent, *Modern Raman Spectroscopy*, 4.

¹⁷¹ Kauffmann, Kokanyan, and Fontana, 'Use of Stokes and Anti-Stokes Raman Scattering for New Applications', 1.

¹⁷² Smith and Dent, *Modern Raman Spectroscopy*, 2, 4.

¹⁷³ Pause, Werf, and Van den Berg, 'Identification of Pre-1950 Synthetic Organic Pigments in Artists' Paints. A Non-Invasive Approach Using Handheld Raman Spectroscopy', 3–4.

¹⁷⁴ Doherty et al., 'Micro-Raman Spectroscopic Study of Artificially Aged Natural and Dyed Wool', 639.

2.4 Chemical imaging techniques

2.4.1 Macro X-ray Fluorescence (MA-XRF)

A part of the painting was scanned by means of macro-X-ray fluorescence. This is a non-invasive imaging technique allowing to collect X-ray fluorescence intensity maps, in which the distribution of specific elements is visualised in grayscale images, ranging from white to black. These maps are generated by scanning the surface of the object with a focused X-ray beam, after which the detector captures the emitted fluorescence radiation.¹⁷⁵ Each pixel presents the relative concentration of the elements detected. The maps eventually need to be humanly interpreted to form conclusions on the materials used in the object. This is not a straightforward process because there is a degree of redundancies and hidden correlations between elements.¹⁷⁶ Furthermore, the elements detected give no information on their crystal structure or chemical environment, so it does not give direct information on certain pigments. Another difficulty is that the information is not layer specific. Therefore, Ma-XRF is most useful in combination with other methods such as sample analysis and traditional imaging techniques.¹⁷⁷

In addition to the deductive identification of materials, Ma-XRF also allows us to distinguish other phenomena like *pentimenti*, covered paint losses, retouches, and overpainted compositions. This look at the subsurface level is made possible by the penetration properties of the applied X-rays, which makes the technique valuable in gaining insight into the working process of the artist and conservation history of the object.^{178, 179}

To scan *The Pink Bows*, an instrument built by the University of Antwerp (AXIS-research group) was used. It has a measurement head that is mounted on a software-controlled motorised stage and can make scans of 57 x 60 cm² (horizontal x vertical). One full scan takes ± 24 hours, in which all elements, starting from magnesium, are detected simultaneously. The X-ray source inside the measurement head

is a 10W rhodium anode transmission tube (Moxtex, UT, USA). The secondary X-rays are detected by a Hitachi Vortex[®] EX-90 Silicon Drift Detector.¹⁸⁰

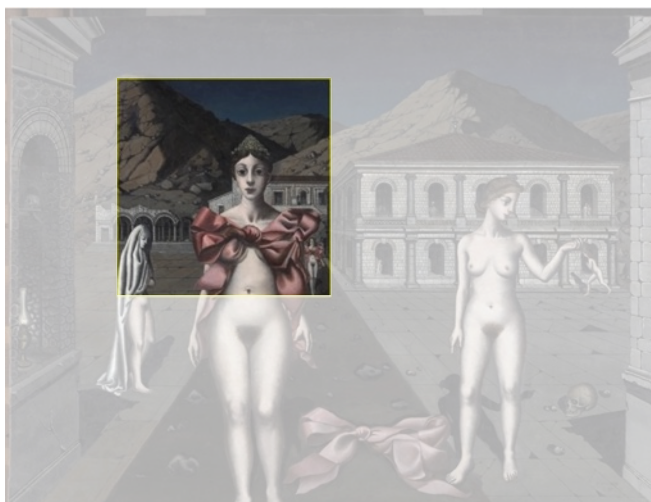


Figure 30: Ma-XRF scanning location.

Thanks to the mobility of the scanner, the painting could be analysed in situ, in the external depot of the KMSKA. The scanner was set up on a table in front of the painting, which was placed vertically on an easel. During the procedure, a perimeter of forbidden access was installed to maintain the safety of the employees. The scanning location is indicated in Figure 30. The scans can be found in *Appendix 11: Ma-XRF scans*.

¹⁷⁵ University of Antwerp, 'MA-XRF Scanner'.

¹⁷⁶ Alfeld, 'MA-XRF for Historical Paintings', 73.

¹⁷⁷ Geert Van der Snickt et al., 'In Situ Macro X-Ray Fluorescence (MA-XRF) Scanning as a Non-Invasive Tool to Probe for Subsurface Modifications in Paintings by P.P. Rubens', 238–39.

¹⁷⁸ *Ibid.*, 239.

¹⁷⁹ University of Antwerp, 'MA-XRF Scanner'.

¹⁸⁰ AXIS, 'MAXRF Scanner'.

2.4.2 Hyperspectral Imaging (HIS)

Objects can be examined in a non-contact way by means of hyperspectral imaging. The images are taken in broad bands, providing more complete photographic documentation than with the conventional techniques. Combined with spectral information, HIS can be used to characterise the chemical composition materials.¹⁸¹ To this end, a large amount of data is collected in a file or image cube. Each spot in this cube is identified by coordinates, connecting it to the surface of the object. The spatial coordinates (x and y) identify a pixel, while a spectral coordinate identifies the wavelength. Ultimately, each cube has a unique set of coordinates and thus information.¹⁸²

Often, researchers rely on fluorescence for identifying the presence of materials. However, as the fluorescence can be influenced by several factors, the spectral measurements provide more accurate information on the materials. Moreover, the results are complementary to other techniques, substantiating the presence or absence of materials.

HIS in the near-infrared range was performed to analyse the presence of an underdrawing. Unfortunately, results are not yet processed, so I will not go deeper into this technique.



Figure 31: Set-up of the UV-VIS HIS by the Perugia team.

Preliminary spectroscopic results were obtained by ultraviolet-visible induced fluorescence HIS (UV-VIS HIS). The painting was analysed with a SOC710 hyperspectral camera (Surface Optics Corporation, San Diego, USA). A line scanner provides a hypercube with a size of 696 x 520 pixels, covering the range of 400-1000 nm. Approximately every 4,5 nm, a spectrum is collected, until 128 spectral bands are covered. Reflective measurements were obtained by using two Elinchrom Scanlite 350W halogen lamps with diffusing umbrellas.¹⁸³ The set-up is shown in Figure 31. The painting was first fully scanned, before taking point measurements on specific locations of interest. The full scan contains roughly 60 to 80 scans, with $\pm 200\,000$ spectra per frame.¹⁸⁴ To reduce the abundance of information to what is needed for identification, the images need to be processed. This can be done by statistical methods like Principal Component Analysis (PCA) or by using neural networks (an artificial intelligence-method) for classifying the information. This helps to group materials based on spectral similarities, after which distribution maps can be created.¹⁸⁵ Processing has not yet been completed.

¹⁸¹ MacDonald et al., 'Assessment of Multispectral and Hyperspectral Imaging Systems for Digitisation of a Russian Icon', 1.

¹⁸² Iperion HS, 'Uv-Vis Induced Fluorescence Hyperspectral Imaging (450-1000 Nm)'.

¹⁸³ Iperion HS, 'Hyperspectral Camera Operating in Reflection and Emission Mode in the VIS-NIR Range'.

¹⁸⁴ Romani, Personal communication.

¹⁸⁵ Kubik, 'Hyperspectral Imaging: A New Technique for the Non-Invasive Study of Artworks', 2.

3 Invasive research on samples

3.1 Sample preparation

To further investigate the varnish and paint layers of *The Pink Bows*, the conservation team decided to take samples before continuing the treatment. Because the painting is considered a Masterpiece, permission was needed from the Masterpiece Council (*Topstukkenraad*). After their approval, three samples in two locations were taken using a microblade scalpel under the stereo microscope (Figure 32). Table II shows an overview of the samples. Some of them were embedded in resin to be viewed under the microscope. Other parts have been used for elemental analysis.

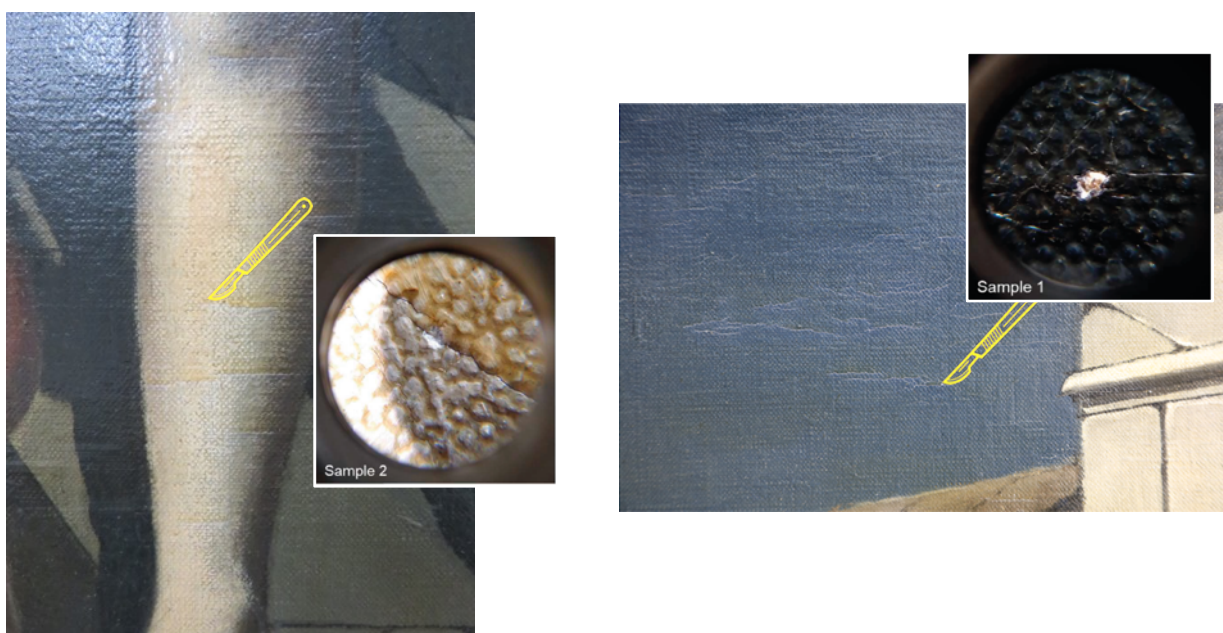


Figure 32: Sample locations © KIK-IRPA, 2021 and KMSKA, 2021

Sample 3 was embedded by the conservator at the KMSKA. The others were prepared by the Royal Institute for Cultural Heritage (KIK-IRPA) in Brussels.¹⁸⁶

Table II: Overview cross-sections

Sample number	Description	Type of analysis
1 C99.183 C99.184 C99.192	Dark blue, sky with thick, yellow varnish	Microscopy, THM-GC/MS
2 C99.185 C99.186	White, carnation	Microscopy, THM-GC/MS
3 2850.01	Dark blue, sky (x: 147,5 cm y: 100 cm)	Microscopy, SEM-EDX

¹⁸⁶ The following description of the method is derived from Decq, '2021.14659 - Paul Delvaux - De Roze Strikken'.

The KIK-IRPA embedded the samples in Technovit® 2000 LC, a methacrylate-based resin. This resin cures under cold blue light, with a curing temperature ranging from 50-90 °C.¹⁸⁷ The samples were laid on a clear cube of pre-cured resin and covered with a second layer. After curing, the cube was polished mechanically with sandpaper (200-400 mesh), followed by hand-polishing (Micro-Mesh, 12000 mesh).

3.1 Visual research: microscopy

Optical microscopy allows us to gain insight in the build-up of the layers in a painting. The KIK-IRPA therefore analysed the cross-sections with a Zeiss Axio M.1 Imager. To get a better view of binding media and varnishes, they used polarised white light and UV-light (excitation bandpass filter from 390 to 420 nm, beam splitter at 425 nm, and emission lowpass filter of 450 nm). Polarised light provides a high-resolution image so single (pigment) particles can be observed. UV-light, on the other hand, makes varnishes visible, informing the observer of the application technique.¹⁸⁸

The researchers took pictures of all three samples. Cross-section 2850.01 was also photographed with a 3D-microscope at the University of Antwerp of the Olympus DSX-HRSU 510 type.

3.2 Chemical analysis

3.2.1 Py-GC/MS and THM-GC/MS¹⁸⁹

The samples that were not embedded were analysed by means of pyrrole gas chromatography/mass spectrometry (Py-GC/MS) and thermally assisted hydrolysis and methylation gas chromatography/mass spectrometry (THM-GC/MS). These techniques particularly allow identification of synthetic polymeric media, e.g., synthetic varnishes. During the analysis, the sample is heated and broken down into smaller, more volatile fragments, after which they are separated on a gas chromatograph.¹⁹⁰ As many of the fragments contain polar groups which are not easily separated, a derivatising reaction can be performed by adding tetramethylammonium hydroxide (TMAH). This reaction causes methylation of the polar groups, making them easier to identify (THM-GC/MS).¹⁹¹

Pyrolysis was carried out without oxygen, in a helium atmosphere at 480°C (Frontier Lab pyrrole-unit model 3030). One of the samples was pyrolysed at 550°C, without derivatization, to show possible synthetic components more clearly. The samples were placed in a steel cup and, when derivatised, 5% TMAH in methanol was added. For the chromatographic separation (Thermo TraceGC), a Supelco SLB-5ms column with a length of 20 m, an internal diameter of 0.18 and film of 0.18 µm thickness was used. The samples were exposed to the following temperatures:

- 1 minute at 35°C
- heating to 240°C at a speed of 10°C/minute
- heating to 315°C at a speed 6°C/minute, for 5 minutes

¹⁸⁷ Kulzer GmbH, 'Technovit 2000 LC'.

¹⁸⁸ Keune and Townsend, 'Microscopical Techniques Applied to Traditional Paintings', 56–57.

¹⁸⁹ Decq, '2021.14659 - Paul Delvaux - De Roze Strikken', 3–4.

¹⁹⁰ 'NGA Conservation: Scientific Research'.

¹⁹¹ Decq, '2021.14659 - Paul Delvaux - De Roze Strikken', 4.

The detection of components was performed using a mass spectrometer, with a high sensitivity (quadrupole MS, Thermo ISQ7000, scanned between 35 and 600 amu, MS at 240°C, transfer line at 270°C). The column was directly connected to the pyrrole-unit without using the classical injector. The gas flow was programmed to increase with heat, to allow for a better resolution at higher temperature.

The acquired pyrogram was manually and semi-automatically searched for components indicating natural resins, waxes, oils, proteins, and synthetic components, using reference databases. Automated Mass Spectral Deconvolution and Identification System (AMDIS) and specific AMDIS-target libraries were used for the semi-automatic analysis.

3.2.2 SEM-EDX

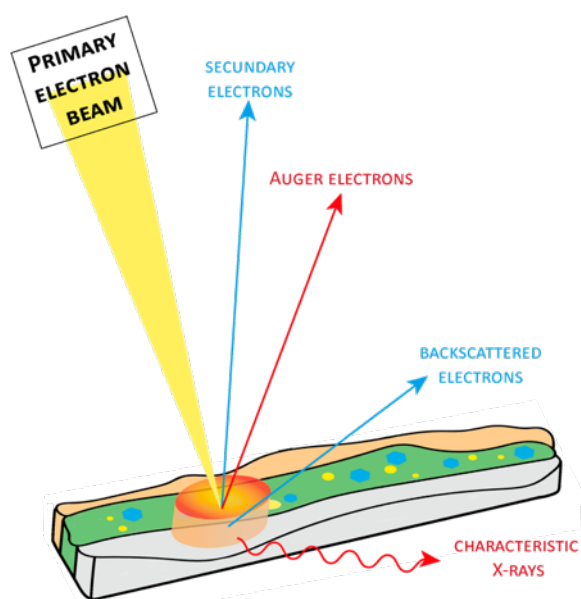


Figure 33: Principle of SEM-EDX on a sample with varnish (top), paint layer (middle) and ground layer (bottom). The primary electron beam causes interaction of the sample materials, resulting in emission of different radiation types. The blue emission is used for imaging, the emission in red is used for analysis.

its conductivity.¹⁹⁴ A lack of conductivity in samples causes charging, possibly resulting in distorted images.¹⁹⁵ Moreover, a coating allows the measuring of the signals under high vacuum, which is more efficient than ones under high pressure without a coating.¹⁹⁶

The sample was studied with a Field Emission Gun-Environmental Scanning Electron Microscope (FEG-ESEM) coupled with an EDX-detector of the FEI Quanta 250 type (USA), located at the AXIS and EMAT

Scanning Electron Microscopy (SEM) – Energy-Dispersive X-radiation (EDX) is an imaging-analytical technique that allows for both quantitative and qualitative information on chemical elements in a sample. The image, providing information on size, composition, crystallography etc. of particles, is produced by using the secondary and backscattered electrons, after the surface of the sample is radiated with a primary beam source. The analytical information on the other hand, is obtained through the emission of characteristic X-rays.¹⁹² Figure 33 gives a visual overview of the principle of SEM and EDX. The primary beam penetrates the sample 1 to 3 μm , making the emission of different radiation possible: secondary electron and Auger electron interaction happens at the surface (nm range and 5-75 \AA depth respectively), backscattered electron interactions at 10-100 nm, and the X-ray interactions at 1-3 μm .¹⁹³

After documenting cross-section 2850.01, a layer of carbon (15 nm) was added to the sample to increase

¹⁹² Goldstein, *Scanning Electron Microscopy and X-Ray Microanalysis*, 7.

¹⁹³ VUB-SURF, 'Scanning Electron Microscopy & Energy Dispersive X-Ray Spectroscopy'.

¹⁹⁴ Nuyts, 'RE: Quanta ESEM - Support PC Issue', 8 March 2022.

¹⁹⁵ Echlin, *Handbook of Sample Preparation for Scanning Electron Microscopy and X-Ray Microanalysis*, 247.

¹⁹⁶ Nuyts, 'RE: Quanta ESEM - Support PC Issue', 8 March 2022.

research groups¹⁹⁷ of the University of Antwerp. The measurements were carried out by Gert Nuyts (A-Sense Lab)¹⁹⁸.

EDX mappings were acquired, using a beam current of 250 pA at 10 kV. They were recorded with a resolution of $\sim 0.6 \mu\text{m}$. All EDX data analysis was performed by using the Inca software package provided by Oxford Instruments.

¹⁹⁷ AXIS: Antwerp X-ray Imaging and Spectroscopy laboratory, EMAT: Electron microscopy for materials science.

¹⁹⁸ A-Sense Lab: Antwerp Electrochemical and Analytical Sciences Lab

4 Mock-ups

Oiling out and varnishing have an impact on the appearance of a painting. To gain better insight in their practice and differentiation, mock-ups were made. The materials were chosen to resemble those in *The Pink Bows* as closely as possible. Two different supports were used to check the influence of the canvas and the ground material.

4.1 Materials

In Table III, an overview of the supports is given.

Table III: Build-up of the supports for the mock-ups

	MOCK-UP 1	MOCK-UP 2
Canvas provider	Claessens	Unknown
Structure	Intermediate	Coarse
Size layer	Polyvinyl alcohol	Animal glue
Ground layer 1	Zinc white	Animal glue + chalk
Ground layer 2	Titanium white	Zinc white (commercial paint)

The paint colours are all manufactured by Royal Talens and listed in Table IV. The materials for the coatings are the following: Boiled linseed oil (Royal Talens), colophony, and beeswax. The latter ingredients are from an unknown source but were provided by the University of Antwerp.

Table IV: Colours used in the mock-ups.

TUBE NR.	COLOUR NAME	CHEMICAL CLASS	PIGMENT NUMBER
508	Prussian Blue	Ferric-ferrocyanide	PB27
506	Ultramarine deep	Polysulfide of sodium alumino silicate	PB29
339	Light Oxide Red	Synthetic iron oxide	PR101
408	Raw Umber	Hydrated synthetic iron oxide	PY42, PR101, PBk11
701	Ivory Black	Bone black (mixture of calcium phosphate and carbon), polysulfide of sodium alumino silicate	PBk9, PB29

4.2 Recipes

Three mixtures in various ratios were made for the varnishes. Their preparation was based on a study in which historical recipes of oil-colophony varnishes were reconstructed.¹⁹⁹ Table V shows their ratios. In historical manuals, often a 1:3 oil-resin ratio is offered. This gives a varnish with a very thick consistency, making it hard to apply. Therefore, an additional mixture was qualitatively made: Linseed oil was added until it had the viscosity of a contemporary varnish.

¹⁹⁹ Tirat et al., 'Historical Linseed Oil/Colophony Varnishes Formulations: Study of Their Molecular Composition with Micro-Chemical Chromatographic Techniques'.

Table V: Varnish ratios

NR.	INGREDIENT 2	INGREDIENT 1	INGREDIENT 3	RATIO
1	Linseed oil (9 gr)	Colophony (27 gr)	-	1:3
2	Linseed oil (9 gr)	Colophony (27 gr)	Beeswax (± 1 pellet)	1:3 + beeswax
3	Linseed oil (qualitative)	Colophony (27 gr)	-	$\pm 2:3$

4.3 Application

The mock-ups were prepared by painting five strips, one for each colour. Then, each strip was divided in two. The bottom part was covered repeatedly with a layer of Prussian blue. This mimics the layering in the sky but can also give an idea for other areas where colours were put on top of a grey layer, containing this pigment (see the results section for a detailed description of the pigments).

After a drying period of three days, the colours were applied according to the scheme in Figure 34. The paint was used straight from the tube and without medium, to avoid differences in oil-to-pigment ratio. On the left-hand side, the paint was added thinly, while on the right-hand side, a thick layer was created. The mock-ups were left to dry for 27 days. Then the coatings were applied. The oil-colophony was applied by brush while hot. This decreased the viscosity. When applying cold, the varnish would drag, creating an uneven layer. The oiling out was done both by brush and by rubbing it in, after which excess was removed.

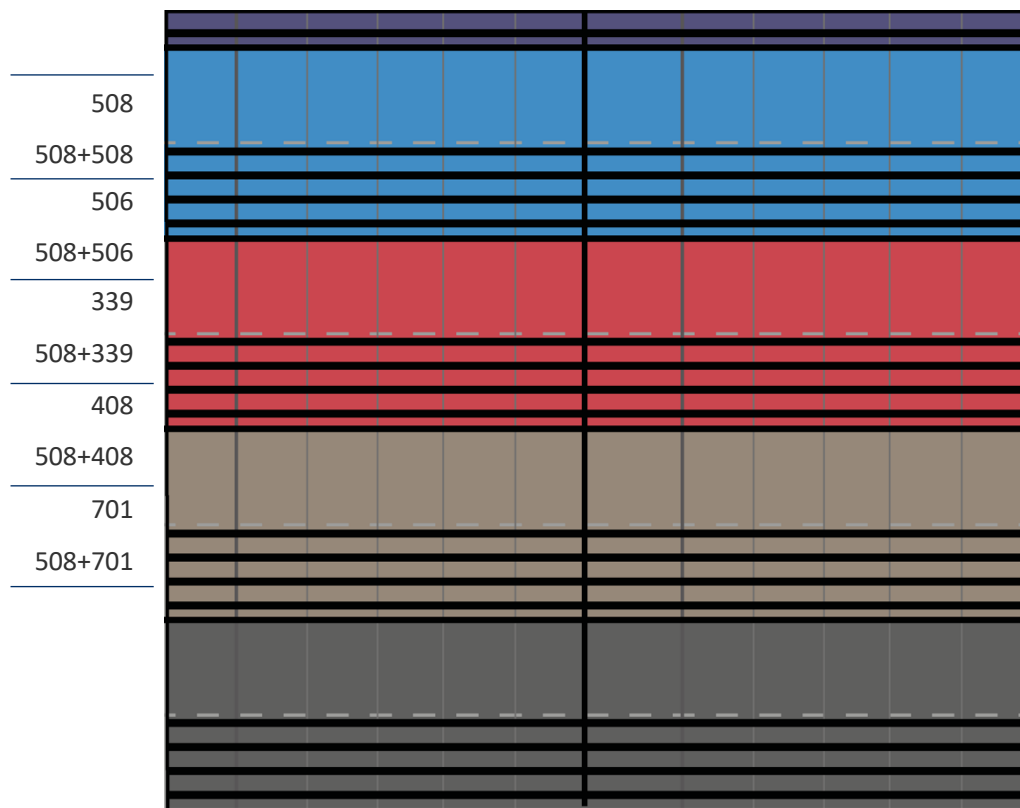


Figure 34: Overview of the materials on the mock-ups.

Chapter 3 - Results

4.1 Build-up and painting materials

In this part, it will become clear that Paul Delvaux took a rather conservative approach to his work, despite the many technical and material evolutions of the time. The build-up and materials of *The Pink Bows* are explored by breaking it down into different layers, starting with the support and ending with the varnish layer. By combining (chemical) analysis and literature, a comprehensive description of the painting is provided below.

4.1.1 Auxiliary support: Stretcher

The canvas of *The Pink Bows* was mounted on a stretcher consisting of two outer stiles (vertical elements) and two rails (horizontal elements) (Figure 38). Due to the paintings' large size (H: 125,5 cm x W: 163,6 cm), an additional stile in the middle was added. Each corner contains two keys which make it possible to adjust the tension of the fabric. The middle beam has one key on every side, placed opposite of each other. All keys are fixed to the bars with paper tape.



Figure 35: Detail of the joint, left upper corner. The yellow line indicates its seam.
©KMSKA, 2021



Figure 36: Stamp of the Parisian customs.



Figure 37: Detail of the scalloped edge with nail holes.
©Rik Klein Gotink, 2021



Figure 38: The back of the painting, without frame. © Rik Klein Gotink, 2021

The painting was strip lined (on two sides) and re-stretched in 2000 due to declined tension in the fabric.²⁰⁰ Thanks to this minimal intervention, the original support system is still visible. However, some areas have been obscured by the added fabric. A treatment report on this intervention is not available, which makes the appearance of the stretcher (e.g., possible traces of fabrication) and to which extent information is present on the bars unclear.

Figure 35 shows the characteristics of the corner joints. They are straight cut; however, further information on the assembly cannot be deduced. An X-radiograph might reveal dowels and keys, indicating the joint method.²⁰¹ The simplest joint is a mortise and tenon one. However, slotted joints and lap joints are also a possibility (Figure 39 through Figure 41).²⁰² The middle stile is fixed through a slotted joint.

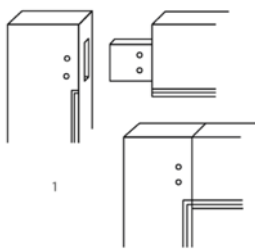


Figure 39: Mortar and tenon joint. ©Hélène Verougstraete, 2005

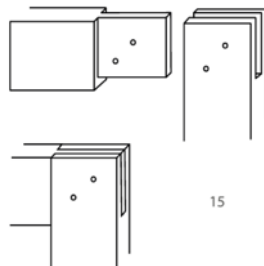


Figure 40: Lap joint. ©Hélène Verougstraete, 2005

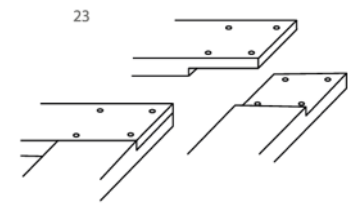


Figure 41: Slotted joint. ©Hélène Verougstraete, 2005

The main visible information on the bars is on the exhibitions where the painting was shown. Most of them are labels, either hand-written or typed by machine. In the middle bar, the inventory number, artist's name, title (in Dutch) and institution name and location is written directly on the wood. Perhaps this was done when the painting was first acquired by the museum in 1957.

A partially damaged label on this bar (Figure 42) indicates an exhibition in 1947. Despite the missing parts, the information could be completed by comparing the label to the one on a painting by Maria Blanchard²⁰³ (Figure 43). This reveals the gallery where the exhibition took place.



Figure 42: Label on The Pink Bows. © Rik Klein Gotink



Figure 43: Label on A Baby with Rattle, by Maria Blanchard, 19th century © Dorotheum

²⁰⁰ Postec, 'Factuur 2000/06 - Schilderijen Klaarmaken Voor Bruiklenen van Het KMSKA Voor Tentoonstellingen', 2.

²⁰¹ Verougstraete, *Frames and Supports in 15th and 16th Century Southern Netherlandish Painting*, 49.

²⁰² *Ibid.*, 51–56.

²⁰³ Dorotheum GmbH & Co KG, 'Maria Blanchard'.

Other writings on the beam include *P.B.A.* (Palais des Beaux-Arts?), which is partially concealed by 158 x 120. The latter closely resembles the measurement of the painting, indicating the stretcher was probably handmade by a carpenter. Another indication of the custom-made nature of the support, is the absence of marks on the fabric like dimensions and letters for standard sized canvases (e.g., for portraits (*figures*) and P for landscapes (*paysages*)), which were available as early as the 17th century.²⁰⁴

4.1.2 Primary support: Canvas

From the mid-nineteenth century onwards, it was customary for painters to buy their supports from suppliers instead of preparing them themselves.²⁰⁵ These industrially prepared canvases were stretched and ground on large frames, before being taken down and rolled into separate pieces for distribution to art suppliers. This is probably also the case for Delvaux's painting. There are visible traces of cusping along only one fabric edge (Figure 37), indicating it was cut from a larger piece. The cusping is caused by the preparation process: after application of the glue layer, the fabric is left to dry, causing shrinking. In a video by Claessens nv, the artisanal method is shown: a thread is woven in a zig-zag manner through hooks, which were applied at the bottom of the canvas, and nails on a lintel (Figure 44). The nail holes in the canvas where the cusping is present, might originate from this production phase, or from tacking the canvas to the stretcher.

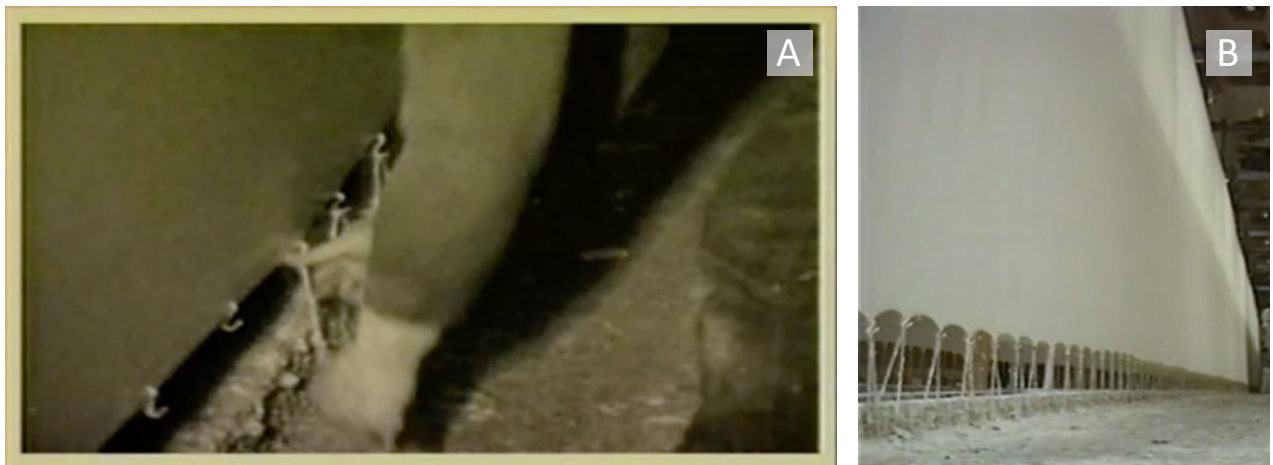


Figure 44: (A) Hanging the canvas before preparation, shot before the 1970's. (B) The fabric is left to dry after preparation, showing the cusping caused by its shrinking. © Claessens nv

Both the canvas and stretcher are marked with a stamp, identified as originating from the supplier.²⁰⁶ This was common practice for 19th and early 20th century European colourmen, who provided these supports.²⁰⁷ However, it reads *PARIS/EXPOSITIONS/DOUANES*. According to *Musée National des Douanes*, this means the painting was temporarily stored for an exhibition. *The Pink Bows* was in Paris several times, but stamps cannot be dated by observation. Another explanation for the stamp could be a link to the first acquisition of the painting by Claude Spaak. He was located in Paris from 1936

²⁰⁴ Rushfield and Stoner, *The Conservation of Easel Paintings*, 139.

²⁰⁵ Van der Snickt, 'James Ensor's Pigments Studied by Means of Portable and Synchrotron Radiation-Based X-Ray Techniques: Evolution, Context and Degradation', 23.

²⁰⁶ Beatriz Lorente, 'Treatment Report', 2.

²⁰⁷ Rushfield and Stoner, *The Conservation of Easel Paintings*, 135.

onwards.²⁰⁸ Archives of the national museums in France could provide more information when it was added to the artwork.²⁰⁹ Unfortunately, no export file could be located.

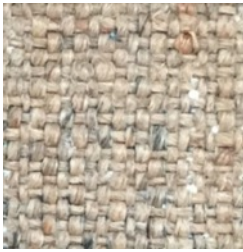


Figure 46: Detail of the fabric's plain weave. The warp threads are distinctively thicker than the weft ones.

No thread sample was taken to identify the nature of the canvas because sampling is restricted by the paintings' status as a Masterpiece. Yet, in the 20th century, artists mainly used both linen and cotton supports with a plain weave. This weave pattern is present in *The Pink Bows*, with a distinctive thread count between the warp (longitudinal, double threaded) and weft (transversal, single threaded) (Figure 46). Before the 19th century, these were more even.²¹⁰ The pattern is discernible through the paint layer, due to the fabric's coarse structure. The structuring of threads plays a crucial role

in its response to external factors, such as temperature, humidity levels and tensioning.²¹¹

The weave pattern is distorted, which probably occurred during the stretching phase in the production process. Moreover, some irregularities can be observed in the canvas. These certainly occurred during the weaving process, as the paint layer is undamaged by e.g., cracks (Figure 45).



Figure 45: Irregularity in the canvas weave.

While it is unclear where Delvaux acquired his canvas, Flanders is renowned for its painting fabrics since at least 1253.²¹² Today, Claessens Artists' Canvas is the main manufacturer in the region. The company dates back to 1906 and still keeps to the artisanal nature of its products. Their products are exported to all continents, emphasising their importance and, indirectly, their quality.²¹³ Only recently Claessens began to mark their fabrics. Before, this practice was left to the companies who stretch the canvases.^{214, 215} I could not trace any other painting fabric company around the time *The Pink Bows* was created, so it is not unthinkable Claessens provided Delvaux with his canvasses, like they did his Belgian contemporary Magritte.²¹⁶ In the next paragraph, similarities between Claessens production with the preparation layer of *The Pink Bows* will be explained.

4.1.3 Preparation layer

Claessens traditionally prepared their canvasses using rabbit skin glue as a sealant. For the ground, they applied zinc pigment in oil, followed by a thin layer of lead white. Huyvaert, the head of the company, mentions how its manual application differed from their French counterpart companies: By following the grain of the canvas, the sweeping motion is less discernible.^{217, 218}

²⁰⁸ Spaak, *Paul Delvaux*, 2:48.

²⁰⁹ documentation@musee-douanes.fr, 'Stamp Douanes', 3 November 2021.

²¹⁰ Rushfield and Stoner, *The Conservation of Easel Paintings*, 139.

²¹¹ *Ibid.*, 120.

²¹² *Ibid.*, 122.

²¹³ Today, the millery where Claessens fabrics are woven, is one of six worldwide companies carrying the Belgian Linen™ quality label. ()

²¹⁴ Deman, 'Van Linnen Tot Schildersdoek: Op Bezoek Bij Claessens Canvas'.

²¹⁵ Carlyle and Hendriks, 'Visiting Claessens, Artists' Canvas Manufacturers', 5.

²¹⁶ Deman, 'Van Linnen Tot Schildersdoek: Op Bezoek Bij Claessens Canvas'.

²¹⁷ Claessens Artists' Canvas, 'Types schilderdoek'.

²¹⁸ Carlyle and Hendriks, 'Visiting Claessens, Artists' Canvas Manufacturers', 5.

The Ma-XRF scans and sample analysis show comparable materials and build-up for *The Pink Bows*. The ground consists of zinc white and a thin lead white layer (Figure 47), of which the distribution is homogeneous: The dark areas in the scan are complementary to the white areas in the lead (Pb) scans (Figure 48 and Appendix 11: Ma-XRF scans). This heavy element, situated in the top layers, attenuate the X-rays, therefore creating a shadow effect. The presence of zinc in the ground layer, as opposed to upper layers, is also substantiated by the UV-fluorescence observable in the samples, showing a greenish colour (Appendix 12: Report Sample Analysis).²¹⁹ The distribution of Pb-white in the ground, follows the grain of the canvas, as explained by Huyvaert.

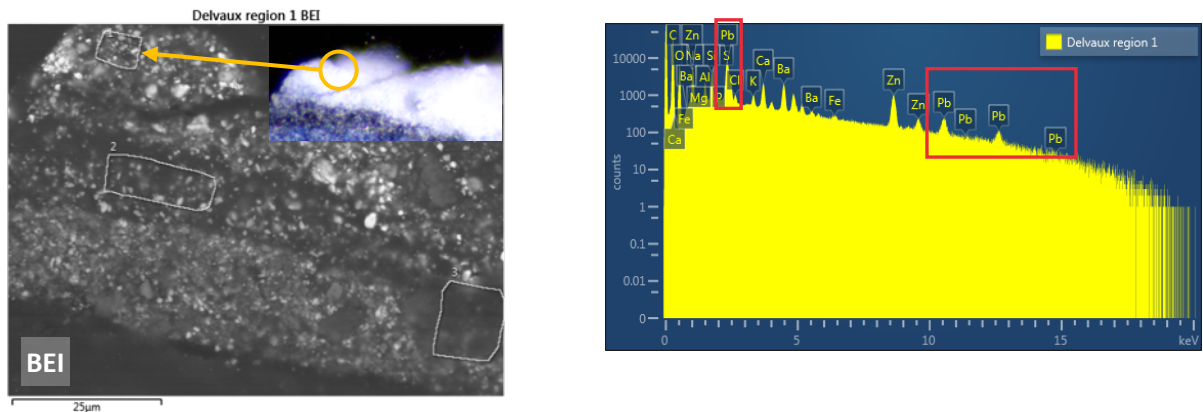


Figure 47: SEM-EDX analysis. The backscatter image shows the locations of analysis. In the spectrum, the Pb and Zn elements are highlighted. © Gert Nuyts

Zinc white was introduced as an alternative for lead white in the painting industry, since the early 19th century, when the toxic nature of lead became apparent. Due to its poor hiding power, it is frequently combined with other white pigments like barytes.²²⁰ Baryte was found in all layers of the sky's sample by means of SEM-EDX.

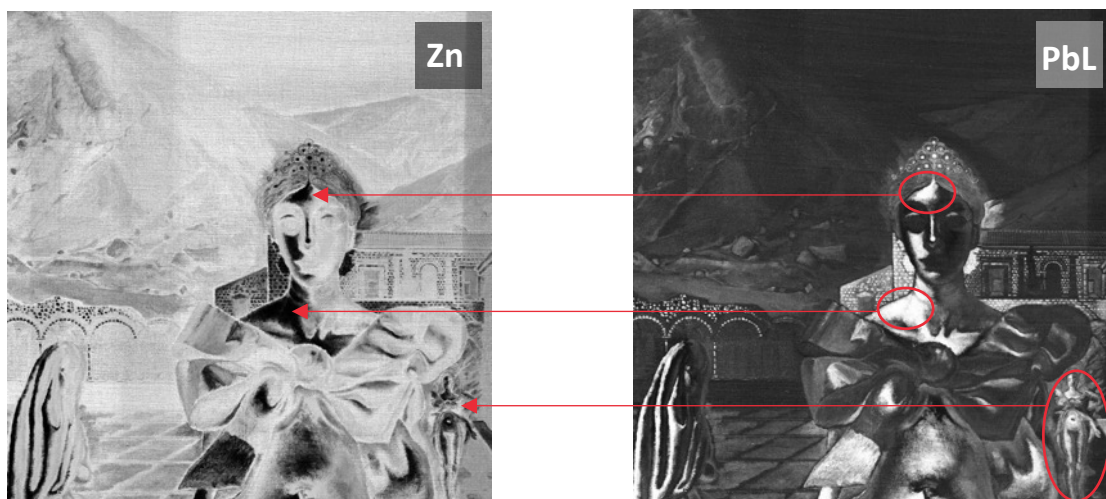


Figure 48: Image of zinc scan. © Nina Deleu

The ground layer seems to be thinly applied, as the structure of the canvas is still visible in the pictorial layer. This is also suggested by the measurements of sample C99.186. The ground is 18 µm thick, while

²¹⁹ D. C. Creagh and David A. Bradley, *Radiation in Art and Archeometry*, 66.

²²⁰ Robert L. Feller, *Artists' Pigments: A Handbook of Their History and Characteristics*. Vol. 1, 1:169, 170.

the paint layer ranges from ca. 30 -50 μm .²²¹ However, the possibility that the sample does not contain the complete ground should not be discarded, therefore making the exact measurements unsure.

4.1.4 Underdrawing

The Pink Bows was certainly well prepared before Delvaux started painting. He was known to create *modello*-like sketches²²²:

J'ai toujours préparé mes tableaux par des dessins, sauf pour 'Les Mains', en 1941, que j'ai improvisé en poignant directement sur la toile. Le dessin m'aide à entrer progressivement dans mon tableau où je vis pendant que je le fais. (...)²²³

Although it is uncertain if a drawing still exists²²⁴, other preparatory sketches give an idea of Delvaux's working process. The following paragraphs will explore some ideas on his approach through a comparison of two paintings and several sketches.

The artist donated a sketchbook to the Royal Museum of Fine Arts of Belgium (KMSKB), containing all "projects" for *The Sleeping Venus* from 1932. On the following page, some sketches are picked out and chronically ordered, based on some key changes. This gives in insight in Delvaux's decision-making in the design process. Some of the changes are highlighted and refer to two paintings: On the left is a painting that was destroyed, but pictured in the oeuvre catalogue, and on the right is one from a private collection.

The later sketches clearly show a grid, so it is most plausible Delvaux used these for the preparation of an underdrawing. It is uncertain however, how he preferred to transfer the sketch to the canvas. A light horizontal line is visible through the shirt of the left seated figure (existing painting), but there are no clear traces of a grid in *The Pink Bows*. Nevertheless, there are indications of a drawing in the form of perspective lines (Figure 49). Some of them are thinner and show through the paint layer. Raman analysis did not yield results about the composition of these lines. Visual observation leads to believe it are graphite pencil lines. These lines might imply a change of mind by Delvaux.

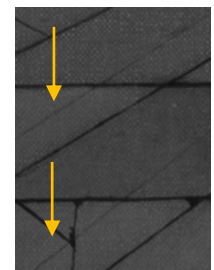


Figure 49: Pencil lines.

It is also unsure to what extent the artist transferred his preparatory sketches. In *The Pink Bows*, the only signs of pencil marks are those perspective lines and one distinct vertical line in the left column. Therefore, he possibly outlined the characters and objects with paint, creating an underpainting rather than -drawing. This is supported by the IR-image, showing large areas of carbon-based pigment. Moreover, in some areas 'blocking out' of elements in grey paint are visible in the paint layer (cf. infra). However, if Delvaux traced an underdrawing with carbon-containing paint, it is possible this layer obscures the carbon signal of graphite in the IR-photo, rendering a drawing invisible.

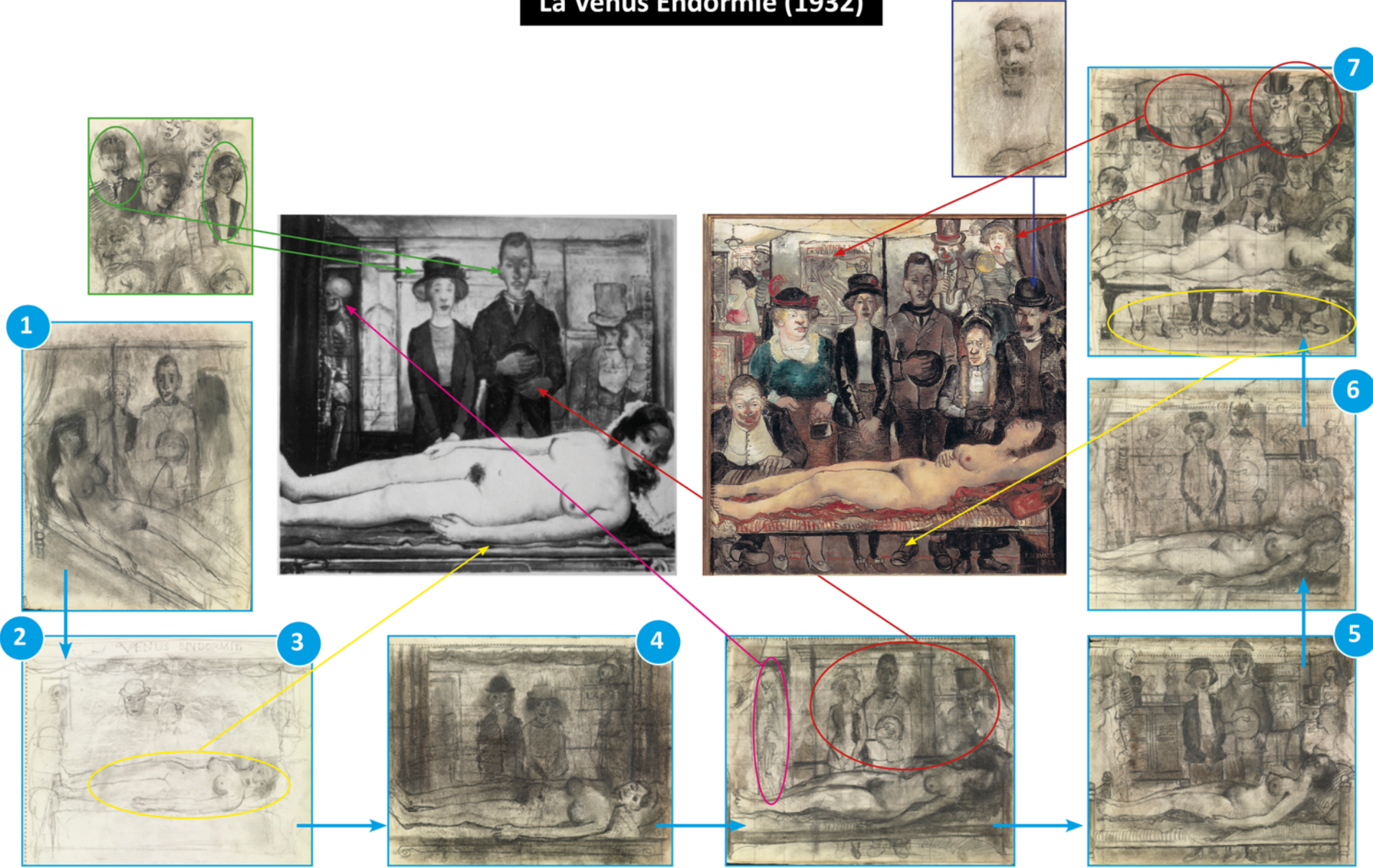
²²¹ Decq, '2021.14659 - Paul Delvaux - De Roze Strikken', 16.

²²² Z. Barthelman en Julie van Deun, *Paul Delvaux: odysee van een droom* (Wommelgem: Paul Delvaux Stichting en BAI, 2007), 33.

²²³ Carels en Van Deun, *Paul Delvaux: Sa vie*.

²²⁴ Delvaux's sketchbooks in the collection of the KMSKB are not available for research purposes, due to their fragile condition. Stamnis, 'Onderzoek Delvaux - Voorbereidende Schets', 14 March 2021.

La Venus Endormie (1932)



4.1.5 Lay-in layer

Van der Snickt describes a lay-in or *ébauche* as the first paint layer in a painting. It is used to colour block the elements that the artist wants to include in a composition. Depending on the painter's approach, the layer is executed in monochrome or polychrome colours, and can have several levels of detail. Here, it is classified as separate from the paint layers, as it serves a distinct purpose.

Some suggestions of a monochrome lay-in are found in *The Pink Bows*. The column on the right side of the painting shows traces of a grey underlayer, which is more distinctive in the IRP-image (Figure 50). Such traces are also visible around the foot and leg of the woman on the right, and in the bows underneath a thin pink layer (Figure 51). Furthermore, the IRP (Figure 52) clearly shows a lean paint layer, unable to cover what lays underneath: As the lay-in is a preparatory layer, it must contain less oil than subsequent layers, to adhere to the fat-over-lean rule in oil painting.²²⁵ This can make the paint overly thinned. A last hint towards a lay-in is the calcium distribution corresponds with ivory black (cf. infra) and is mainly applied in larger blocks, suggesting a monochrome underpainting.

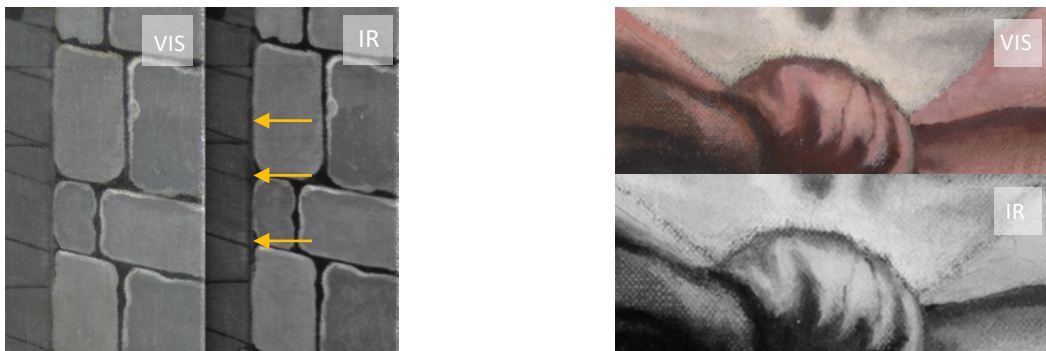


Figure 50: (A) Traces of blocking out the stone column. (B) The bow is layed down in shades of grey, by blocking out the shadows. The outline and shadows can be seen in both the visual light and infrared photo.

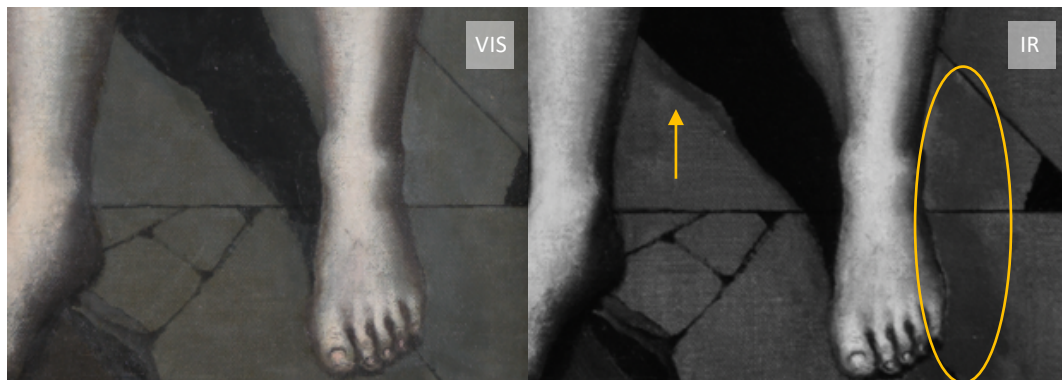


Figure 51: The outline of the shadow extends further than visible in the painting. On the right, an outline or shadow has been largely overpainted. The build-up through shadows is also visible here.

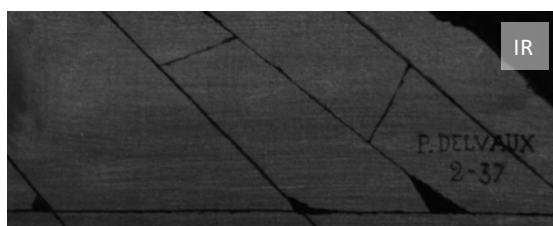


Figure 52: The brush strokes of a lean layer are clearly visible.

²²⁵ Virgil, *Traditional Oil Painting: Advanced Techniques and Concepts from the Renaissance to the Present*, 141.

4.1.6 Paint

Delvaux used a fairly limited palette for painting *The Pink Bows*. It consists of traditional colours like earths and cadmium colours, in addition to ultramarine blue. The colours were not singularly applied in their pure form but were often mixed with zinc white or black to change their tonal values. Lead white was mainly applied as highlights. For obtaining different shades of grey, the artist used Prussian blue in his mixes.

In this chapter, the material nature of the paint will be explained. It starts with the manufacturer, as this influences both the production and ingredients of modern paints. Next, an overview of the binding medium and a more detailed description of the pigments is given.

4.1.6.1 Manufacturer

Thanks to impressionist painters' desire to work outside, the paint tube was invented in 1841. This makes it easier to characterise paint materials of artists from the 20th century onwards, provided the manufacturer has information available on its production. Recent research projects are investigating such archives and are trying to make them accessible.^{226, 227, 228, 229}

It is unknown if Delvaux had a certain favourite brand for oil paint. However, pictures and videos of his studio space might offer clues. Photos by Virginia Haggard-Leirens, taken from 1965 to 1986 in his Boitsfort studio, show several Talens products. Some of these could also be seen in a reconstruction of his studio space in the Delvaux Museum (Figure 53).

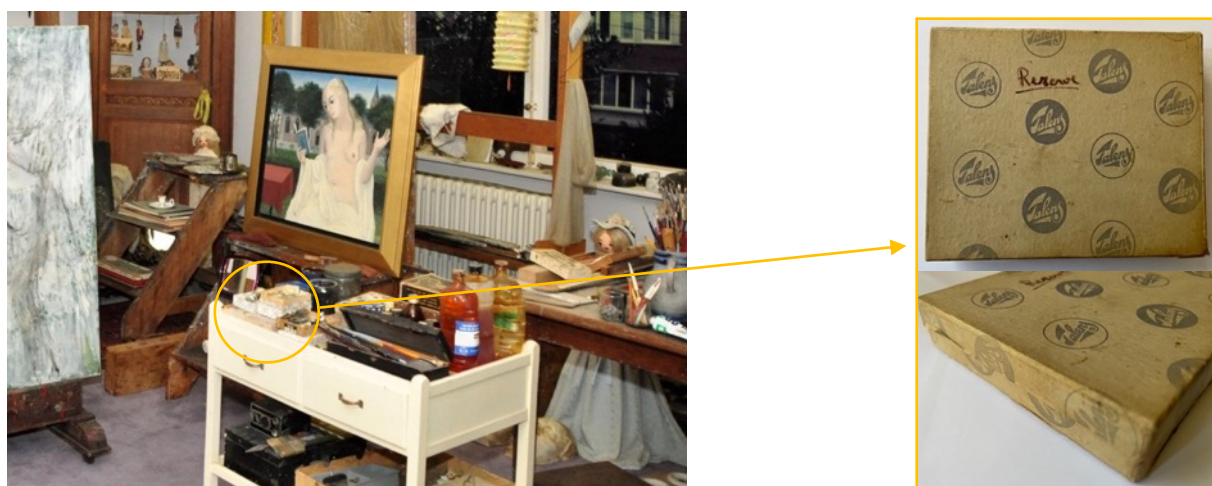


Figure 53: Left: reconstruction of Delvaux's studio. © Alfred Penel. Right: old box of Talens Paint

Furthermore, footage from *The Sleepwalker of Saint Idesbald* (1986) features a close-up of Rembrandt paint tubes, the artist quality line of the brand, and Van Gogh tubes, their student quality. Appendix 13: shows an overview of the colours that could be identified. While no definite conclusions can be drawn from this, the tubes seem to range from different production periods. Talens has had several name

²²⁶ Heuvel et al., 'Approaches to the Identification of Royal Talens ETA (Emulsion) Paint in Objects of Art'.

²²⁷ van Gurp, 'BIJZONDERE ARCHIEFVONDSTEN BIJ TALENS. Synthetisch ultramarijn donker olieverf in de historie van een twintigste eeuwse verffabrikant'.

²²⁸ Veneno et al., 'Yellow Lake Pigments from Weld in Art: Investigating the Winsor & Newton 19th Century Archive'.

²²⁹ Van den Berg to Vandeputte, 'Vraag i.v.m. Talens archief - LOIS databank (1)', 15 May 2022.

changes in its history (Talens & Zn. and Talens Compagnie) and was granted a royal predicate in 1950, becoming Royal Talens as of then. These name changes are reflected in the packaging of their products, which Litjens used to date paint tubes from the Talens archives. Consultation of this study was not permitted, but in a dissertation by Femke Van Gurp, the information was used to connect recipes from the same archives to the paint tubes. This paper states that Talens used metal caps in the early 20th century.²³⁰ According to Coos van Waas, product specialist at the company, the plastic caps are in use since the late 1970's.²³¹ Thanks to the physical properties of these caps, some dating can be applied.

With the help of Klaas Jan van den Berg and Coos van Waas, all but one of the tubes in the still from *The Sleepwalker of Saint Idesbald* could be confirmed as Talens tubes.²³² Most of their caps are plastic, and thus modern tubes. The Ivory black tube, however, shows an older tube with possibly a metal cap. Other distinctive features are the *Hollands Boertje*-logo, which predates the *Talens*-word mark logo, and the multiple translations of the paint colour (Figure 54). The *Boertje*-logo is slightly different from the others: it has less pronounced round corners and the background is similar to that of the text surrounding it. This is not the case in the modern design. In Van Gurps dissertation, a tube with similar elements is dated from ca. 1940 to 1950.²³³ This could mean Delvaux possessed these kind of tubes already earlier in his career.

The red cap on the small tube is peculiar. Talens did not make coloured caps, only grey and whitish ones. It is unclear if the reddish colour is caused by a reflection of the tube, or a light-aberration from the video film.²³⁴

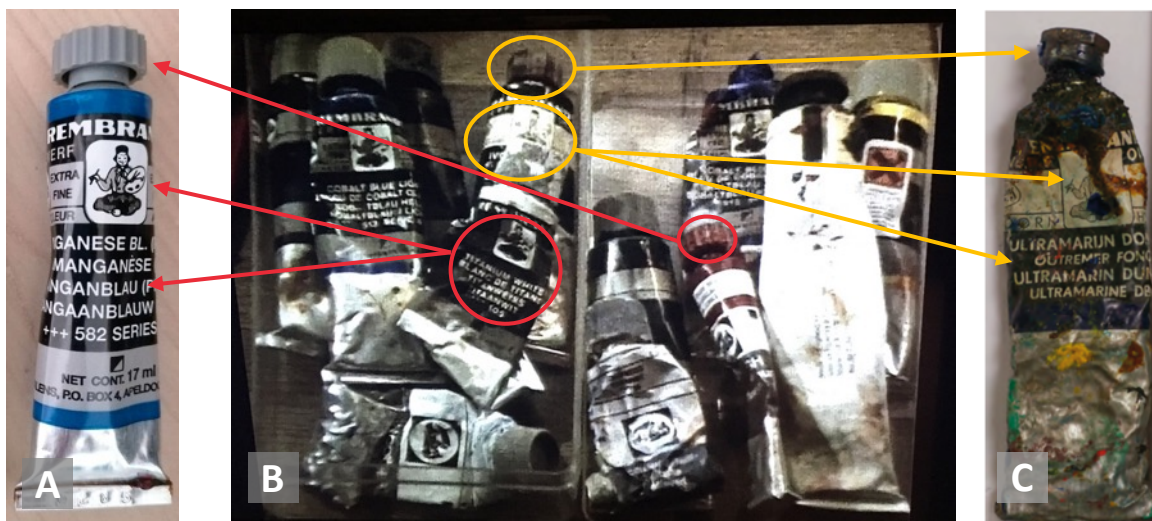


Figure 54: (A) Modern oil tube ©eBay Germany, (B) Still from *The Sleepwalker of Saint Idesbald* ©Adrian Maben, 1986. (C) Paint tube from the Talens archives ©Femke van Gurp, 2014

²³⁰ van Gurp, 'BIJZONDERE ARCHIEFVONDSTEN BIJ TALENS. Synthetisch ultramarijn donker olieverf in de historie van een twintigste eeuwse verffabrikant', 13.

²³¹ Van den Berg to Vandeputte, 'Vraag i.v.m. Talens archief - LOIS databank (3)', 15 August 2022.

²³² Ibid.

²³³ van Gurp, 'BIJZONDERE ARCHIEFVONDSTEN BIJ TALENS. Synthetisch ultramarijn donker olieverf in de historie van een twintigste eeuwse verffabrikant', 71.

²³⁴ Van den Berg to Vandeputte, 'Vraag i.v.m. Talens archief - LOIS databank (2)', 5 August 2022.

4.1.6.2 Binding medium

The invention of the paint tube allowed artists not having to source their own raw materials for making their paints. Additionally, the paint could be produced more consistently. During production, materials such as stabilisers, dispersion agents and driers next to oils were added. This allowed manufacturers to control parameters like shelf life, production efficiency and handling properties, and thus the quality of their product.²³⁵

Traditionally linseed oil and poppy oils were used as binders because they dry to a strong film. For whites, Talens uses safflower oil due to the yellowing of linseed.²³⁶ The properties of the paint can be changed by processing the oil in different ways. Examples are heating for faster drying and curing of the paint to a hard film (less prone to oxidising) and cold pressing to obtain clean, high-quality oil.²³⁷ All of these elements can have an impact on the ageing and/or degradation of the paint, and therefore their conservation needs.

As different pigments need different oil ratios to be satisfactorily dispersed, the paint needs **stabilisers** to keep its brushability, and cohesion with other paint films. Therefore 20th century paints contain metal stearates. According to Tumosa, aluminium (Al) stearate is commonly used²³⁸, while Van Gurp discovered the use of sodium (Na) stearates in Talens paints until the 1960's.²³⁹ Na-stearate additives are possibly found in the paint sample of *The Pink Bows* as there is an overall presence in the Na-map of the SEM-EDX analysis (Figure 55).

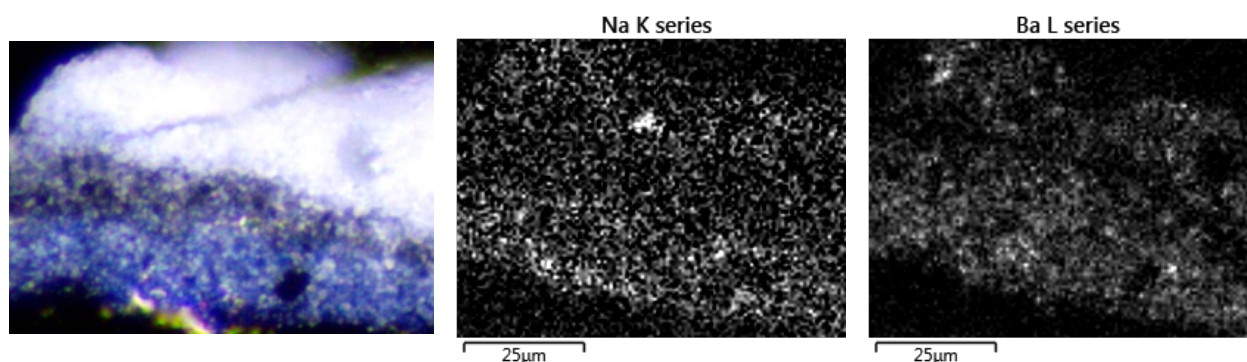


Figure 55: Additives in the paint sample: The higher Na-content in the blue layer is due to the ultramarine pigment. © Geert Van der Snickt, 2022, Gert Nuyts, 2022

Presumably, the paint contains barium (Ba) as a **filler**. Although it is widely assumed this is done to lower the content of pigment (and thus making the paint less expensive to produce), Talens states it is necessary to improve the workability of some paint colours.²⁴⁰

4.1.6.3 Whites

While the ground is largely made up of zinc white, Delvaux mainly used lead white in the paint layer. He used it for both mixing colours and as highlights. The mineral structure of the pigment was identified as hydrocerrusite ($2\text{Pb}(\text{CO}_3)\cdot\text{Pb}(\text{OH})_2$) by means of FTIR (Appendix 14: FTIR Spectra). The characteristics

²³⁵ Izzo, '20th Century Artist's Oil Paints. A Chemical-Physical Survey', 21.

²³⁶ Royal Talens, 'Kleurassortiment Rembrandt Olieverf, Artists' Quality Extra Fine'.

²³⁷ Izzo, '20th Century Artist's Oil Paints. A Chemical-Physical Survey', 26.

²³⁸ Op. cit. Ibid., 23.

²³⁹ van Gurp, 'BIJZONDERE ARCHIEFVONDSTEN BIJ TALENS. Synthetisch ultramarijn donker olievert in de historie van een twintigste eeuwse verffabrikant', 5.

²⁴⁰ Ibid., 17.

are as follows: strong carbonate stretching vibrations around 693-683, 1045 and 1400 cm^{-1} , the OH-stretch around 3530 cm^{-1} , and absorptions attributable to PbO at 392 cm^{-1} .²⁴¹ The FTIR measurements on the white of the bows correlate strongly with these specifics. Yet, the spectrum is influenced by other components as the sample location is a painting *system*, rather than a pure pigment.

In its natural form, hydrocerrusite is very rare, hence its early artificial production as lead carbonate hydroxide. It is argued to be made in China since 300 B.C., making it one of the oldest synthetic pigments.²⁴² Lead white was a favoured pigment due to its stability and hiding power. However, it can degrade due to chemical reactions. Examples are the formation of lead sulphides, leading to discolouration or paint loss resulting from lead soaps.^{243, 244}

Next to lead white for changing a colour's tone, Delvaux also used zinc white. It is best observable in the bow: the brush strokes containing zinc complement the ones containing lead (Figure 56). Although titanium white grew increasingly popular in the 1930's, Paul did not use it for his Pink Bows.²⁴⁵ The titanium distribution in the Ma-XRF scan is equivalent to that of zinc. Paint manufacturers often added titanium to zinc to improve its properties.²⁴⁶

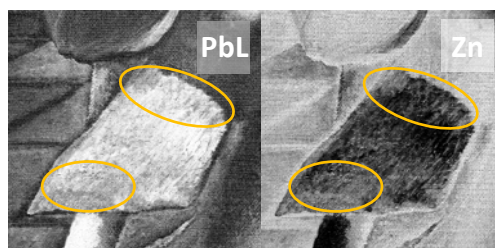


Figure 56: The distribution of Zn and Pb in the bow shows brush strokes.

4.1.6.4 Blues

Debra mentions that Delvaux started out with a limited palette, based on the one of fellow student and life-long friend Jules Payró. As a blue, the artist went for ultramarine. Under the influence of his students at La Cambre, Delvaux would modify his palette. Ultramarine was exchanged for cobalt blue, according to Debra “for it is lighter and more subtle”.²⁴⁷

In *The Pink Bows*, two different blues were used: ultramarine ($(\text{Na,Ca})_8(\text{AlSiO}_4)_6(\text{SO}_4,\text{S,Cl})_2$)²⁴⁸ and Prussian blue (umbrella term for hexacyanoferrate(II)-pigments).²⁴⁹ The SEM-EDX analysis shows ultramarine in the upper layer of the sky. Aluminium, silicium, sodium, sulphur and chloride were found in a spot analysis where a pigment grain is located (Figure 57). Most likely this ultramarine is of synthetic origin, because natural ultramarine was the most expensive blue pigment until 1826, when the synthetic alternative was invented.²⁵⁰

Nearly all the FTIR-analysed spots (exception: white and red from bow on the ground) give a signal for Prussian blue. Delvaux used this to mix a range of greys. In the sample from the sky, a blueish grey layer is present under the ultramarine one. This was a common technique to avoid using large amounts of this

²⁴¹ Gettens, Kühn, and Chase, 'Lead White', 77.

²⁴² Ibid., 67.

²⁴³ Eastaugh et al., *The Pigment Compendium: A Dictionary of Historical Pigments*, 195.

²⁴⁴ Casadio et al., *Metal Soaps in Art*, 10896.

²⁴⁵ Laver, 'Titanium Dioxide Whites', 303.

²⁴⁶ Kühn, 'Zinc White', 178.

²⁴⁷ Debra and Delvaux, *Wandelingen & Gesprekken Met Delvaux*, 194.

²⁴⁸ Ashok Roy, Editor. *Artists' Pigments*, 2:41.

²⁴⁹ Eastaugh et al., *The Pigment Compendium: A Dictionary of Historical Pigments*, 314.

²⁵⁰ Ashok Roy, Editor. *Artists' Pigments*, 2:55.

pigment.²⁵¹ In the mock-ups, it became clear this layering also leads to a deeper colour on top, in comparison to the absence of such a layer (cf. infra).

At the Talens archive, a tube of Prussian blue contained a mix of this iron pigment, but also ultramarine.²⁵² In the Prussian blue layer of the painting Na, Al, Si, and S were detected. Perhaps Delvaux used a tube with a mixture similar to that of Talens' Prussian blue, or he might have mixed some ultramarine in the paint himself. Another explanation could be these are merely impurities: The elements above were found in other Talens tubes like English red, sienna, red ochre, and yellow ochre.²⁵³

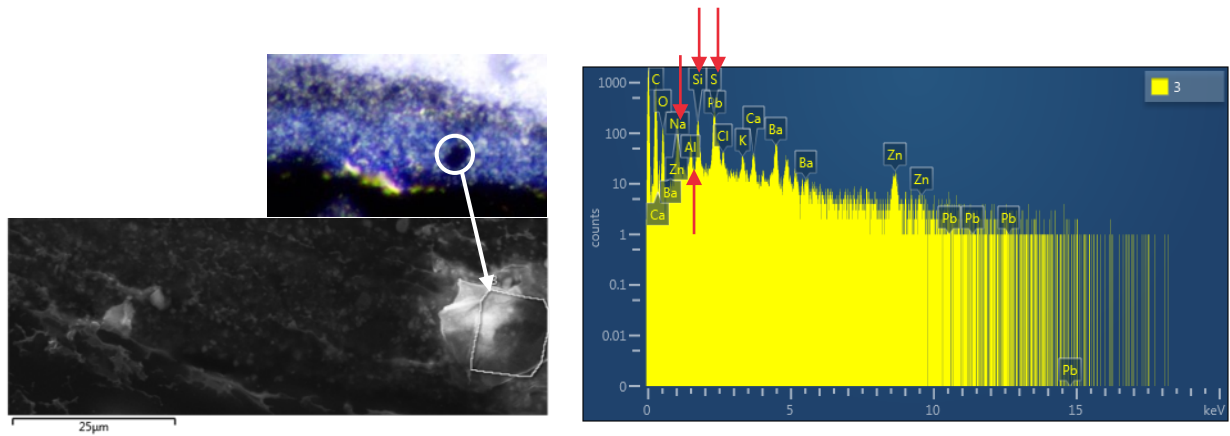


Figure 57: SEM-EDX results of the pigment particle ©Gert Nuyts

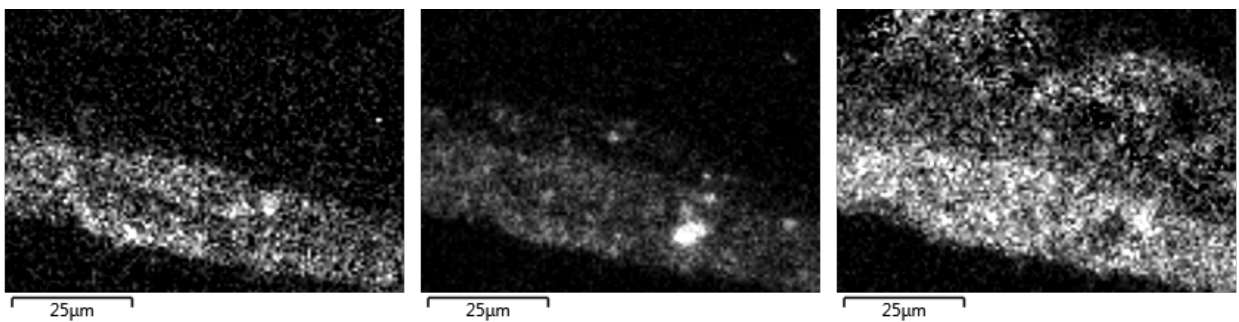


Figure 58: The main elemental maps for identifying ultramarine. ©Gert Nuyts, 2022

²⁵¹ Robbe, Preparation of mock-ups.

²⁵² Bayliss, '9382 - Pruisischblauw'.

²⁵³ LOIS Rijksdienst voor Cultureel Erfgoed, 'Research Object Result' object nrs. 9344, 9357, 9369, 9375, 9400.

4.1.6.5 Reds

According to Debra, Delvaux liked vermilion as a red paint.²⁵⁴ This pigment, with the chemical formula HgS, is certainly present in *The Pink Bows*. It was mainly used in the bodies of the female figures to get a flesh tone, as confirmed by both Ma-XRF and sample analysis. In the drapery of the small left figure thinner lines containing Hg are detected. They follow the shape of the folds but are overpainted completely with lead white.

Surprisingly, the bow of the front figure contains vermilion only in small parts according to the Ma-XRF scan. In the IRFC-picture (Figure 60), the bow shows a yellow to orange reflection, indicating Delvaux glazed it with a red lake to obtain its pink colour. A lake is dyestuff that is precipitated on a substrate or as an insoluble complex with certain metal salts, making it act like an organic pigment. The most common natural dye lakes used in paintings are madder (plant-based) and cochineal (insect-based), however, after the 1930's, synthetic variants became dominant.²⁵⁵

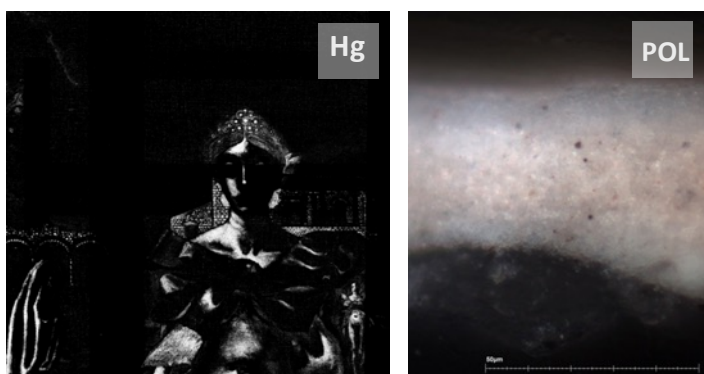


Figure 59: Left: Ma-XRF scan of mercury (Hg). © Nina Deleu, right: Sample C99.185 showing a light pink area with distinctive red particles. © Louise Deca

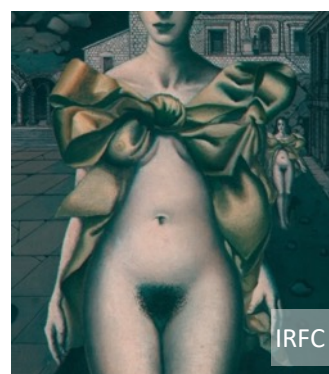


Figure 60: Detail of IRFC. The bow has a distinct yellow/orange fluorescence.

In the IRFC-image, the bow region shows up a pale yellow, with an orange tinge in the upper left corner (Figure 60). According to Cosentino's flowchart for multispectral imaging, these are indications for respectively alizarin (a red madder lake with a blueish tint)²⁵⁶ and carmine (cochineal).²⁵⁷ The presence of an anthraquinone-based pigment, which they both are, is confirmed by UVR. As a substrate, it is likely that barium sulfate (BaSO_4) was used, which is a common compound for creating lakes.²⁵⁸ The Raman spectra of the red areas show the stretching of SO_4 at 989 cm^{-1} (Appendix 15: μ -Raman spectra (532 nm)).²⁵⁹

Carmine lakes are very fugitive, while the lightfastness of alizarin lakes depends on its colourants (e.g., purpurin).^{260, 261} This characteristic might be visible in the painting (Figure 61). Although Delvaux mentioned that the two main bows differ in colour vibrancy (cf. supra), the difference is not obvious. Additionally, a grey underlayer seems to show through in multiple areas. In a black and white picture

²⁵⁴ Debra and Delvaux, *Wandeligen & Gesprekken Met Delvaux*, 31.

²⁵⁵ Schweppe and Roosen-Runge, 'Carmine', 264.

²⁵⁶ FitzHugh, *Artist's Pigments Vol 3*, 3:109.

²⁵⁷ Cosentino, 'Identification of Pigments by Multispectral Imaging; a Flowchart Method', 9.

²⁵⁸ Feller, 'Barium Sulfate - Natural and Synthetic', 47.

²⁵⁹ Buzgar, Buzatu, and Sanislav, 'The Raman Study of Certain Sulfates', 7.

²⁶⁰ Schweppe and Roosen-Runge, 'Carmine', 264.

²⁶¹ FitzHugh, *Artist's Pigments Vol 3*, 3:114.

from 1946, brushstrokes of this layer already seem to be present (Figure 62). However, the transparency of the lake might have increased over time, due to ageing, making the grey lay-in even more visible.²⁶²

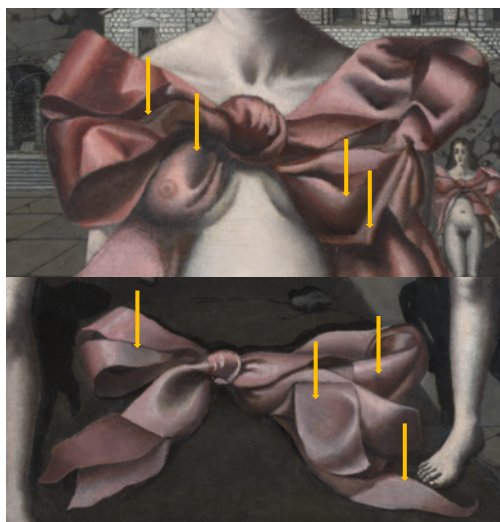


Figure 61: Detail of the bows, with indications of possibly faded red lake.

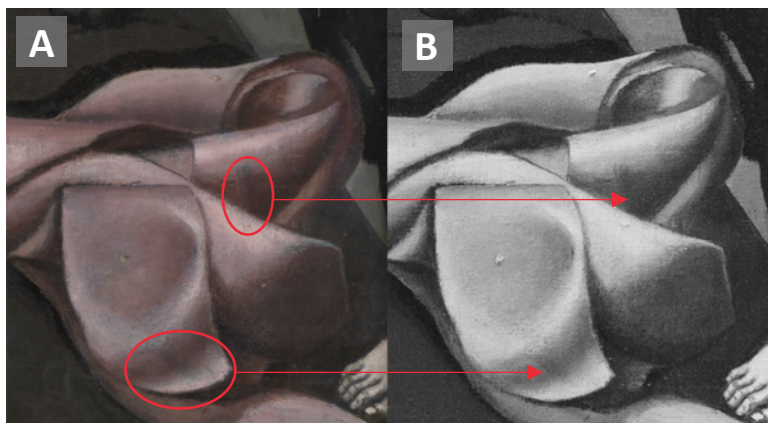


Figure 62: Indications that the red lake was originally very thinly applied. (A) is the current state, (B) is a detail from a picture taken in 1948 © KIK-IRPA, Brussels.

4.1.6.6 Yellows

The only yellow pigment that can be confirmed with certainty is cadmium yellow (CdS)²⁶³. It is present in a small part of the crown (see Appendix 11: Ma-XRF scans). Delvaux probably used yellow ochre ($\text{FeO}(\text{OH})$)²⁶⁴, mixed with lead white, for the other parts of the crown. This colour was a staple on his palette from early on.²⁶⁵ It is difficult to discern however, because the lead signal covers that of iron.

Yellow ochre is one of the most common iron oxides in soils and thus widely available. Furthermore, it is one of the earliest pigments used.²⁶⁶

A signal for antimony was detected in the hair portion, referring to the use of lead antimonate yellow (also known as Naples yellow, $\text{Pb}_2\text{Sb}_2\text{O}_7$)²⁶⁷. It is part of a pentiment, as there are no visible traces of the colour in the top paint layer. It was covered by a dark grey mixture that now forms a part of the mountain. In the hair, most brush strokes can be found under what we now see as dark brown. Naples yellow is an early invented pigment (from 16th-14th century B.C.) and was the only yellow pigment for a long time, before it was replaced with lead tin yellow. It has fallen in and out of favour of artists during art history. It was most popular in Europe from 1750 to 1850, after which chrome and cadmium colours were preferred.²⁶⁸

In Vandenaabeele's research, massicot (PbO)²⁶⁹ is mentioned as a yellow pigment. Massicot historically grew to refer to lead-tin yellow, which makes the terminology quite confusing. Lead-tin yellow occurs in

²⁶² Schweppe and Roosen-Runge, 'Carmine', 264.

²⁶³ Robert L. Feller, *Artists' Pigments: A Handbook of Their History and Characteristics*. Vol. 1, 1:65.

²⁶⁴ Eastaugh et al., *The Pigment Compendium: A Dictionary of Historical Pigments*, 407.

²⁶⁵ Debra and Delvaux, *Wandelingen & Gesprekken Met Delvaux*, 31.

²⁶⁶ Eastaugh et al., *The Pigment Compendium: A Dictionary of Historical Pigments*, 407.

²⁶⁷ Robert L. Feller, *Artists' Pigments: A Handbook of Their History and Characteristics*. Vol. 1, 1:219.

²⁶⁸ Ibid.

²⁶⁹ Eastaugh et al., *The Pigment Compendium: A Dictionary of Historical Pigments*, 262.

two variations, namely type I (Pb_2SnO_4) and type II (Pb_3O_4), of which the first is more commonly used.²⁷⁰ ²⁷¹ Ma-XRF shows a very weak signal for Sn, making it possible Delvaux painted with this pigment in the female's crown.

4.1.6.7 Blacks

The Pink Bows contains two black pigments, namely carbon black (amorphous carbon) and ivory black ($\text{C}+\text{Ca}_3(\text{PO}_4)_2$). Carbon black can be used to describe a number of blacks. A more specific term is lamp black and refers to how it is obtained. Different production processes exist since ancient times, but they more or less all come down to collecting soot after burning oils, resins or wood.²⁷² In modern times, lamp black is sourced from oils that are mainly comprised of aromatic hydrocarbons. These are burned in steel vessels, after which the off gas containing the carbon black, is collected.²⁷³

The pigment was identified by means of Raman in only one location, namely in the shadow of the right female. The dominant peaks for amorphous carbon are situated around the D- and G-peaks. The G-peak is characteristic for graphite materials and therefore also known as the graphite peak. It sits at 1582 cm^{-1} .²⁷⁴ The D-peak is present in materials with impurities or imperfections in the material, hence the D for disorder. This peak sits at 1350 cm^{-1} .²⁷⁵ The D- and G-bands in the spectrum of the black shadow are correspondent with their respective peaks at $\pm 1560 - 1600\text{ cm}^{-1}$ and $\pm 1250-1330\text{ cm}^{-1}$ (Appendix 15: μ -Raman spectra (532 nm)). Carbon black was also found in Vandenabeele's research.²⁷⁶

The predominant black in the painting is Ivory black. It is made by charring ivory. Despite its name is still in use, the modern pigment is made of animal bones due to ivory's scarcity and is therefore also called bone black.²⁷⁷ After firing the material, the collagen forms a black coke on hydroxylapatite ($\text{Ca}_5(\text{PO}_4)_3(\text{OH})$).²⁷⁸ The ultimate pigment contains $\pm 10\%$ carbon and 90% calcium-based material (84% calcium phosphate and 6% calcium carbonate).²⁷⁹ The abundance of calcium helps in identifying this black by means of

Ma-XRF. It was identified with FTIR in the shadows of the left and central figures, the central dark pavement with rocks, and in the signature (Appendix 14: FTIR Spectra). Moreover, the calcium distribution in the Ma-XRF scan corresponds with the areas where black is visible or expected (e.g., grey, or dark shadows), suggesting a bone black lay-in (Figure 63).

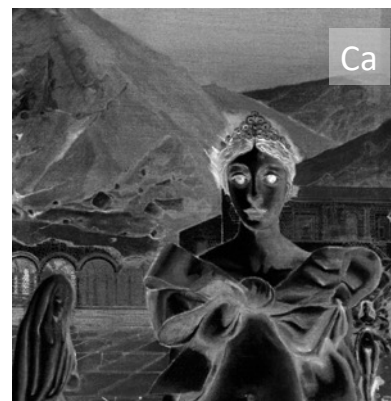


Figure 63: Suggestion of a monochrome lay-in layer with ivory black. © Nina Deleu

²⁷⁰ Ibid.

²⁷¹ Science and Art Initiative, 'Lead-Tin Yellow - Artificial Inorganic Pigment'.

²⁷² Eastaugh et al., *The Pigment Compendium: A Dictionary of Historical Pigments*, 222.

²⁷³ Buxbaum and Pfaff, *Industrial Inorganic Pigments*, 168–75.

²⁷⁴ Hodkiewicz, 'Characterizing Carbon Materials with Raman Spectroscopy', 2.

²⁷⁵ Marton et al., 'Raman Spectroscopy of Amorphous Carbon Prepared by Pulsed Arc Discharge in Various Gas Mixtures', 1.

²⁷⁶ Vandenabeele et al., 'Evaluation of a Principal Components-Based Searching Algorithm for Raman Spectroscopic Identification of Organic Pigments in 20th Century Artwork', 532.

²⁷⁷ Lipscher, 'Ivory Black - Natural Organic Pigment Known since Prehistoric Times'.

²⁷⁸ Eastaugh et al., *The Pigment Compendium: A Dictionary of Historical Pigments*, 90.

²⁷⁹ Douma, 'Bone Black'.

4.1.6.8 Browns and earth colours

A lot of pigments to make a brown colour are iron based of which sienna, umber and red earth are among the most common. This makes it hard to distinguish them, purely by analysing the elements, and even more so when colours are mixed. The only giveaway for the pigments stated above, is the presence or absence of manganese (Mn).²⁸⁰ Other features need to be identified by visual observation or other descriptive research methods. In the case of Delvaux, Debra describes his palette without mentioning a brown colour, except for English red.²⁸¹ Talens calls their colour 339 this in Dutch (*Engelsrood*), but translates it to Iron Oxide Light in English.²⁸² This translation refers less ambiguously to its contents, namely PR101 (Pigment Red 101 or synthetic iron oxide red).²⁸³ A tube of this colour is visible in the documentary *Paul Delvaux: The Sleepwalker of Saint Idesbald* (Appendix 13: Identification of Talens paint tubes). While some of the Fe-containing regions in the painting appear to be a reddish-brown colour and lack manganese, it is possible he used this colour. However, as there is a plethora of iron-based pigments, this cannot be said with certainty.



Figure 64: Ma-XRF scans of Fe and Mn. © Nina Deleu

Despite a difficult identification, the presence of umber or sienna is very likely. The Ma-XRF scans of Fe and Mn show equal distributions in several locations (Figure 64). Based on visual observation, raw umber is a reasonable interpretation, because this mountain appears darker than those in front of it. The use of the pigment is in its name, namely *shadow* (derived from the Latin *ombra*) and thus for creating shadow colours. In the hair and large mountain on the left, burnt sienna or burnt umber could have been used. These are more reddish-brown colours, as opposed to the yellow tone and greenish tone of their respective raw counterparts (Figure 65).

Noteworthy is the presence of barium in some of the Fe-pigments (Appendix 11: Ma-XRF scans). Probably this was added by the manufacturer as a filler or drying agent. Furthermore, the Ma-XRF scans show that the hair was supposed to be larger or in a bun, which is now partly covered by a dark colour.

²⁸⁰ Eastaugh et al., *The Pigment Compendium: A Dictionary of Historical Pigments*, 383.

²⁸¹ Debra and Delvaux, *Wandelingen & Gesprekken Met Delvaux*, 31.

²⁸² Royal Talens, 'Olieverf Tube 15 ml Engelsrood'.

²⁸³ Myers, 'The Color of Art Pigment Database: Pigment Red, PR'.

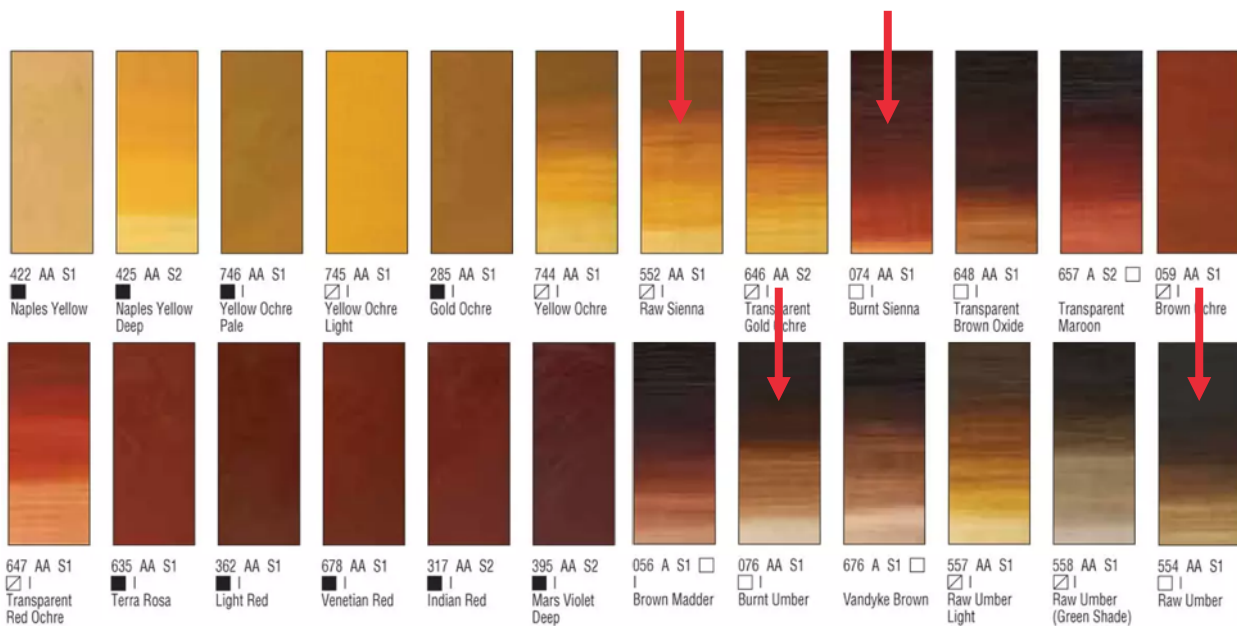


Figure 65: Detail from a Winsor & Newton colour chart for oil paints. Most of these colours contain iron. © Winsor & Newton

4.1.7 Varnish

The varnish situation will be explained starting from the top layer and working its way down into the painting. Three different varnish applications have been found. As stated in the context (Paragraph 4.2 *It's complexity*), the following terminology will be used in this paragraph: (*Top*) varnish for the top layer, *intermediate (transparent) layer* for varnish between paint layers, and *oil layer* for locally applied varnish.

The top varnish was removed during treatment, as it was considered non-original. Before the intervention, samples were taken for analysis. Their stratigraphy was investigated by microscopic observation (both in visible and UV-light). Through GC/MS the materials were characterised. The full report can be found in *Appendix 12: Report Sample Analysis*). Optical coherence tomography was used to determine the stratigraphy in a non-invasive manner.

It was not always possible to identify the materials of the layers separately. Only the materials of one of the layers in the top varnish could be characterised with certainty, suggesting an oil-colophony varnish. The analysis did not yield results on the nature of the intermediate and oil layers.

The impact of varnish and oils on paint will be explored in the next paragraph.

4.1.7.1 Top varnish

In Figure 66, the painting is shown in its condition before treatment. It has a dulled and yellow appearance, contrasting Delvaux's palette which was known to consist of cool colours (cf. supra). The UIVFP-image highlights its highly irregular application, mainly at the top of the painting.



Figure 66: The Pink Bows before restoration, with the presence of a highly oxidised varnish layer. © Rik Klein Gotink

The preliminary research by the conservator already concluded the varnish was applied some time after the artwork's completion, as the material was found on lifted cracks. These cracks appear due to interactions between the paintings' layers or under the influence of environmental conditions and thus take time to form.²⁸⁴ When cracks are left untreated and remain under unstable environmental conditions, the edges of the crack start to lift from its surface. The accumulation of varnish on these lifted edges suggested they were already present at the time of varnishing.²⁸⁵ A counter-indication for originality could be the regeneration of varnish, commonly practiced in (historical) restorations for treating blanched varnish.²⁸⁶ Blanching obscured the view of an artwork due to moisture that found its way through the layer's micro-cracks. Using alcohol vapours, the varnish liquified, restoring its translucency. The KMSKA used to exercise this treatment in the studio.²⁸⁷ However, microscopical analysis contradicts the hypothesis of a regenerated varnish.

The sample from the sky shows two varnish layers on top of the paint, with a thin deposition layer of dirt in between (Figure 67, 3-5). On top of the varnish, a thin, intermittent organic layer was observed by the KIK.²⁸⁸ The layer immediately on top of the paint layer was only found in the samples of the sky, not in the carnations, which potentially implies this is an oil layer (cf. infra), rather than a varnish. This layer could not be characterised.

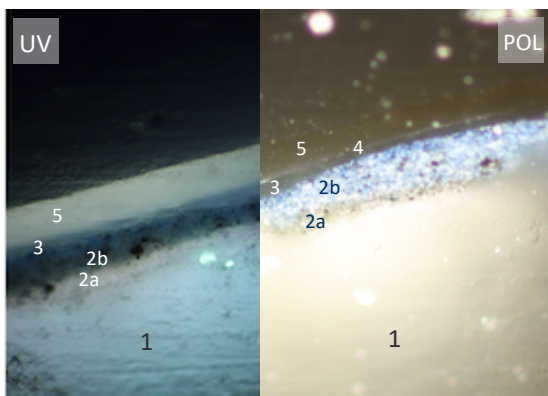


Figure 67: Sample 2850.01, x200 © Beatriz Lorente, Paula Aleixandre

1. Ground
- 2a. Grey paint layer
- 2b. Blue paint layer
3. Organic layer
4. Dirt
5. Varnish

²⁸⁴ Bucklow, 'The Classification of Craquelure Patterns', 286.

²⁸⁵ Beatriz Lorente, 'Treatment Report', 6.

²⁸⁶ Bierings, 'Spoorloos vernist? De ontwikkeling van een analysemodel voor onderzoek naar de originaliteit van schilderijvernissen met een toepassing op zeven schilderijen van George Hendrik Breitner in de collectie van het Rijksmuseum Amsterdam.', 39.

²⁸⁷ Van den Berg, *Analysis of Diterpenoid Resins and Polymers in Paint Media and Varnishes. with an Atlas of Mass Spectra.*, 12.

²⁸⁸ Decq, '2021.14659 - Paul Delvaux - De Roze Strikken', 5.

The GC/MS-analysis showed the presence of a drying oil (linseed) and a pine resin (colophony) in both sample locations. In one of the carnation samples, additionally a mixture of beeswax and candelilla wax was detected, with possibly a small amount of paraffine wax. No consistent synthetic layer could be identified, despite indicators for synthetic resins (ketone). These are hypothesised to be residues or contaminants of e.g., restoration products.²⁸⁹

Oil-resin varnishes were among the earliest encountered and widely applied. They provided a highly glossy protective coating to an artwork.²⁹⁰ Resins are balsam-like exudations of pine trees (*Pinaceae* family), referred to as common turpentine, and are modified according to their application. In the case of colophony (rosin), the material is obtained through heating the resin.²⁹¹ Afterwards, it is dissolved in hot oil, turning it into a varnish.²⁹² Linseed oil is made by pressing dried seeds from the flax plant (*Linum usitatissimum*). Thanks to its fatty acids it oxidates easily, acting as a dryer in mixtures.²⁹³

As exemplified by *The Pink Bows*, oil-colophony resins are known to be brittle (because of its small molecular size) and prone to yellowing due to oxidation.²⁹⁴ However, due to the low price of colophony, it was often used in favour of other varnishes or to modify more expensive ones.²⁹⁵

It is unclear who added the varnish to this painting. No treatment reports indicating such an intervention were found. However, in earlier times, reports with detailed information on what was done and with what materials were not always provided, unlike recent practice. In the history of the KMSKA, the *Benders* were a well-known restorers family, employed for taking care of its collection. While they often failed to document their interventions, an article from 1948 on painting restoration was found in the archives of the museum. In it, the use of oil-containing varnishes was highly *discouraged*.²⁹⁶ However, the Benders were also known to frequently experiment²⁹⁷, so it remains unclear whether they were the ones varnishing Delvaux's painting. As stated in the previous paragraph, it cannot be ruled out the painting was varnished elsewhere in preparation for an exhibition.

For the treatment, the presence of the dirt layer proved beneficial. It allowed the conservators to remove the varnish in stages, maintaining maximum control on the preservation of the oil layers.²⁹⁸

After varnish removal and surface cleaning, the paint layer was re-saturated with a synthetic resin (Laropal A81), which was also used as a final varnish layer after the complete treatment. A new UIVF-photograph was taken to document the after-stage (see Appendix 9: UIVFP). This photo shows the original transparent layers on top of the paint better since the fluorescence is not disturbed by the oil-colophony varnish.

²⁸⁹ *Ibid.*, 5–7.

²⁹⁰ Townsend and Phenix, 'A Brief Survey of Historical Varnishes', 254.

²⁹¹ Horie, *Materials for Conservation. Organic Consolidants, Adhesives and Coatings*, 256.

²⁹² Townsend and Phenix, 'A Brief Survey of Historical Varnishes', 255.

²⁹³ Woodfield and Harwood, 'Oilseed Crops: Linseed, Rapeseed, Soybean, and Sunflower', 34.

²⁹⁴ Horie, *Materials for Conservation. Organic Consolidants, Adhesives and Coatings*, 248.

²⁹⁵ Van den Berg, *Analysis of Diterpenoid Resins and Polymers in Paint Media and Varnishes. with an Atlas of Mass Spectra.*, 13.

²⁹⁶ Bender, *Het herstellen van schilderijen*.

²⁹⁷ Borms, Personal communication.

²⁹⁸ Beatriz Lorente, 'Treatment Report', 6.

4.1.7.2 Intermediate varnishes

Several locations of the painting were analysed by OCT to determine the presence of transparent layers. Where the painting showed a significant saturation of varnish, multiple such layers were expected. Additionally, the application manner of varnish in the central female's hair was of interest, as it followed its shape. Additionally, the letters in the signature were analysed.

In the hair, at least three transparent layers could be identified. Combined with the Ma-XRF scans (cf. supra), this suggests a change in composition. Figure 68 shows the measuring location and the tomogram, enlarged for clarity. This tomogram is like a sample cross-section, in which the green/blue lines are opaque layers. The one underneath is the first paint layer on the canvas. It follows the weave pattern of the canvas, hence its mountain-like shape. The black hollow spaces between the opaque lines indicate transparent layers.

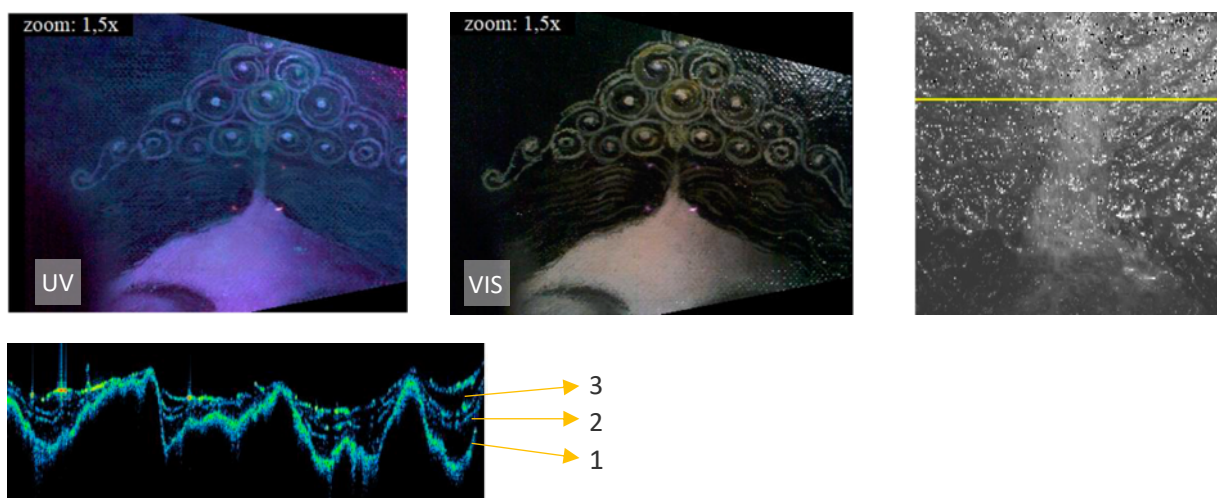


Figure 68: Top: The location of measurement. Bottom: Preliminary tomogram, showing multiple transparent layers. © Magda Iwanicka and Piotr Targowski

The presence of transparent areas in the tomogram of the signature (Figure 69) is noteworthy. This could lead to believe the signature was applied on top of a varnish or oil layer. In some tomograms a faint opaque layer is visible. This might represent surface dirt. That would mean Delvaux did not sign this work immediately after completion.

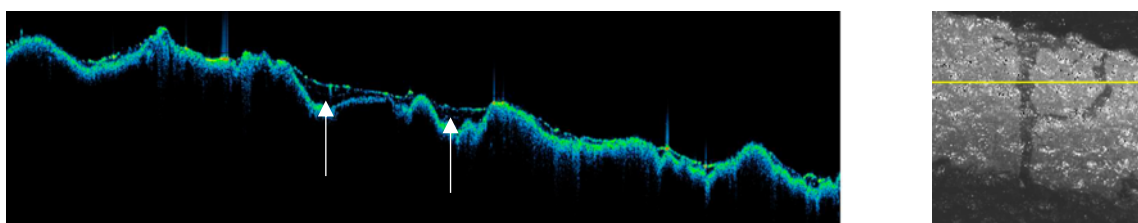


Figure 69: Tomogram of the P in the signature and the measuring location. © Magda Iwanicka and Piotr Targowski

The presence of an intermediate varnish is also observable in the sample from the carnation (C99.186). It is 1-5 μm thick, approximately 5 to 8 times less than the paint layers surrounding it. Under UV-light, the varnish fluoresces brightly (see Appendix 12: Report Sample Analysis, p 16).

4.1.7.3 Oil layers

Even before restoration, a number of drippings or islands of a semi-transparent or browned substance were observable. Others are now visible under UV-light. While the nature of these layers was not characterised, several factors indicate they are oil layers. As stated before, colours like earths, blacks, and Prussian blue are known to sink in, so artists often saturate them with oil to even out the gloss in a painting. In *The Pink Bows*, mainly these kinds of colours are the ones with an oil-like layer on top. This observation was also made by Karen Bonne during the conservation treatment of Delvaux's *Night Train Station II* from 1963 (collection *National Company of Belgian Railways*). She was able to identify the material as a slow-drying (linseed) oil.²⁹⁹

The discolouration of the oil in some areas make the islands and drippings on *The Pink Bows* quite prominent. Despite this, the conservators opted to preserve them, and thus retaining the original materiality of the painting.

4.1.8 Frame

The Pink Bows is bordered by a simple frame (Figure 70, left). It consists of four wooden beams which were painted white at the front and black at the sides. The paint was quite thickly applied, and brush strokes are clearly visible (Figure 70, right). There is no distinct joining system keeping the beams together. During the conservation treatment a new framing system was added because the lack of a rebate or grooves in the beams made it difficult attaching the painting securely to the frame.³⁰⁰



Figure 70: Left: *The Pink Bows* in its frame on view in the KMSKA, after restoration. Right: Close up of the right corner (backside).

Several different types of sources indicate that this frame is original. The first one is the frame itself. It fits just around the painting, suggesting it was purposely made for it.³⁰¹ Moreover, several photos of different paintings exist, showing the same kind of framing. *The Women of The Night*, closest in execution to the painting in question, was displayed in a similar frame at a 1937 exposition in London

²⁹⁹ Iwanicka, 'Paul Delvaux, *The Pink Bows*. OCT – Preliminary Results', 12.

³⁰⁰ Koninklijk Museum voor Schone Kunsten Antwerpen, 'Korte Beschrijving Inv 2850 Paul Delvaux', 2.

³⁰¹ Koninklijk Museum voor Schone Kunsten Antwerpen, 'Korte Beschrijving Inv 2850 Paul Delvaux', 2.

(Figure 71, left). In a picture from an exhibition in 1984, we can see *The Pink Bows* in its frame, but also a couple of other paintings in similar frames (Figure 71, right).



Figure 71: Left: *The Women of the Night* pictured in a similar frame at the expo Young Belgian Artists in the London Gallery (1937). E.L.T. Mesens is pictured next to the painting. © Caterina Caputo. Right: *Princess Hanako of Hitachi* at a Delvaux exhibition in Tokyo, Japan. *The Pink Bows* is in the corner of the room. © The Asahi Shimbun via Getty Images

An interesting source is the account of Delvaux on how he had to provide for the framing himself, for an exhibition in Brussels in December 1945. It was a retrospective showing 90 of his artworks. As he only sold one painting during the German occupation, he had no money to outsource this job. Hence, he and his friend Giron worked several days to make the frames. They ordered rough timber per running meter and sawed them rectangular, using a mitre box. Then, the beams were gathered around the paintings. It was only after that they applied a paint layer to them. Some, they decorated with a layer of gold: “So for several days they stood with a brush in one hand and a pot of gilt in the other, carefully fiddling with it to avoid touching the painting.” (Debra, own translation).³⁰² A picture by Lee Miller shows the artist behind a painting framed this way, possibly in preparation for the above exhibition (Figure 72).



Figure 72: Miller took this picture in 1944 in Brussels. © Lee Miller Archives, England 2016.

³⁰² Debra and Delvaux, *Wandeligen & Gesprekken Met Delvaux*, 126.

4.2 Techniques and working process of the artist

After explaining the build-up and materials of *The Pink Bows*, it is interesting to say something about *how* it came to exist. Some suggestions were already made in the previous section, but this paragraph offers an elaboration on Delvaux's practice. This helps to further contextualise the painting and offers possibilities for further research, e.g., the investigation of an evolution in the artist's practice by comparing the working process of paintings in different stages of his career.

The main working tools for this painting were brushes, for both the application of paint and oil layers. Examples of brushes were found on display in the Delvaux Museum, indicating the several sizes and shapes he preferred. Some of these characteristics could be linked to the painting. In *The Pink Bows*, round brushes of various sizes were a staple in the artist's tool kit.

As for the technique, a classical approach can be determined. Some areas are built up in layers which have had time to dry in between. Other areas were worked wet-in-wet, mainly to provide shapes with smooth edges. Video footage shows Delvaux painting in a calmly, deliberate manner, which is represented through his painting. No extravagantly placed brush strokes can be found. Every stroke seems to be well thought out.

This section is concluded by an experiment to test out the impact of varnish and oil layers on the appearance of colours. It shows that Delvaux probably did not want a highly glossy surface, but rather an overall even sheen. To obtain this, he extensively saturated the paint layers with an oil-like substance.

4.2.1 Working tools

In the Delvaux Museum, a tin can is on display, holding Delvaux's paint brushes (Figure 73). Although they are so intensively used that of some brushes almost all hairs are withered, we can distinguish the different shapes: round, flat, and filbert. Sizes of brushes that were readable, range from 6 to 16, although much smaller brushes could be observed. The only identifiable brand is the French Isabey, to this day considered to be of high quality. The hairs on one of the tools is marked sable, known for its *holding* capacity, meaning it retains a large amount of fluid, letting the paint flow easily on the surface.³⁰³

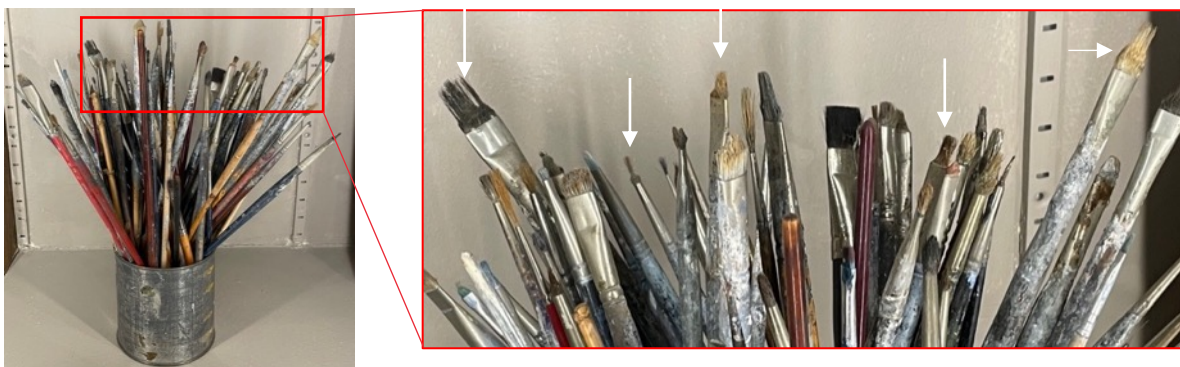


Figure 73: The tin jar with Delvaux's brushes, enlarged on the light. Some of the withered brushes are highlighted.

³⁰³ Rosemary & Co Artist's Brushes, 'Frequently Asked Questions'.

In *The Pink Bows*, the different brush sizes are found. For the larger blocks of colour, Delvaux used a wider brush, while the details he added by small, round brushes (Figure 74, left). In the bow, he used a similar small brush to create a gradient from dark to light pink (Figure 74, centre). In the body of the females, strokes from a flat brush can be distinguished (Figure 74, right).



Figure 74: Details of brush strokes, taken through the stereomicroscope.

Other tools used are a ruler and pencil, to map out the edges of the lines. This was also encountered in *The Night Station II*.³⁰⁴ In some locations of *The Pink Bows*, they were attempted to be erased. It is not clear whether this was done by a brush or a fingertip. In video footage, Delvaux can be seen touching paint layers with his fingers.³⁰⁵

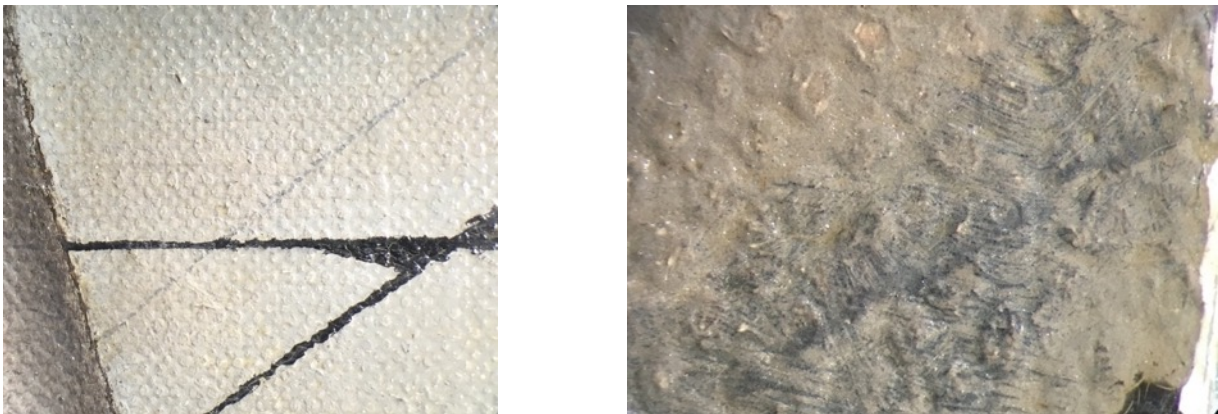


Figure 75: Stereomicroscopic view on the pencil lines. On the right is showed an attempt to erase it.

Delvaux was known to collect objects to model his compositions after. The Delvaux Museum has some objects on show which he used as inspiration for antiquity-inspired scenes, like small busts and scale buildings. Other objects include a cast of a hand, various lamps, and skeletons. Pictures of his studio show that he owned an extensive series of skulls.

The building on the right of the painting looks like a combination of two scale models on display in the museum. Mainly the tiles on the roof of the Parthenon's reconstruction are remarkably similar (Figure 76).



Figure 76: Scale reconstruction of the Parthenon, owned by Delvaux.

³⁰⁴ Iwanicka, 'Paul Delvaux, The Pink Bows. OCT – Preliminary Results', 5.

³⁰⁵ Paul Delvaux. *The Sleepwalker of Saint-Idesbald*.

4.2.2 Painting technique

There is little spontaneity to be found in Delvaux's works, despite his change of mind in composition sometimes. A catalogue entry for an auction in 2016 explains that "(...) Delvaux used an almost inscrutable painting style in order that the brushwork would not distract the viewer from the contents of his pictures," and quotes the artist saying "Painting is not only the pleasure of putting colours on a canvas, (...) It is also the expression of a poetic feeling... What interests me is plastic expression, the rediscovery of poetry in painting, which had been lost for centuries".³⁰⁶ *The Pink Bows* is an example of such a well-thought out, carefully executed artwork.

It mainly shows the use of dry paint, containing little oil. This is evident in parts like the female figures, where the structure of the canvas shines through. It might explain the extensive oil layers for evening out the overall gloss.

In areas like the sky, the paint was built up in layers. In other words, a paint layer was left to dry before proceeding with a new layer. These are mostly quite thin and cautiously added. An example can be found in how the brick walls were created (Figure 77). First, the grey layer was painted, after which the bricks were outlined with thick black lines. They were finished with light grey to white patches. These are so carefully applied, they barely touch the black borders, only overlapping them in a few spots. In this example, we can also see the flesh tone of the female was added on top of the grey paint, wet-on-dry. The black lines are details that were added later: They have a distinct end point, approximately 1mm from the shape of the neck. Another wet-on-dry example can be found in the stairs of the left-hand building. Similarly, the grey paint acts as a base. On top of this, alternating lines of white and black were painted (Figure 78).



Figure 77: Stereomicroscopic image showing the build-up of the brick wall.

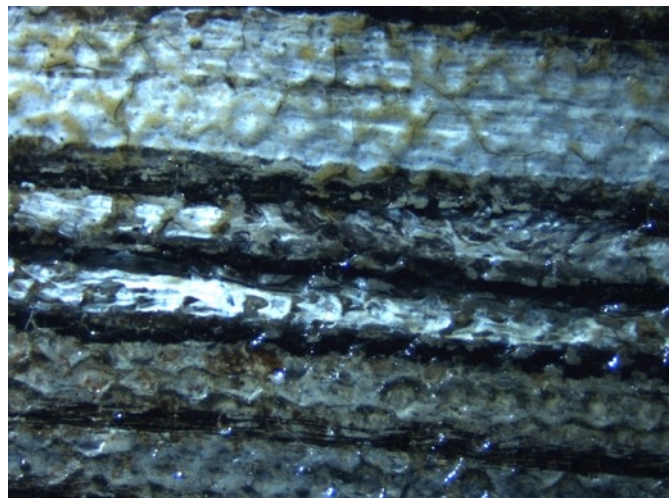


Figure 78: Stereomicroscopic image of the staircase.

³⁰⁶ '20th Century & Contemporary Art Evening Sale. London Auction 9 February 2016 7pm'.

We can clearly see a wet-in-wet technique too. Delvaux applied this for mixing colours or to soften the edges of shapes. The latter is exemplified in the carnation sample (Figure 79).

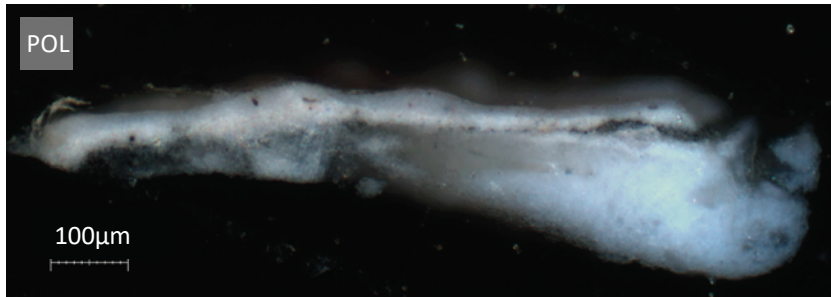


Figure 79: Carnation sample (C99.186), x500. White and grey paint are mixed wet-in-wet © Louise Decq, KIK-IRPA, 2021

While most layers are either thin or very homogeneously distributed, sometimes we can observe thick paint splotches, called impastos. They vary a lot in relief, making them susceptible for accumulating dirt, or in this case, varnish (Figure 80). The picture also shows ageing cracks, suggesting the paint layer was unable to adjust to interactions with other paint layers or environmental conditions after it dried.

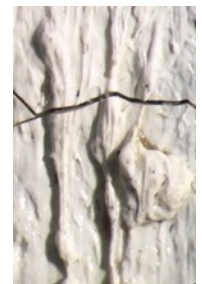


Figure 80: Detail of an impasto in the left female figure.

The fact that the paint is raised like this, substantiates the use of dry paint. It looks *dragged* instead of flowy. The latter would let the paint sink in more as well, creating less distinguished edges.

In *Entretien avec Paul Delvaux*³⁰⁷ and *The Sleepwalker of Saint Idesbald*, we can see the artist at work (Figure 81). As stated in literature, he hums while carefully applying paint to an artwork. He holds several brushes at the same time, so he can easily switch to the one he likes. Surprisingly, he is seen painting with his right hand, while all other activities, like drinking from a glass, is done by left hand. This is probably the result of his education. Until the 1960's, when pen and ink was in use, school children were taught to write with their right hand, despite being left-handed. With the left hand, the pen would be pushed into the paper, making it harder to write.³⁰⁸



Figure 81: Stills from *Entretien avec Paul Delvaux* (left and centre), and Paul Delvaux: *The Sleepwalker of Saint Idesbald* (right). © RTBF, Adrian Maben

³⁰⁷ 'Entretien avec Paul Delvaux'.

³⁰⁸ Leijssen, 'Hoe Het Was in de Klas... Herinneringen Komen Boven.'

4.2.3 Oiling out

4.2.3.1 Application

The sky contains a lot of islands of a variety in size. It looks like a brush (or other tool) containing a large amount of oil was stroked at the top, after which the oil found its way down. This is suggested by the distinct borders, which indicate an accumulation of the substance. A similar accumulation was formed at the borders of the mountain, highlighting the layering of the painting: the mountains were painted on top of the sky and therefore appear slightly higher. In one location the weight of the oil let it extend over the mountain, creating a distinct dripping (Figure 82).

Other traces of how the oil layer was applied, is also present in other areas (Figure 83). Between the front figure and the one on her right, the substance is clearly applied with a large brush like a spalter. In the case of the female, it appears as if Delvaux deliberately went over the dark shadows of her body. The oil forms a sharp edge, following her shape. It is unclear if the oil extends over her whole body, or if they are contained to the dark areas. Notably, a dark area in the leg seems unsaturated. Perhaps this was painted over the oil layer.

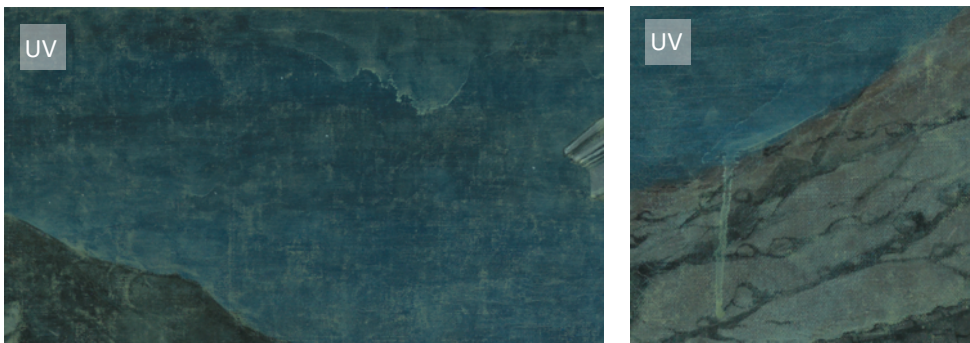


Figure 82: Left: Close-up of the island in the sky (top right of the painting). Right: Dripping

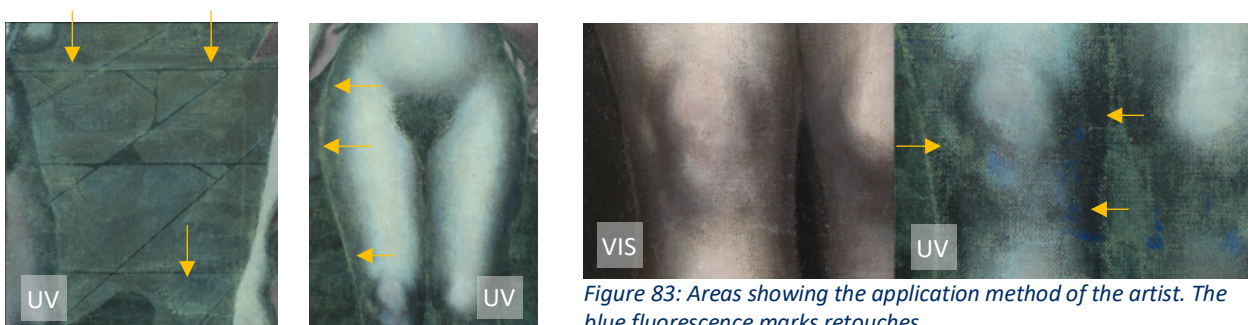


Figure 83: Areas showing the application method of the artist. The blue fluorescence marks retouches.

Edges of oil are also visible around the arm of the female on the right. While the application is not constrained to the painted shape, it clearly follows its outline (Figure 84). In the bow of the centre female, an oil island in the corner is distinguishable, next to softer applied oil layers more below (Figure 85).



Figure 84: Oil layer around the arm of the female on the right.

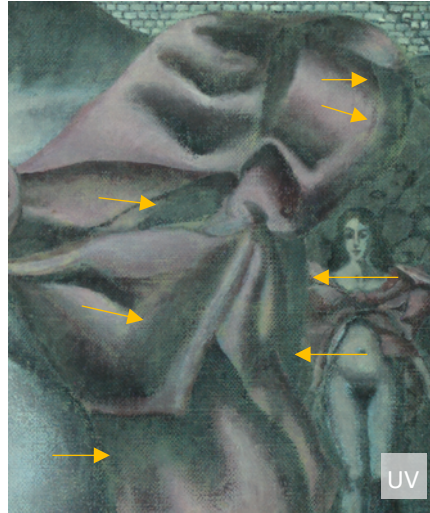


Figure 85: Oil layers in the bow of the centre female.

Delvaux practiced the technique of oiling throughout his career. Several works in the Delvaux Museum clearly show areas with a higher gloss or drippings. A selection is presented in Figure 86. Additionally, another work by him in the KMSKA's collection, *Ecce Homo* (1957, inv. 2877), showed similar occurrences under UV-light (Figure 87).

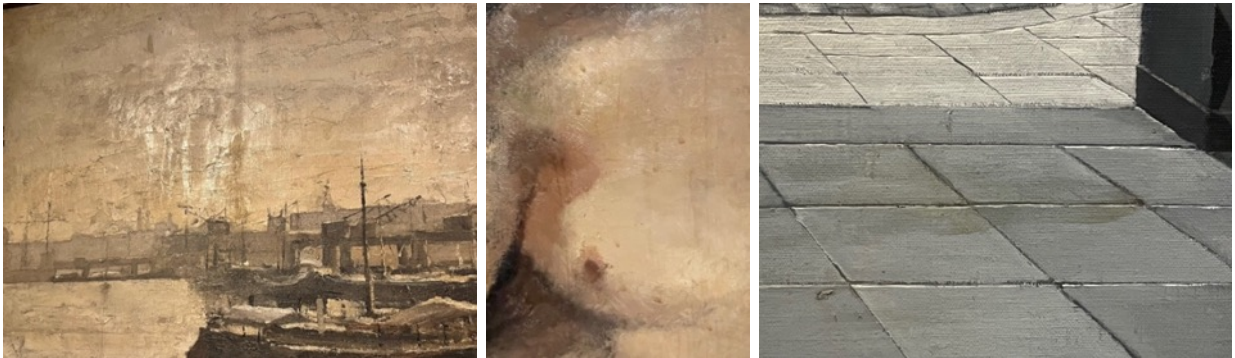


Figure 86: Paintings in the Delvaux Museum. From left to right: Brussels' Harbour, 1922, The Model, ca. 1924, The Dawn, 1944.

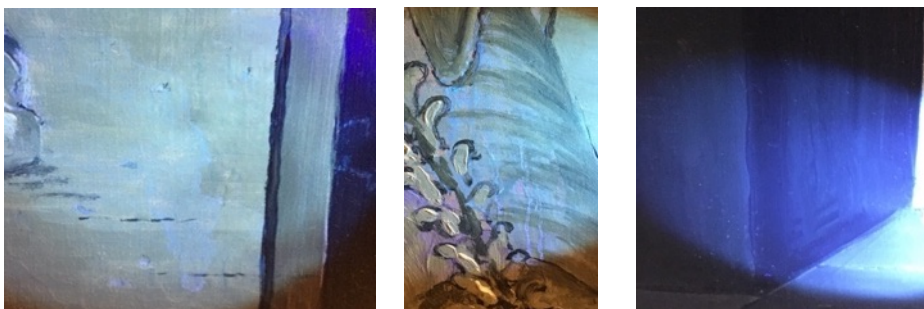


Figure 87: Paul Delvaux, *Ecce Homo*, 1957, inv. 2877: Details in UV-light, showing drippings and brush strokes.

4.2.3.1 Effect on colours

The sinking in of colours has already been mentioned several times in this paper, rendering certain colours more matte than others. This happens when the binder is being absorbed by the layers underneath. The effect is related to the pigment-binder ratio, which can be influenced by the artist, by adding oil or thinning the paint with solvent. Some pigments are more prone to sinking in, an effect related to their Pigment Volume Concentration (PVC) and Critical Pigment Volume Concentration (CPVC). PVC is the percentage of pigment in a paint layer that is left after it has fully dried. CPVC stands for the optimal ratio of oil to binder, so that the pigment is fully surrounded with binder, without air pockets in between. When the CPVC is reached, the paint film has the most optimal characteristics.³⁰⁹ A too high content of pigment (ratio beyond CPVC) causes a more matte appearance, since the development of air pockets between the pigment particles allow the light to scatter more.³¹⁰ Figure 88 visualises the concept of the PVC in relation to CPVC and the effect on changing the pigment-binder ratios.

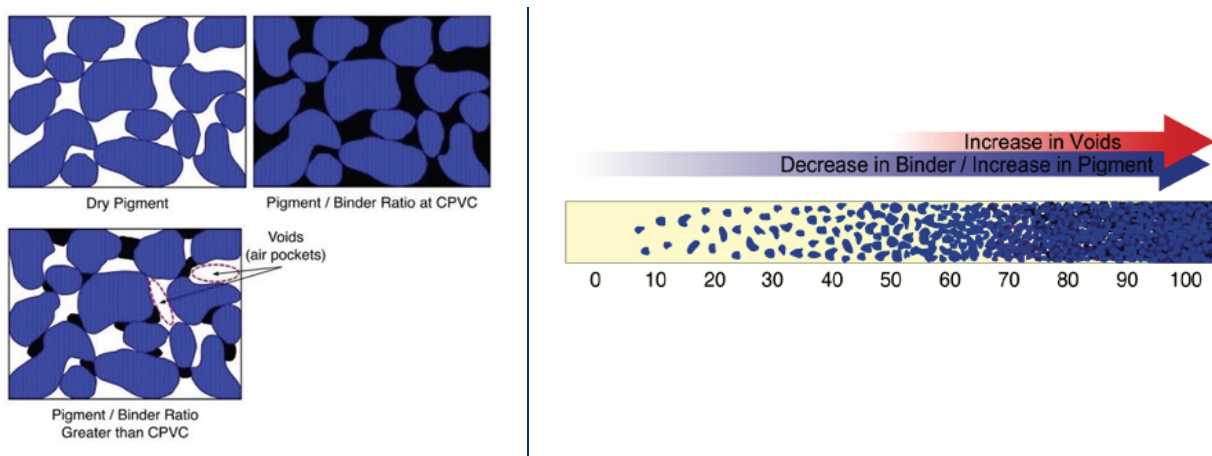


Figure 88: On the left, the relationship between binder and pigment is shown. On the right, the effect is shown when the PVC-ratio is increased. © Golden Artist Colors, Inc, 2016

By oiling out, the air pockets in the paint layer can be filled, allowing the light to be absorbed and creating a more saturated appearance.

To gain better insight in the effect of oiling out and to differentiate it from varnishing, mock-ups were made with colours present in *The Pink Bows*. Full details on their preparation can be found in chapter 2 (4 Mock-ups). In the next paragraphs, the results will be discussed. Not only their visual appearance will be explored, but a comparison will be made with the theoretical CPVC of the pigments³¹¹, listed in Table V. The following formula was used to determine the CPVC³¹²:

$$CPVC = \frac{1}{1 + \frac{(AO \text{ pigment})(\rho \text{ pigment})}{\rho \text{ linseed oil}}}$$

OA = Oil Absorption value

ρ = density

ρ linseed oil = 93,5

³⁰⁹ Yebra and Weinell, '13 - Key Issues in the Formulation of Marine Antifouling Paints', 316.

³¹⁰ Sands, 'Pigment Volume Concentration and Its Role in Color', 2.

³¹¹ The CPVC can be influenced by additives or fillers and can therefore differ between brands. Here the OA and density have been determined from Kremer Pigmente and Natural Pigments

³¹² Abbott, 'Critical Pigment Volume Concentration, CPVC'.

Table VI: CPVC of the pigments used in the mock-ups

COLOUR NAME	PIGMENT	OIL ABSORPTION VALUE (g/100g)	Density ρ (g/ml)	CPVC (%)	
Prussian Blue	PB27	45	1,8	54	
Ultramarine Blue	PB29	35	2,35	53	
Light Oxide Red	PR101	28	5,00	40	
Raw Umber	PY42	65	4,00	26	38
	PR101	28	5,00	40	
	PBk11	21	4,60	49	
Ivory Black	PBk9	35	2,52	51	52
	PB29	35	2,35	53	

Before applying the transparent layers, the gloss of the colours was assessed (Appendix 17: Saturation assessment on the mock-ups before coating). Areas with gloss are defined as *there where a reflection of light is visible*.

The different supports had a distinct impact. Apart from black, all the colours decreased in gloss in the mock-up 2, with the more open weave and more absorbent ground. There was also a difference due to the application. Where the paint was thickly applied, the colour retained its saturation better. The only exception is ultramarine, which was matte in both cases.

Only one colour had an overall, even saturation upon drying, namely light oxide red. Upon application from the tube, it was already apparent it was the smoothest paint. It also has the lowest CPVC (when considering single pigments).

Notably, the Prussian blue underlayer absorbed the oil from several top layers, increasing the PVC-ratio of the colour on top, leaving it more matte. The decrease in gloss for these layers is equal for both mock-ups. Despite their similar theoretical PVC, however, ultramarine dried more matte than Prussian blue and ivory black. These two observations combined, may explain why the sky of *The Pink Bows*, with both a Prussian blue and ultramarine layer, contains a lot of oil islands.

Raw umber lived up to its reputation of sinking in, as no saturation was visible in either mock-up. However, its combined CPVC is the lowest of all, and the individual pigments have a lower to similar CPVC. It is unclear from this experiment why it did not get saturated as well as those other pigments. Perhaps it has to do with the combination of pigments, which may differ in particle size. Further research could provide better insight.

A lot of grey to dark areas in the painting are covered with an oil layer, which is in concordance with the finding that thin layers of ivory black and Prussian blue are prone to sinking in.

After this assessment, the different mixtures of varnish were applied, and two blocks per colour were oiled out (Appendix 16: Pictures of the mock-ups). The 1:3 varnish mixtures were difficult to apply, even while still warm. This was especially the case for the addition of beeswax, as it solidifies quickly upon cooling down. The wax made the coating more matte, a property known and used by conservators to create varnishes with a more satin-like sheen.³¹³

All the coatings were able to increase saturation of the paint layers. Despite their varying ratios of linseed oil, the varnishes without beeswax show a similar gloss. The qualitatively mixed one appears thinner, slightly more absorbed by canvas. Colophony varnishes are known to have a rather thick

³¹³ Horie, *Materials for Conservation. Organic Consolidants, Adhesives and Coatings*, 295.

consistency.³¹⁴ On the industrially prepared ground, which is finer woven than the other one, the varnish looks like a glass plate, not showing the weave pattern. The coarser pattern of the other mock-up is visible in some areas, creating an uneven sheen.

The oiling out samples are the most similar in appearance to the painting. They show a gloss, but despite its finer woven canvas, the layer does not behave like a coating on top like the varnishes do. In all samples, the colours appear more saturated than the ones without an extra oil layer. There is a difference between the colours, however. Where there was already gloss apparent, like in the oxide red, the gloss is higher than in e.g., ultramarine blue. There is no notable difference in saturation done by brush or by rubbing it in. Ultramarine is, again, the exception. In mock-up 1, the rubbing was not sufficient to homogeneously fill the air pockets around the particles, rendering the colour still matte (although slightly less than the sample without a transparent layer). Only at the sides, where there possibly was an accumulation of oil, an increase in gloss is notable.

Several conclusions can be drawn from the experiment. First, there is a distinct difference in the outcome of oiling out and varnishing. An oil layer provides a more even saturation of the colours, without completely covering the relief of the weave pattern. An oil-colophony varnish also evens out the gloss but acts more as a thin glass-like barrier, proving its function as a protective coating. Furthermore, the mock-ups have shown there is indeed a difference in the sinking in of pigments, hence the need for locally applied oil layers when an even saturation is wished to obtain.

Lastly, it is highly likely Delvaux did not varnish his painting. Despite the abundance of oil islands, there is no evidence to suggest his goal was to leave the painting with a highly glossy surface. Most of the of the oil traces are only visible under UV-light. The most distinctive ones are in areas with colours that were likely highly matte upon drying. The painting also suggests that Delvaux rather used a brush for application than the technique of rubbing and wiping away excess oil.

³¹⁴ Decq, '2021.14659 - Paul Delvaux - De Roze Strikken', 6.

Conclusion

In this final section, the study will be concluded by summarising the key findings, which will be related to the research objectives stated in the introduction.

For this master thesis, *The Pink Bows*, a pivotal work in the career of Belgian painter Paul Delvaux, was extensively analysed. The results were obtained through a joint venture between the University of Antwerp and the KMSKA, which was financially supported by the Access to Research Infrastructures activity in the Horizon 2020 Programme of the EU (IPERION HS Grant Agreement n.871034).

The main goal of the study was to fill a gap in the understanding of Delvaux's study practice, by providing a comprehensive material-technical analysis of the painting. To this end, a number of (chemical) imaging techniques and analytical methods were performed on both the painting and samples. Furthermore, information was obtained by descriptive research and the analysis of mock-ups.

For a better understanding of the context surrounding the painting and the artist, a short literature review and summarised biography was presented. Special attention was given to varnishes. The ambiguous terminology proved problematic for interpreting the different transparent layers in the painting. Therefore, a set of neutral terminology per layer, based on specific characteristics (location, materiality, function) was proposed.

In the first part of the results-section, the build-up and materials were explored. Overall, this revealed a **traditional stratigraphy and use of pigments**.

The canvas is an industrially prepared canvas, substantiated by the presence of cusping along one of its edges. The absence of a company stamp made it difficult to locate its origins. However, while the research has not conclusively proven that it was manufactured by the Belgian company Claessens, several findings have shown similarities to their production. Examples are the ground material (zinc white, topped with a thin layer of lead white) and the way it was applied, namely following the grain.

As Delvaux was known to carefully think through his paintings by preparatory drawings, the presence of an underdrawing was expected. However, the only evidence of this could be found by visual observation and in limited parts of the painting. It is more likely a monochrome underpainting or lay-in was used to map out the composition, as the infrared photograph shows an abundance of carbon-containing paint. The distribution largely corresponds with the areas where a block-in of shapes is visible, or where shadows were executed. Moreover, a preparatory sketch could not be located. However, several sketch books were not available for research, so a sketch for *The Pink Bows* should not be ruled out. Furthermore, the monochrome paint layer might obscure an underdrawing because they are both carbon-based.

According to biographical literature, the palette of the artist contained cobalt blue, vermillion, ochres, English red, emerald green and ultramarine, which was later exchanged for cobalt blue. Research by Vandenabeele added massicot, realgar and carbon black. This study has confirmed the presence of vermillion, ultramarine and carbon black. Massicot, a lead-based yellow, is a pigment that historically grew to refer to lead-tin yellow. Delvaux might have used it in the female's crown, as Ma-XRF showed a very weak signal for Sn.

Some other pigments were found in the painting as well. Spectroscopical data of UV-VIS fluorescence hyperspectral imaging has detected the presence of an anthraquinone-based pigment in the bows. This, together with the presence of barium sulfate, indicates the use of lake, which is a dyestuff precipitated on substrate to act as a pigment. Analysis could not further specify the pigment, e.g., alizarin or crimson, both anthraquinones.

As a white, Delvaux has used both zinc and lead white, both for mixing as for highlighting certain areas. Furthermore, the painting contains two different blacks, namely carbon and ivory black. They lay-in was probably executed in ivory black, as calcium was found in areas where black is visible, or is to be expected (e.g., greys or shadows). Large amounts of the organic synthetic pigment Prussian blue were detected in the greys. Due to its high tinting strength, Delvaux might have used it in his mixes for economic reasons.

Some of the colours could not be completely identified. Mainly earth colours are difficult to discern based on their materiality because they predominantly contain iron. Umbers and sienna are certainly present, however. They contain both iron and manganese, which were found together in the brown areas.

Although the preference of Delvaux towards a certain brand could not be derived from the literature review, some suggestions are made towards Royal Talens, a Dutch paint manufacturer. In a reconstruction of his studio, the brand's packaging can be seen, as well as a number of Talens paint tubes in a documentary on Delvaux. The latter show tubes with different characteristics, which have been studied in The Netherlands. Some of them, such as the caps or the design of the company logo, are said to give an indication of its production period. While a lot of the tubes in the documentary are most certainly modern, a tube could be linked to one in the Talens archives that dates around the 1940's to the 1950's. As the documentary was filmed in the late 1980's, it is not impossible to think that Delvaux possessed other, even older tubes. Additionally, a red oxide pigment is produced by Talens under the name *Engelsrood*, which was mentioned by Debra to be part of Delvaux's palette. A last indication for Talens is the overall presence of sodium in the samples. Van Gurp discovered that Talens added sodium stearate as a stabiliser to their paints until the 1960's. Moreover, Talens mentions the necessity for barium to improve the workability of some colours. This element was also abundantly found in *The Pink Bows*. Caution needs to be asserted, however. While Tumosa names aluminium stearate as a more common stabiliser, it is not clear whether Talens was an exception with sodium stearate or not. Other companies might also have extensively used barium as a filler but researching this was outside the scope of this study.

The study is concluded by exploring the working process of the artist. It has shown that **the execution of the painting follows a thoughtful, deliberate process**. The composition was obtained by working both wet-on-dry and wet-in-wet. The latter was mostly done to achieve a mix in colours or to soften the borders of shapes.

Delvaux's main tools for *The Pink Bows* are paint brushes, ranging in sizes and shapes (flat, round, filbert). The details, including certain colour gradients, were mostly achieved by a fine, round brush. Apart from some impasto's, no clear outlines of brush strokes are visible, when perceiving the painting as a spectator. It is believed Delvaux did not want them to distract from the overall composition.

The question of varnishing made up an important part of the study and spans both the material aspects of the painting as the working process. **The transparent layers have been found to differ in function**

and material, although not all layers could be precisely characterised. The top varnish layer was identified as an oil-colophony varnish, a traditional varnish with a rather thick consistency. The transparent layers under the varnish could not be characterised but have a different consistency and appearance. They were added directly on top of the paint layer, indicating they were added by the artist himself. In between the paint layers of the central figure's hair, another transparent layer was detected.

The study has determined these layers serve different purposes. The top varnish layer was most certainly added as a protective coating. The thickness of the oil-colophony mixture in the mock-up layer has shown it acts as a physical barrier between the paint layer and the environment, while this was not the case for the oil layer. Such an oil layer is known to be applied for saturating colours, since some colours, mainly earths and dark colours, are known to sink in. Upon drying, they appear more matte as their oil-pigment ratio is too low. By adding oil (known as *oiling out*), this ratio can be balanced out, providing the colours with a better saturation. **The mock-ups have also suggested a possible link between the pigments and the artist's practice of oiling out.** The colours in the painting that were covered by oil layers have shown in the mock-ups to sink in. Ultramarine and Prussian blue, abundantly present in the sky of the painting, were among the most notable pigments. **After oiling out, an overall improvement of saturation was obtained.** However, the experiment needs to be elaborated to further confirm a link between pigments and practice, e.g., with different paint brands, more colours and mixtures of colours.

Lastly, the intermediate transparent layer was found in a location of a pentiment. This means that Delvaux had a change of mind in composition, which is now hidden by the subsequent layer. The function of this layer is not to saturate the colours, as we cannot see them, but to act as a base for a new paint layer, preventing its sinking in.

To summarise the build-up of *The Pink Bows*, a visual representation was made (Figure 89).

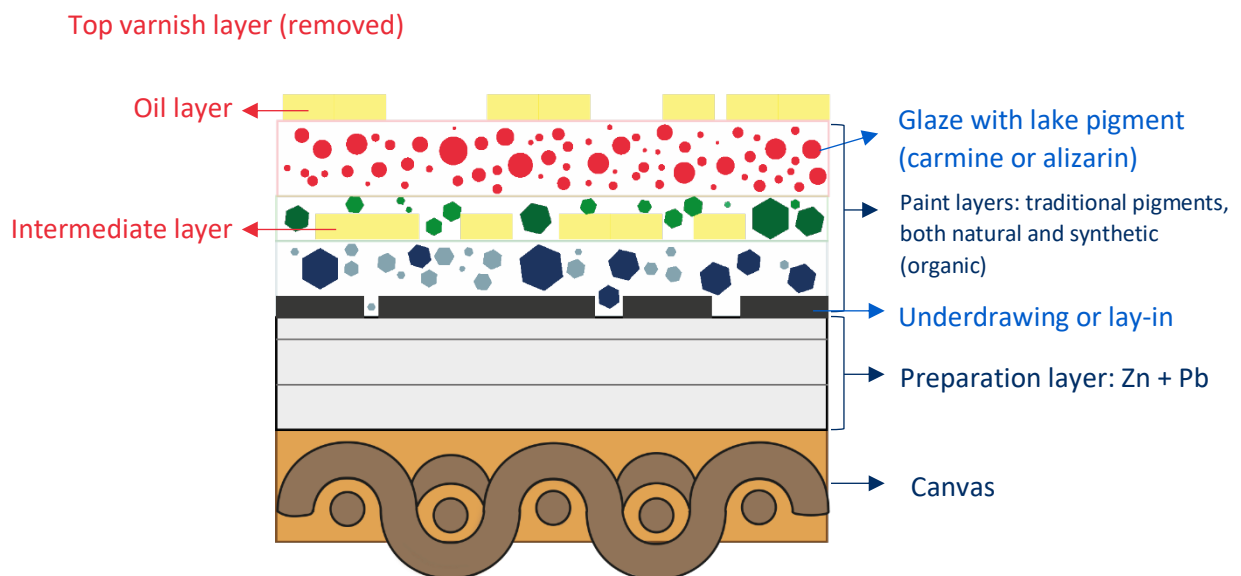


Figure 89: Build-up of *The Pink Bows*

The future

This dissertation is only a small fish in the vast sea that research in the field of conservation-restoration is. Despite its modest aspirations, it has potential to be a starting point for further research. A logical outcome is applying the methodology of this study on other paintings by Delvaux. A comparison to works in the same period could confirm or disprove the conclusions from this work. The method could also be expanded to his early works or paintings from the later stages of his career to find similarities or differences. It could be the start of a database, containing a comprehensive overview of his oeuvre and its materiality. To this end, it would be helpful to turn the tools and artists materials into a reference collection, so it can be thoroughly studied and linked to objects. Such a project is currently being set up for Edvard Munch in Oslo. Similarly, if it can be proven the paint he used was predominantly from Talens, the study on Delvaux's studio practice can serve as an addition to the project by the Cultural Heritage Agency in the Netherlands, which aims to gather knowledge on the production and contents of Talens paint.

Another opportunity lies in the further exploration on transparent layers. A more extensive study could be executed on the terminology and its practical impacts. Does the use of ambiguous terminology perhaps influence the interpretation of artworks or their conservation treatment? Have artists oiled out their paintings since centuries or is this a more recent concept? Has the terminology maybe evolved throughout history? More uniformity on the terminology of transparent layers and their functions would prove beneficial in the treatment of objects. Furthermore, an elaboration on the experiment could provide a better understanding on the relation between the phenomenon of sinking in and the practice of oiling out.

The ultimate project would be to set up a tool which links Delvaux's artworks to their materials, the ingredients of these materials, their degradation phenomena, and a possible treatment, after systematic research on his oeuvre. Conservators could then use it as a search engine for problems they encounter on similar works, or researchers could use it as a reference database for analysis on other artists' artworks. Such a project would ask an enormous effort in producing metadata, semantic web ontologies and the application of artificial intelligence. It would however mean a fruitful collaboration between the conservation field and digital humanities. It only takes one person to start dreaming before it becomes reality.

Before resorting into big ideas, however, I will continue this research by collecting more data from the Iperion research teams and present them to a wider public at the Colours22 conference in Évora, Portugal. Additionally, I will present some results on the upcoming IIC Wellington Congress, in the form of a poster.

List of figures and tables

All images are by the author, unless otherwise stated.

FIGURE 1: TIMELINE CONCERNING PAUL DELVAUX AND THE PINK BOWS (SHOWN IN PINK)	16
FIGURE 2: DELVAUX IN HIS STUDIO AT BOSVOORDE, BEHIND A TRAIN DOOR (1976) © PAUL DELVAUX FOUNDATION-SABAM.....	17
FIGURE 3: THE CLASS OF MONTALD IN 1918. © PAUL-ALOÏSE DE BOCK, 1967.....	18
FIGURE 4: ANNE-MARIE TAM DE MARTELAERE © PIERRE GHÊNE, 2000	19
FIGURE 5: A LIST OF PAINTING SALES. NOTE THE MENTION OF THE CONTRACT. © CARELS AND VAN DEUN, 2004	19
FIGURE 6: THE PAUL DELVAUX-MUSEUM TODAY. © BENNY PROOT, 2022	20
FIGURE 7: BURIEL SITE OF TAM AND PAUL DELVAUX. © HARVEY KNEESLAPPER, 2019 (CROPPED)	21
FIGURE 8: BOOK COVERS OF HUBERT LAMPO. © JAN VENDERICKX	22
FIGURE 9: LP COVER OF LIVE AT BRIXTON ACE - THIRD EDITION (1983). © SISTERSWIKI.ORG	22
FIGURE 10: THE ZINC FACTORY OF CORFALIE, 1929, OIL ON CANVAS, 80x100 CM, COLLECTION FOUNDATION PAUL DELVAUX.	23
FIGURE 11: ROBERT GIRON IN DELVAUX'S STUDIO. THE PAINTINGS IN THE BACKGROUND GIVE A GLIMPSE OF PAUL'S PAINTING STYLE BACK THEN. © PAUL-ALOÏSE DE BOCK, 1967.....	23
FIGURE 12: (A) DE SMET, SUNDAY, 1921, INV. 2931 © KMSKA. (B) PERMEKE, THE FIANCÉES, 1923, INV. 4868 © RMFAB. (C) DELVAUX, COUPLE WITH CHILD IN THE WOODS, 1928-29, INV. 11936 © RMFAB.	24
FIGURE 13: (A) INGRES, THE GREAT ODALISK (1814), INV. RF 1158 © MUSÉE DU LOUVRE/FRANK RAUX, 2017. (B) DELVAUX, SLEEPING VENUS (1944), INV. T00134 © FOUNDATION P DELVAUX - ST IDESBALD, BELGIUM/DACS, LONDON 2022. (C) DELVAUX, SLEEPING VENUS (1943), PRIVATE COLLECTION © CHRISTIES LONDON, 2014.....	25
FIGURE 14: THE LAMPS, 1937, INV. 2018.286. © 2018 ARTISTS RIGHTS SOCIETY (ARS), NEW YORK / SABAM, BRUSSELS	26
FIGURE 15: CHRISTMAS NIGHT, 1956, PRIVATE COLLECTION © AKG-IMAGES / CDA / GUILLEMOT.....	27
FIGURE 16: CALYPSO, 1986, COLLECTION PAUL DELVAUX FOUNDATION (DETAIL).	27
FIGURE 17: THE PINK BOWS BY PAUL DELVAUX, 1937, INV. 2850 © KMSKA, RIK KLEIN GOTINK.....	28
FIGURE 18: APPROVAL OF THE SALE BY EMILE LANGUI. © KMSKA ARCHIVE.....	29
FIGURE 19: WOMEN OF THE NIGHT (1936). THIS PAINTING HAS THE SAME CLEAR LOOK AS THE PINK BOWS AFTER RESTORATION. THIS PICTURE FROM A CHRISTIES SALE IS THE ONLY COLOUR REPRODUCTION TO BE FOUND, AS ITS BUYER IS NOT DISCLOSED. © CHRISTIES IMAGES LTD.....	31
FIGURE 20: (A) PHASES OF THE MOON (1937), INV. 504.1951, MoMA COLLECTION. © 2022 PAUL DELVAUX / ARTISTS RIGHTS SOCIETY (ARS), NEW YORK / SABAM, BRUSSELS. (B) THE BREAK OF DAY (1937), INV. NR. 76.2553 PG 103, PEGGY GUGGENHEIM COLLECTION. © PAUL DELVAUX FOUNDATION (C) THE JOY OF LIFE (1938), COLLECTION UNKNOWN © PAUL DELVAUX / DACS.....	31
FIGURE 21: OVERVIEW OF THE METHODOLOGY	37
FIGURE 22: A VISUAL REPRESENTATION OF THE ELECTROMAGNETIC SPECTRUM WITH MOLECULAR INTERACTIONS. © MOOMOOMATH AND SCIENCE, IEEE	38
FIGURE 23: HASSELBLAD CAMERA ON A STAND IN FRONT OF THE PINK BOWS.	41
FIGURE 24: STEREO MICROSCOPE MOUNTED ON A TRIPOD.	41
FIGURE 25: PROCESS OF MAKING THE UVFC-IMAGE. © EVELINE VANDEPUTTE, BASED ON JC WONG	43
FIGURE 26: COMPARISON OF A TOMOGRAM TO A PHYSICAL SAMPLE, TAKEN FROM TARGOWSKI AND IWANICKA, 2011. (A) IS THE OCT TOMOGRAM (280 μM X 2 MM), (B) SHOWS THE PHYSICAL SAMPLE. IN (C), THEY ARE COMBINED. © ARRECHI ET AL., TARGOWSKI AND IWANICKA.....	43
FIGURE 27: SET-UP OF THE OCT-INSTRUMENT IN FRONT OF THE PAINTING.	44
FIGURE 28: FTIR-SETUP.	45
FIGURE 29: VISUAL REPRESENTATION OF THE RAMAN-EFFECT, WITH THE DIFFERENCES IN ENERGY LEVELS. © MOSCA, 2021	46
FIGURE 30: MA-XRF SCANNING LOCATION.	47
FIGURE 31: SET-UP OF THE UV-VIS HIS BY THE PERUGIA TEAM.	48
FIGURE 32: SAMPLE LOCATIONS © KIK-IRPA, 2021 AND KMSKA, 2021	49
FIGURE 33: PRINCIPLE OF SEM-EDX ON A SAMPLE WITH VARNISH (TOP), PAINT LAYER (MIDDLE) AND GROUND LAYER (BOTTOM). THE PRIMARY ELECTRON BEAM CAUSES INTERACTION OF THE SAMPLE MATERIALS, RESULTING IN EMISSION OF DIFFERENT RADIATION TYPES. THE BLUE EMISSION IS USED FOR IMAGING, THE EMISSION IN RED IS USED FOR ANALYSIS.	51
FIGURE 34: OVERVIEW OF THE MATERIALS ON THE MOCK-UPS.	54
FIGURE 35: DETAIL OF THE JOINT, LEFT UPPER CORNER. THE YELLOW LINE INDICATES ITS SEAM. © KMSKA, 2021.....	56

FIGURE 36: STAMP OF THE PARISIAN CUSTOMS.	56
FIGURE 37: DETAIL OF THE SCALLOPED EDGE WITH NAIL HOLES. ©RIK KLEIN GOTINK, 2021.....	56
FIGURE 38: THE BACK OF THE PAINTING, WITHOUT FRAME. © RIK KLEIN GOTINK, 2021	56
FIGURE 39: MORTAR AND TENON JOINT. ©HÉLÈNE VEROUGSTRAETE, 2005.....	57
FIGURE 40: LAP JOINT. ©HÉLÈNE VEROUGSTRAETE, 2005	57
FIGURE 41: SLOTTED JOINT. ©HÉLÈNE VEROUGSTRAETE, 2005.....	57
FIGURE 42: LABEL ON THE PINK BOWS. © RIK KLEIN GOTINK.....	57
FIGURE 43: LABEL ON A BABY WITH RATTLE, BY MARIA BLANCHARD, 19TH CENTURY © DOROTHEUM	57
FIGURE 44: (A) HANGING THE CANVAS BEFORE PREPARATION, SHOT BEFORE THE 1970'S. (B) THE FABRIC IS LEFT TO DRY AFTER PREPARATION, SHOWING THE CUSPING CAUSED BY ITS SHRINKING. © CLAESSENS NV.....	58
FIGURE 45: IRREGULARITY IN THE CANVAS WEAVE.....	59
FIGURE 46: DETAIL OF THE FABRIC'S PLAIN WEFT. THE WARP THREADS ARE DISTINCTIVELY THICKER THAN THE WEFT ONES.....	59
FIGURE 47: SEM-EDX ANALYSIS. THE BACKSCATTER IMAGE SHOWS THE LOCATIONS OF ANALYSIS. IN THE SPECTRUM, THE Pb AND ZN ELEMENTS ARE HIGHLIGHTED. © GERT NUYTS	60
FIGURE 48: IMAGE OF ZINC SCAN. © NINA DELEU	60
FIGURE 49: PENCIL LINES.	61
FIGURE 50: (A) TRACES OF BLOCKING OUT THE STONE COLUMN. (B) THE BOW IS LAYED DOWN IN SHADES OF GREY, BY BLOCKING.....	63
FIGURE 51: THE OUTLINE OF THE SHADOW EXTENDS FURTHER THAN VISIBLE IN THE PAINTING. ON THE RIGHT, AN OUTLINE OR SHADOW HAS BEEN LARGELY OVERPAINTED. THE BUILD-UP THROUGH SHADOWS IS ALSO VISIBLE HERE.	63
FIGURE 52: THE BRUSH STROKES OF A LEAN LAYER ARE CLEARLY VISIBLE.	63
FIGURE 53: LEFT: RECONSTRUCTION OF DELVAUX'S STUDIO. © ALFRED PENEL. RIGHT: OLD BOX OF TALENS PAINT	64
FIGURE 54: (A) STILL FROM THE SLEEPWALKER OF SAINT IDESBALD ©ADRIAN MABEN, 1986. (B) PAINT TUBE FROM THE TALENS ARCHIVES ©FEMKE VAN GURP, 2014	65
FIGURE 55: ADDITIVES IN THE PAINT SAMPLE: THE HIGHER NA-CONTENT IN THE BLUE LAYER IS DUE TO THE ULTRAMARINE PIGMENT. © GEERT VAN DER SNICKT, 2022, GERT NUYTS, 2022	66
FIGURE 56: THE DISTRIBUTION OF ZN AND Pb IN THE BOW SHOWS BRUSH STROKES.....	67
FIGURE 57: THE MAIN ELEMENTAL MAPS FOR IDENTIFYING ULTRAMARINE. ©GERT NUYTS, 2022	68
FIGURE 58: SEM-EDX RESULTS OF THE PIGMENT PARTICLE ©GERT NUYTS.....	68
FIGURE 59: LEFT: MA-XRF SCAN OF MERCURY (Hg). © NINA DELEU, RIGHT: SAMPLE C99.185 SHOWING A LIGHT PINK AREA WITH DISTINCTIVE RED PARTICLES. © LOUISE DECQ.....	69
FIGURE 60: DETAIL OF IRFC. THE BOW HAS A DISTINCT YELLOW/ORANGE FLUORESCENCE.	69
FIGURE 61: DETAIL OF THE BOWS, WITH INDICATIONS OF POSSIBLY FADED RED LAKE.	70
FIGURE 62: INDICATIONS THAT THE RED LAKE WAS ORIGINALLY VERY THINLY APPLIED. (A) IS THE CURRENT STATE, (B) IS A DETAIL FROM A PICTURE TAKEN IN 1948 © KIK-IRPA, BRUSSELS.	70
FIGURE 63: SUGGESTION OF A MONOCHROME LAY-IN LAYER WITH IVORY BLACK. © NINA DELEU.....	71
FIGURE 64: MA-XRF SCANS OF Fe AND Mn. © NINA DELEU	72
FIGURE 65: DETAIL FROM A WINSOR & NEWTON COLOUR CHART FOR OIL PAINTS. MOST OF THESE COLOURS CONTAIN IRON. © WINSOR & NEWTON	73
FIGURE 66: THE PINK BOWS BEFORE RESTORATION, WITH THE PRESENCE OF A HIGHLY OXIDISED VARNISH LAYER. © RIK KLEIN GOTINK..	74
FIGURE 67: SAMPLE 2850.01, x200 © BEATRIZ LORENTE,.....	74
FIGURE 68: TOP: THE LOCATION OF MEASUREMENT. BOTTOM: PRELIMINARY TOMOGRAM, SHOWING MULTIPLE TRANSPARANT LAYERS. © MAGDA	76
FIGURE 69: TOMOGRAM OF THE P IN THE SIGNATURE AND THE MEASURING LOCATION. © MAGDA IWANICKA AND PIOTR TARGOWSKI .	76
FIGURE 70: LEFT: THE PINK BOWS IN ITS FRAME ON VIEW IN THE KMSKA, AFTER RESTORATION. RIGHT: CLOSE UP OF THE RIGHT CORNER	77
FIGURE 71: LEFT: THE WOMEN OF THE NIGHT PICTURED IN A SIMILAR FRAME AT THE EXPO YOUNG BELGIAN ARTISTS IN THE LONDON GALLERY (1937). E.L.T. MESENS IS PICTURED NEXT TO THE PAINTING. © CATERINA CAPUTO. RIGHT: PRINCESS HANAKO OF HITACHI AT A DELVAUX EXHIBITION IN TOKYO, JAPAN. THE PINK BOWS IS IN THE CORNER OF THE ROOM. © THE ASAHI SHIMBUN VIA GETTY IMAGES	78
FIGURE 72: MILLER TOOK THIS PICTURE IN 1944 IN BRUSSELS. © LEE MILLER ARCHIVES, ENGLAND 2016.	78
FIGURE 73: THE TIN JAR WITH DELVAUX'S BRUSHES, ENLARGED ON THE LIGHT. SOME OF THE WITHERED BRUSHES ARE HIGHLIGHTED.	79
FIGURE 74: DETAILS OF BRUSH STROKES, TAKEN THROUGH THE STEREOMICROSCOPE.	80
FIGURE 75: STEREOMICROSCOPIC VIEW ON THE PENCIL LINES. ON THE RIGHT IS SHOWED AN ATTEMPT TO ERASE IT.	80
FIGURE 76: SCALE RECONSTRUCTION OF THE PARTHENON, OWNED BY DELVAUX.	80

FIGURE 77: STEREOMICROSCOPIC IMAGE SHOWING THE BUILD-UP OF THE BRICK WALL.....	81
FIGURE 78: STEREOMICROSCOPIC IMAGE OF THE STAIRCASE.	81
FIGURE 79: CARNATION SAMPLE (C99.186), x500. WHITE AND GREY PAINT ARE MIXED WET-IN-WET © LOUISE DECOQ, KIK-IRPA, 2021	82
FIGURE 80: DETAIL OF AN IMPASTO IN THE LEFT FEMALE FIGURE.	82
FIGURE 81: STILLS FROM ENTRETIEN AVEC PAUL DELVAUX (LEFT AND CENTRE), AND PAUL DELVAUX: THE SLEEPWALKER OF SAINT IDESBALD (RIGHT). © RTBF, ADRIAN MABEN	82
FIGURE 82: LEFT: CLOSE-UP OF THE ISLAND IN THE SKY (TOP RIGHT OF THE PAINTING). RIGHT: DRIPPING RUNNING	83
FIGURE 83: AREAS SHOWING THE APPLICATION METHOD OF THE ARTIST. THE BLUE FLUORESCENCE MARKS RETOUCHES.	83
FIGURE 84: OIL LAYER AROUND THE ARM OF THE FEMALE ON THE RIGHT.	84
FIGURE 85: OIL LAYERS IN THE BOW OF THE CENTRE FEMALE.....	84
FIGURE 86: PAINTINGS IN THE DELVAUX MUSEUM. FROM LEFT TO RIGHT: BRUSSELS' HARBOUR, 1922, THE MODEL, CA. 1924, THE DAWN, 1944.	84
FIGURE 87: DETAILS OF ECCE HOMO IN UV-LIGHT, SHOWING DRIPPINGS AND BRUSH STROKES.....	84
FIGURE 88: ON THE LEFT, THE RELATIONSHIP BETWEEN BINDER AND PIGMENT IS SHOWN. ON THE RIGHT, THE EFFECT IS SHOWN WHEN THE PVC-RATIO IS INCREASED. © GOLDEN ARTIST COLORS, INC, 2016	85
FIGURE 89: BUILD-UP OF THE PINK BOWS	90
FIGURE 93: 1946 © KIK-IRPA, BRUSSEL	129
FIGURE 94: 1957 © KIK-IRPA, BRUSSEL	130
FIGURE 95: 1972, ORIGINEEL, © KIK-IRPA, BRUSSEL.....	131
FIGURE 96: 1972, NA BEELDBEWERKING DOOR FOTO SCHELFHOUT ANTWERPEN.	132
FIGURE 97: VISIBLE PHOTOGRAPHY BEFORE TREATMENT. ©RIK KLEIN GOTINK.....	133
FIGURE 98: VISUAL PHOTO AFTER TREATMENT. © RIK KLEIN GOTINK.....	134
FIGURE 99: UIVFP BEFORE TREATMENT. © RIK KLEIN GOTINK.....	135
FIGURE 100: UIVFP AFTER TREATMENT. ©RIK KLEIN GOTINK.....	136
FIGURE 101: IRP BEFORE TREATMENT. NO PICTURE WAS TAKEN AFTER TREATMENT. ©RIK KLEIN GOTINK	137
FIGURE 102: UVIFP-FC BEFORE TREATMENT. ©RIK KLEIN GOTINK, ADJUSTED TO FC BY EVELINE VANDEPUTTE	138
FIGURE 103: UVIFP-FC AFTER TREATMENT. ©RIK KLEIN GOTINK, ADJUSTED TO FC BY EVELINE VANDEPUTTE	139
FIGURE 104: IRFC BEFORE TREATMENT. ©RIK KLEIN GOTINK	140
FIGURE 105: THE FULLY LINED TUBES ARE IDENTIFIED; THE DOTTED LINED TUBES ARE POSSIBLE IDENTIFICATIONS. THE THIN GREY OUTLINED TUBES COULD CONTAIN NO CLUES.....	164
FIGURE 106: LOCATIONS OF FTIR ANALYSIS.	165
FIGURE 107: LOCATIONS OF RAMAN ANALYSIS.....	168
TABLE I: OVERVIEW OF RESEARCH METHODS.....	39
TABLE II: OVERVIEW CROSS-SECTIONS	49
TABLE III: BUILD-UP OF THE SUPPORTS FOR THE MOCK-UPS	53
TABLE IV: COLOURS USED IN THE MOCK-UPS.....	53
TABLE V: VARNISH RATIOS	54
TABLE VI: CPVC OF THE PIGMENTS USED IN THE MOCK-UPS	86
TABLE VII: LEGEND OF THE SATURATION ASSESSMENT ON THE MOCK-UPS.....	175

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Appendices

Appendix 1: Identification sheet

Identification	
Institution	Royal Museum of Fine Arts Antwerp
Inventory number	2850
Title	De roze strikken (NL) Les noeuds roses (FR) The Pink Bows (ENG) Rosa Schleifen (GER)
Description (museum text)	In an unknown world, recognisable elements from reality are given a new place. The silence is palpable. The naked women, Paul Delvaux's favourite characters, wander around in an alienating landscape with classical ruins. One of the women wears a large bow around her upper body. On the upper gallery of the building on the right, a skeleton can be seen. Delvaux's painting can be described as that of the stilled gesture, of repetition, of frozen eroticism, of childhood memory.
Artist	Delvaux, Paul (Antheit 1897 – Veurne 1994)
Date of creation	1937
Material	Oil on canvas
Size	121,5 × 160 cm (Dagmaat) 120,9 × 158,8 × 2,7 cm (Volledig) 125,5 × 163,6 × 5,5 cm, 13,4kg (Inclusief lijst)
Distinctive features	Flemish <i>topstuk</i> (Masterpiece) since 2007. The decision was informed based on the representativeness of Delvaux's first surreal period, starting from 1935. It also holds a significant artistic value in the depiction of the females and landscape with classical buildings, derived from renaissance and classical art. Lastly, it holds a hall-mark value because of the skeletons in the painting, which were added for the first time according to the commission. ³¹⁵ However, <i>The Evening Comedy</i> from 1936 already shows skulls.
Signature	P. DELVAUX/2-37 (lower right)

³¹⁵ Departement Cultuur; Jeugd en Media, "De roze strikken".

Objectgeschiedenis en – associaties	Previously owned by Claude Spaak
Iconography (iconclass)	<p>25H landscapes</p> <p>25H11 mountain range</p> <p>31AA(+89) nude woman</p> <p>31A21 skeleton</p> <p>31A211 skull</p> <p>31AA231 standing woman</p> <p>31D15 adult woman</p> <p>41A11 palace</p> <p>41A431 carpet</p> <p>41A9 ruin of a dwelling, house, castle, etc.</p> <p>41B34 oil-lamp</p> <p>41D26 accessories</p> <p>41D2654 bow</p> <p>41D27 drapery, draped garment</p> <p>44BB191 crown</p> <p>48C149 ruin of a building - architecture</p> <p>48C24 piece of sculpture, reproduction of a piece of sculpture</p>
Acquisition	
Acquisition	Bought
Acquisition from	Claude Spaak, by moderation of the Palace of Fine Arts Brussels
Acquisition date	1957
Additional data	
Exhibitions ³¹⁶	<p>1938, Belgium, Brussels, Palais des Beaux-Arts, Exposition d'art Belge contemporain (Les Compagnons de l'Art) (as <i>Les Belles de nuit</i>³¹⁷), nr. 269</p> <p>1947, Belgium, Brussels, Galerie George Giroux, Exposition de l'Art Vivant dans les Collections Privées Belges, 2-9 june 1947, nr. 20</p> <p>1948, France, Paris, Galerie Drouin, nr. 2³¹⁸</p> <p>1952 Sarrebruck, Peinture surréaliste en Europe, nr. 12</p>

³¹⁶ Retrieved from Michel Clair Jean Houbart-Wilkin Suzanne Butor, *Delvaux [catalogue de l'oeuvre peint, 1975]* (Bruxelles: Cosmos, 1975). for exhibitions before 1983, unless otherwise stated. Exhibitions after this date were retrieved from The Museum Management-system of KMSKA.

³¹⁷ Paul-Aloïse de Bock, *Paul Delvaux : l'homme, le peintre, psychologie d'un art* (Bruxelles: Laconti, 1967), 289.

³¹⁸ Ibid.

	<p>1962, Belgium, Ostend, Royal Museum of Fine Arts, Feestpaleis, Paul Delvaux, nr.5</p> <p>1965, Belgium, Mons, Musée des Beaux-Arts, Hainout Cinq. Hommage à Paul Delvaux, nr.2, repr.</p> <p>1966, Belgium, Antwerp, Royal Museum of Fine Arts Antwerp, De Generatie van 1900, Surrealisten, Animisten, nr.52, repr.</p> <p>1966, Switzerland, Genève, Galerie Krugier & Cie, Delvaux, nr. 1</p> <p>1971, France, Bordeaux, Galerie des Beaux-Arts, Surréalisme, nr. 54, repr.;</p> <p>1971, Belgium, Charleroi, Palais des Beaux-Arts, Le Hainaut. Terre de Surréalisme, nr. 16</p> <p>1972, Venice, Museo Correr, XXXVIe Biennale. Capolavori della pittura del XX secolo, 1900-1945, nr 78, col. repr.</p> <p>1973, The Netherlands, Rotterdam, Museum Boymans-Van Beuningen, Paul Delvaux, nr. 11, repr. p. 49</p> <p>1973, Belgium, Knokke-Heist, Casino, nr. 8, 2 repr.</p> <p>1975, Japan, Tokyo, Musée National d'Art Moderne Tokyo, Paul Delvaux, nr. 4, repr.</p> <p>1983, Japan, Osaka, Musée d'Art de Daimaru, Umeda, Paul Delvaux, nr. 8, afb.;</p> <p>1984, Japan, Himeji, Musée d'Art Municipal d'Himeji, Paul Delvaux, nr. 8, afb.;</p> <p>1984, Japan, Tokyo, Musée d'Art d'Isetan, Shinjuku, Paul Delvaux, nr. 8, afb.;</p> <p>1984, Japan, Toyama, Musée d'Art Moderne de Toyama, Paul Delvaux, nr. 8, afb.;</p> <p>1990, Unites States of America, Berkeley, University Art Museum, Anxious Visions. Surrealist, afb. nr. 9, p. 21;</p> <p>1991, France, Paris, Grand Palais, Salon des Indépendants, Paul Delvaux. Peintures. Dessins. 1922-1982, nr. 13, afb. p. 46;</p> <p>1993/1994, Belgium, Antwerp, Royal Museum of Fine Arts Antwerp, In depot / out of depot. De modernen in het koninklijk museum;</p> <p>1996/ 1997, Belgium, Ostend, PMMK, Museum voor Moderne Kunst, Van Ensor tot Delvaux. Ensor. Spilliaert. Permeke. Magritte. Delvaux, afb. p. 344;</p> <p>1997, Belgium, Brussels, Royal Museums of Fine Arts of Belgium, Paul Delvaux. 1897-1994, nr. 33, afb. p. 88;</p> <p>2000, Japan, Himeji, Himeji City Museum of Art, From Ensor to Delvaux, nr. 67, afb. p. 154;</p> <p>2000, Japan, Sakura, Sakura City Museum of Art, From Ensor to Delvaux, nr. 67, afb. p. 154;</p> <p>2001, Japan, Tokyo, Isetan Museum of Art, From Ensor to Delvaux, nr. 67, afb. p. 154;</p>
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	<p>2001, Japan, Osaka, Umeda, Daimaru Museum, From Ensor to Delvaux, nr. 67, afb. p. 154;</p> <p>2001, Japan, Okazaki, Okazaki City Museum, From Ensor to Delvaux, nr. 67, afb. p. 154;</p> <p>2008, Antwerp, Belgium, Antwerp, Royal Museum of Fine Arts Antwerp, Een halve hond heel denken;</p> <p>2008, Antwerp, Belgium, Antwerp, Royal Museum of Fine Arts Antwerp, De roze strikken. Museumwandeling, afb. omslag;</p> <p>2009/ 2010, Brussels, Royal Museums of Fine Arts of Belgium, Delvaux en de oudheid, nr. 25, afb. p. 76-77;</p> <p>2010, Japan, Ibaraki, The Museum of Modern Art, From Ensor to Magritte. Belgian Painting between 1880 and 1940, nr. 66, afb. p. 81;</p> <p>2010, Japan, Hiroshima, Hiroshima Museum of Art, From Ensor to Magritte. Belgian Painting between 1880 and 1940, nr. 66, afb. p. 81;</p> <p>2010, Japan, Shimane, Shimane Art Museum, From Ensor to Magritte. Belgian Painting between 1880 and 1940, nr. 66, afb. p. 81;</p> <p>2010, Japan, Tokyo, Tokyo Opera City Art Gallery, From Ensor to Magritte. Belgian Painting between 1880 and 1940, nr. 66, afb. p. 81;</p> <p>2011/2012, Antwerp, Koningin Fabiolazaal, De Modernen. Topstukken uit het Koninklijk Museum, afb. detail;</p> <p>2012/2013, Paris, Musée d'art moderne de la ville de Paris, L'art en guerre. France. 1938-1947, afb. p. 31;</p> <p>2013/2014, The Netherlands, Arnhem, mmka, Museum voor Moderne Kunst Arnhem, De melancholieke metropool. Stadsbeelden tussen magie en realisme. 1925-1950, afb. p. 36-37;</p> <p>2014, Antwerp, Koningin Fabiolazaal, De Modernen. Onwaarschijnlijk echt. Magisch realisme en nieuwe zakelijkheid, afb.;</p> <p>2014/2015, Germany, Dresden, Deutsches Hygiene-Museum, Blicke! / Körper! / Sensationen / Ein anatomisches Wachsabinet und die Kunst, afb. p. 75;-'</p> <p>2015/ 2016, Germany, Bremen, Kunsthalle, Last Year in Marienbad. A Film as Art, nr. 59, afb. p. 174-175;</p> <p>2021/2022, Germany, Munich, Kunsthalle München, Fantastisch Real. Belgische Moderne von Ensor bis Magritte, afb. p. 220-221.</p>
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Appendix 2: Key elements

Cat. Nr.	Title	Key elements in the most creative years				Elements from <i>The Pink Bows</i>		
		Female	Lamp	Ancient-like reference	Skeleton	Tiled square/floor	Mountain	Bow
1936	72	Procession In Lace	✓		✓		✓	
	73	The Escape	✓			✓		
	74	The Rose	✓	✓		✓	✓	
	75	The Rape	✓			✓	✓	
	76	The Wait	✓					
	77	The Mirror	✓		✓		✓	
	78	The Window	✓				✓	
	79	Women of the Night	✓		✓	✓	✓	✓
	80	Women in a Cave	✓				✓	
1937	81	The Pink Bows	✓	✓	✓	✓		
	82	Composition	✓				✓	
	83	The Lamps	✓	✓	✓	✓	✓	
	84	Nymphs of the Water (I)	✓		✓		✓	
	85	The Birth of Day	✓		✓	✓	✓	✓
	86	Daytime Suggestions	✓		✓		✓	✓
	87	The Narrator	✓		✓		✓	✓
1938	88	The Joy of Life	✓					✓
	89	The Call of the Night	✓	✓	✓	✓	✓	
	90	The Sleeping City	✓		✓	✓	✓	
	91	The Summer	✓			?	✓	
	92	Nymphs of the Water (II)	✓		✓		✓	✓
	93	The Greeting	✓		✓		✓	✓
1939	94	Street of the Trams	✓	✓	✓			✓
	95	Nocturne	✓		✓	?	✓	✓
	96	Phases of the Moon (I)	✓	✓			✓	✓
	97	The Visit	✓	✓				
	98	Pygmalion	✓	✓	✓		✓	✓
	99	The Awakening of the Forest	✓					
	100	The Road to the City	✓	✓			✓	✓
	101	The Fire	✓				✓	✓

Cat. Nr.	Title	Key elements in the most creative years				Elements from <i>The Pink Bows</i>			
		Female	Lamp	Ancient-like reference	Skeleton	Tiled square/floor	Mountain	Bow	
1940	102	The Man of the Road	✓		✓			✓	
	103	The Vigil	✓				✓	✓	
	104	The Entrance to the City	✓		✓		✓	✓	
	105	Landscape to the Violinist	✓					✓	
	106	The Dawn over the City	✓	✓	✓				✓
1941	107	Phases of the Moon (II)	✓	✓		✓		✓	
	108	The Worried City	✓		✓	✓		✓	✓
	109	The Hands	✓		✓		✓	✓	
	110	The Congress	✓	✓	✓	✓		✓	
	111	The Ancient City	✓		✓		✓	✓	
	112	The Courtesans	✓	✓	✓		✓	✓	
	113	Both Ages	✓	✓	✓		✓	✓	
1942	114	The Prisoner (I)	✓		✓		✓	✓	
	115	The Village of the Sirens	✓		✓			✓	
	116	The Prisoner (II)	✓		✓		✓		
	117	The Nocturnal Night	✓		✓			✓	
	118	The Temple	✓		✓		✓		
	119	The Visit	✓	✓				✓	
	120	The Meeting	✓	✓	✓		✓	✓	
	121	Phases of the Moon (III)	✓	✓	✓		✓	✓	
1943	122	Composition	✓						
	123	The Spitzner Museum	✓	✓	✓	✓	✓		
	124	The Grey City	✓		✓		✓	✓	
	125	The Mystery of the Road	✓		✓		✓	✓	
	126	The Dawn	✓		✓		✓	✓	
	127	The Courtesans	✓		✓	✓			
	128	Skeleton				✓			
	129	The Women in Front of the Sea	✓						
	130	The Green Woman	✓		✓	✓	✓		
	131	The Sleeping Venus	✓		✓		✓	✓	
	132	The Red City	✓		✓	✓	✓	✓	
133	The Temple	✓		✓		✓	✓		

Cat. Nr.	Title	Key elements in the most creative years				Elements from <i>The Pink Bows</i>		
		Female	Lamp	Ancient-like reference	Skeleton	Tiled square/floor	Mountain	Bow
1944	134	The Lunar City	✓		✓	✓	✓	
	135	The Skeletons				✓		
	136	(The) Sleeping Venus	✓		✓	✓		✓
	137	Skeleton (front + backside)	✓			✓		
	138	The Skeletons				✓		
	139	The Courtesans	✓		✓			
	140	Woman and Skeleton	✓	✓		✓		
	141	The Skeletons		✓	✓	✓		
	142	Naked Women	✓		✓		✓	✓
	143	The Dream	✓				✓	✓
	144	The Dream	✓	✓				
	145	Figures in a Classical Landscape	✓		✓	✓	✓	✓
	146	Composition	✓		✓	✓	✓	✓
	147	The Wall	✓		✓		✓	
	148	The Call	✓	✓	✓	✓		✓
	149	The Sleeping Venus	✓		✓	✓	✓	✓
	150	The Skeleton with the Shell			✓	✓	✓	✓
	151	Skeletons		✓		✓		
152	The Visit	✓	✓					
153	Woman with a Lamp	✓	✓					
1945	154	Infernal Solitude	✓	✓	✓		✓	✓
	155	Nude in the Mirror	✓		✓			
	156	Portrait of Sacha Goemans	✓				✓	✓
	157	Portrait of Madame Pollet	✓		✓		✓	✓
	158	The Fire	✓	✓		✓	✓	✓
	159	Skeleton				✓		
	160	The Walk	✓		✓		✓	✓
	161	Pénélope	✓		✓		✓	✓
	162	Woman with the Lamp	✓	✓	✓			
	163	The Seated Woman	✓	✓	✓			
	164	Two Seated Women	✓		✓			✓
	165	Composition	✓		✓			✓

Cat. Nr.	Title	Key elements in the most creative years				Elements from <i>The Pink Bows</i>			
		Female	Lamp	Ancient-like reference	Skeleton	Tiled square/floor	Mountain	Bow	
1946	166	The Rape of Lucrecia	✓	✓	✓		✓	✓	
	167	The Temptation of St. Anthony	✓		✓			✓	
1946	168	The Caryatids	✓		✓		✓	✓	
	169	The Black City	✓	✓	✓		✓	✓	
	170	Pénélope	✓		✓		✓	✓	
	171	Two Women	✓		✓		✓	✓	
	172	Nude at the Statue	✓		✓		✓	✓	
	173	The Table	✓		✓		✓	✓	
	174	The Sacred Wood	✓		✓		✓	✓	
	175	Venus with Mirror	✓				✓		
	176	Tramway, Porte-Rouge, Ephese	✓		✓		✓		
	177	Time to Sleep	✓	✓	✓		✓	✓	
	178	The Road of Tramways	✓	✓	✓		✓	✓	
1947	179	The Staircase	✓		✓		✓	✓	
	180	A Night street	✓	✓	✓		✓	✓	
	181	The First Rose	✓		✓		✓	✓	
	182	The Walkers	✓	✓	✓		✓	✓	
	183	The Grand Sirens	✓	✓	✓			✓	
	184	The Birth of Venus	✓		✓		✓	✓	
	185	Train of the Night	✓	✓	✓		✓		
1948	186	The Nude and the Mannequin	✓	✓	✓		✓	✓	
	187	Leda	✓		✓		✓	✓	
	188	The Praise of Melancholy	✓	✓	✓		✓		
	189	The Waiting	✓		✓		✓	✓	
	190	The Staircase	✓					✓	
	191	The Balcony	✓	✓	✓		✓		
	192	The Forest	✓						
	193	The Public Voice	✓		✓		✓		✓
TOTAL			121	39	85	28	70	84	8

Appendix 3: Relevant paintings

1936-1946

Note: Only the paintings which could be located and/or a contact person was found, are included in the table.

Year	Title	Location	Contact	Information	Comment
1935	Without title	Royal Museums of Fine Art Belgium	Curator		Part of Liege research project
	The Fire	Royal Museums of Fine Art Belgium			
1936	The Women of the Night	Private collection, formerly in the collection of Edward James Sold at Christies in 1988	Zack Boutwood (Client Service Apprentice at Christie's Client Service)	- none - possibly restored according to the found images.	
1937	The Lamps	Art Institute Chicago	Research centre	No knowledge of or access to conservation documents. No sharing policy.	
1938	The Call of the Night	Scottish National Gallery Of Modern Art (Modern One)	Lesley Stevenson, senior paintings conservator	No material-technical documentation or information on the paintings.	
	Street of the Trams				
1939	Nocturnes	Royal Museums of Fine Art Belgium	Curator		Part of Liege research project
	Pygmalion				
	Phases of the Moon	Museum of Modern Art, New York	Painting and sculpture study centre	Notes on condition are confidential	

		Awakening of the Forest	Art Institute Chicago	Research centre	No knowledge of or access to conservation documents. No sharing policy.	
	1940	Man in the Street	Musée des Beaux-arts de Liège (La Boverie)	Curator		
		The Break of Dawn	Belfius Art Collection	Collection manager		
	1941	Ancient City	The Met, New York	Isabelle Duvernois, Paintings conservator	No material-technical documents or condition reports	
		The Congress	Belfius Art Collection	Collection manager		
	1942	Phases of the Moon III	Museum Boijmans - Van Beuningen	Curator		
	1944	The Red City				
	1946	The Staircase	Museum of Fine Arts Ghent (MSK)	Gerard Lieven, curator	- no research - no known conservation history - present at the Venice Biennale of 1948	

Other periods

Year	Title	Location	Contact	Information	Comment
1947	The Great Sirens	The Met, New York	Isabelle Duvernois, Paintings conservator	No material-technical documents or condition reports	
1948	The Public Voice	Royal Museums of Fine Art Belgium	Curator		Part of Liege research project
1952	Crucifixion				
1957	Ecce Homo	Royal Museum of Fine Art Antwerp	Gwen Borms, head of the conservation lab	No treatment reports	

Appendix 4: Proposal Iperion HS



Description of the project

To upload the file online, please save the file in pdf and rename it with the acronym of the proposal (acronym.pdf)

1. Project summary¹ (max 300 words)*

The Royal Museum of Fine Arts Antwerp (KMSKA) has one of Belgium's largest collections of modern art. They take a leading position in the museum landscape by investing in (material-technical) research, documentation, and knowledge sharing. This translates into promoting the KMSKA as the centre of expertise for James Ensor (1860-1949). The resulting Ensor Research Project in 2013 focused mainly on art historical, iconographic and stylistic issues. To tackle the lack of material technical research on his oeuvre and studio practice, a PhD project was funded and started in 2021 in collaboration with the University of Antwerp (Conservation-Restoration). Direct links with contemporary avant-garde artists such as Van Gogh and Munch are anticipated.

In addition, the KMSKA collection also holds key paintings by Paul Delvaux (1897-1994), another influential Belgian artist, who named Ensor as one of his greatest influences. Delvaux's work makes up an important part of Belgian art history as his oeuvre spans from the early Interwar period to the end of the 20th century. However, **no systematic research** has been conducted yet on the studio practice or built-up of Delvaux' paintings. The information that is currently available on his work consists mainly of biographical books, (video) interviews, and photographs of his (later) workspace. Therefore, the KMSKA sought assistance from master thesis research, dovetailing with ongoing conservation treatments, to initiate research on Delvaux.

The proposed Iperion project will not only substantiate the ongoing or scheduled conservation treatments, but will also underpin and expand the aforementioned PhD and master thesis research. The proposed research is focused on complementing previous investigations with stereomicroscope, conventional imaging methods and MA-XRF imaging.

As for previous Molab proposals (e.g. on Memling), this project is a collaboration between the KMSKA, the Antwerp X-ray Imaging and Spectroscopy laboratory (AXIS-Prof. Koen Janssens) and the Antwerp Cultural Heritage Sciences (ARCHES-Prof. Geert Van der Snickt) research groups of the University of Antwerp.

The main goals are to (1) investigate the *modus operandi* of the painters by characterizing the painting materials and (2) to get an overview of the structural condition of the paintings (see further).

The paintings of interest for analysis are the following:

¹ Be sure to include the novelty and/or added value of the proposed work.



James Ensor



Figure 1: *The Intrigue (ENSOR 2)*, by James Ensor, inv. 1856, 89.5 x 149 cm (HxW), KMSKA



Figure 2: *Woman with Upturned Nose (ENSOR 1)*, inv. 2077, 53 cm x 43 cm x 7 cm (HxWxD) KMSKA



Figure 3: *The Temptation of St. Anthony the Great (ENSOR 3)*, by James Ensor, inv. 4003, KMSKA

Paul Delvaux



Figure 4: *The Pink Bows (TPB)*, by Paul Delvaux, Inv. nr. 2850, 160 x 121,5 cm (HxW), KMSKA

2. Scientific background (max 500 words)*

Ensor

Ensor is seen as the pivotal figure in Belgian avant-garde, but is also a somewhat overlooked artist. He has been of great significance to the German Expressionists, the development of an informal Surrealism after World War II, and certain aspects of post-modernism. His oeuvre is marked by experimenting with different techniques which caused multiple stylistic and iconographical changes. To investigate these changes, momentous works, marking periods of transition, **with sound dating and provenance** were selected for the PhD research and the related Iperion proposal.²

Woman with Upturned Nose (ENSOR 1) is part of Ensor's early period, characterised with a realistic painting style and dark palette. From 1887 on, Ensor switched to a grotesque and symbolic iconography, characterised by using grotesque figures, skulls, and masks. The latter being Ensor's most important contribution to modern art.

The Intrigue (ENSOR 2) is part of the collective memory in Belgium, and besides *Christ's Entry into Brussels in 1889* (1888, The Getty), one of the most prestigious examples of that period in Ensor's oeuvre. It is unvarnished and painted with contrasting, pure, and bright colours, a simple paint layer build-up of mostly thickly applied paint, meticulously following the lines of the underpainting.

From 1887 on Ensor painted several versions of *The Temptation of Saint Anthony the Great* (ENSOR 3). Due to several stylistic changes throughout his oeuvre, the 1927 version is painted in a completely different style than its predecessors. Using almost transparent paint layers and limited colours, the smooth, double layered white ground is left visible and plays an important role in the final appearance of the painting.

Delvaux

² Annelies Rios-Casier, *PhD Fellowship Proposal*, 2021.

Although Paul Delvaux did not want to be labelled a surrealist, his mature period (1935-1950) is greatly influenced by the movement with artists like René Magritte (1898-1967) and André Breton (1896-1966). Delvaux took their ideas, i.e. the freedom of expression, the idea of the subconscious and a dream world, to generate a poetic atmosphere in his paintings.

In *The Pink Bows* (TPB), an unknown world is created by placing recognisable elements in a new context. This early painting already shows Delvaux's most beloved characters, i.e. naked women, in a surreal landscape with classical ruins. One of them wears a pink bow, an element that returns in several other Delvaux paintings.

Literature describes that Delvaux liked painting on a large scale and with very lean paint. Photographs and visual observation of the painting show that he mostly worked in layers and with smaller paint brushes.

TPB was recently restored and raised questions on Delvaux's varnish practice. A very thick, yellowed, and irregular varnish was present. Visual observation and microscopical analysis on samples suggest that this was not applied by the artist himself. However, there are indications leading to believe Delvaux used a reworking varnish in some places. **Optical Coherence Tomography (OCT)** would be useful to provide complementary evidence.

3. *Description of the planned work and experimental methods (if it is the case)³ (max 600 words) **

Ensor

During several conservation treatments, an enigmatic 'grey layer' was reported on various Ensor artworks. In the past, this layer was sometimes interpreted as dirt and therefore removed, but recent examination shows that this layer does not act as a 'regular' dirt layer. It is hitherto unclear if this layer is (a) deliberately applied by Ensor, or a later addition and (b) if this concerns an unsolicited degradation layer or a superficial dirt layer.

Portable Particle Induced X-ray Emission (PIXE), might provide more information on the **materials composition** of the grey layer on ENSOR 2, as this method analyses the surface of the painting and is sensitive to low/medium atomic mass elements. PIXE might be helpful in identifying the used blue colour in said painting, as previous PXRF measurements failed to do so and (artificial) ultramarine is expected.

Digital Holographic Speckle Pattern Interferometry (DHSPI) can answer questions on the **fragility of the paint layers** as the whites in the sky and the blue of the hat scale. The sky area is assumed to be a lead white paint layer on top of a zinc white layer, visible with Ultraviolet-Induced Visible Fluorescence Photography (UIVFP) due to several losses in the top layer. With High Resolution Microscopy (HIROX), we would like to **visualize these separate layers**. This method might confirm or disprove the presence of metal soaps on ENSOR 1 (Figure 5A) and ENSOR 2.

(number, location, etc.).



Figure 5: (A) Detail of ENSOR 1 with the blue arrow pointing to transparent protrusions and the white arrow showing a crater-like loss. (B) Detail on ENSOR 2 showing losses in the lead white layer, showing a zinc white layer underneath. (C): Grey layer follows the contour of the dark blue hat.

The UVFP of ENSOR 3 showed an orange fluorescence typical to that of a red lake. Some paint strokes on the paintings' edges covered by the frame, are of a stronger colour (Figure 6). On ENSOR 1, several small paint strokes with red lakes are present. We know this is a later addition as Ensor did not use lakes this early in his oeuvre. UVFP shows an orange/pink fluorescence of paint strokes that are invisible to the naked eye. These findings raise the question whether the lakes on these paintings have faded.

With reflection FT-IR spectroscopy (FT-IR), additional information with μ -Raman, UV-VIS Induced Fluorescence Hyperspectral imaging (UV-VIS HIS) and UV-VIS Time-Decay (UV-VIS TD) we aim to characterise and identify these lakes and try to measure the possible fading.

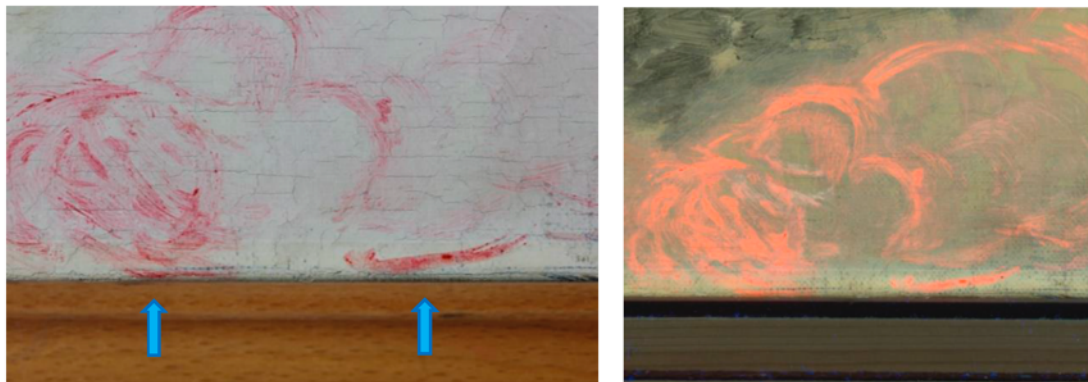


Figure 6: Left: Detail of ENSOR 3, where the blue arrows point out the paint strokes which were covered by the frame. Right: Same detail under UV-light.

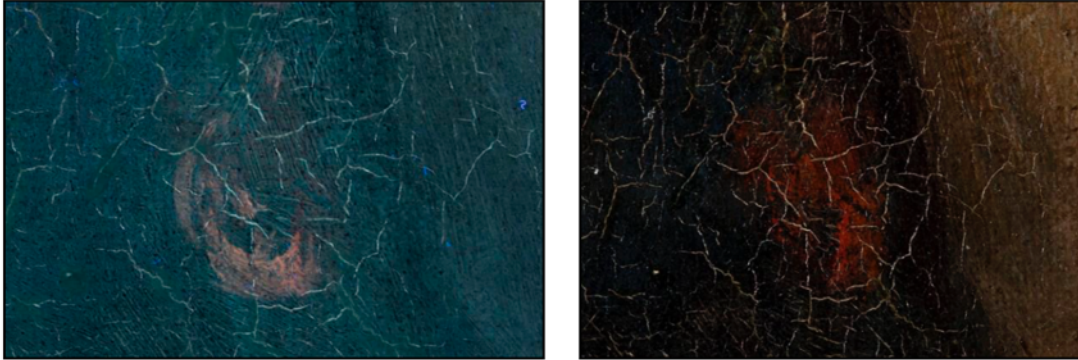


Figure 7: Left: Detail of ENSOR 1 under UV-light. Right: Detail of under normal light.

Delvaux

Current research almost exclusively describes the art historical context of Delvaux's oeuvre. Therefore, the MOLAB research would preferably concentrate on the characterisation of layers and materials. The next paragraphs clarify the scope of this research.

To acquire an extensive understanding of the materials Delvaux used, FT-IR and HIS would be exceptionally useful as they can determine the **nature of the pigments and binders**. They would be beneficial in complementing the already conducted MA-XRF imaging. Furthermore, FT-IR can help in understanding several resin-like deposits on the surface (Figure 8).

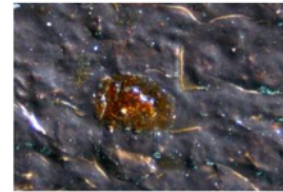


Figure 8: Resin-like deposit.

In the past, *TPB* was often attributed a bad state of conservation, resulting in counter-advising loans. Before the recent restoration, multiple horizontal cracks, possibly formed due to incorrect handling of the painting, were visible. With DHSPI, we could gain insight in the current **structural condition of the materials**. Results could enable the monitoring of the painting itself and its handling.

Microscopic observations showed protrusions and crater-like losses in several locations of the paint layer (Figure 9). They are currently hypothesised as the result of **metal soaps**. In other locations, orange deposits were found. With HIROX, both phenomena could be studied with more precision as to get a better understanding.



Descriptions of Delvaux's working process indicates the use of an underdrawing in each painting. NIR-HIS would be useful to determine to what extent this is true for TPB.

Samples of the painting show uncharacterizable organic layers in the painting's stratigraphy, possibly indicating the presence of a reworking varnish. Some samples, however, were considered unrepresentative which makes the results uncertain. With OCT, we can analyse relevant areas in the painting in a **non-destructive** way to (a) confirm or reject the **hypothesis of a reworking varnish**, and (b) **characterize** such a layer. The results in this painting can be used as a **benchmark** for other paintings in Delvaux's oeuvre and therefore help with the decision-making in future restorations regarding varnish removal. Furthermore, with HIROX, the samples could be analysed in greater depth to get a clearer view of the **stratigraphy**.

Measurement strategy

	Day 1		Day 2		Day 3		Day 4	
OCT	AM		AM		AM		AM	TPB
	PM		PM		PM		PM	
VIS-NIR-HIS	AM	TPB	AM		AM		AM	
	PM		PM		PM		PM	
UV-VIS TD	AM	ENSOR 2	AM	ENSOR 3	AM		AM	
	PM	ENSOR 1	PM		PM		PM	
UV/VIS-HIS	AM	ENSOR 2	AM	ENSOR 3	AM		AM	
	PM	TPB	PM	ENSOR 1	PM		PM	
DHSPi	AM		AM	ENSOR 1	AM	ENSOR 2	AM	
	PM		PM	TPB	PM	ENSOR 3	PM	
High Res Microscopy	AM		AM	ENSOR 2	AM	TPB + samples	AM	
	PM		PM	ENSOR 3	PM	ENSOR 3	PM	
μ-Raman	AM		AM		AM	ENSOR 1	AM	ENSOR 3
	PM		PM		PM	ENSOR 2	PM	
PIXE	AM		AM		AM	ENSOR 3	AM	ENSOR 2
	PM		PM		PM	ENSOR 1	PM	TPB
FTIR	AM		AM		AM	ENSOR 2	AM	ENSOR 1
	PM		PM		PM	TPB	PM	ENSOR 3

Figure 10: Overview of a proposed timetable. The grey area shows techniques to be conducted in a dark room, which is available at the KMSKA.

4. *Previous analysis on the artefact (max 300 words)**

Ensor (PXRF, Samples (SEM-EDX, FTIR, MSGC), UIVFP, UVR, IRP, FCIR, XRR)

The Intrigue

The grey layer was analysed once in 2005. Several samples were taken on *The Intrigue* and studied with optical microscopy (OM) and SEM-EDX. The results showed this layer as a semi-transparent layer with a thickness of ca. 1 μm containing very fine dark red/black organic particles and a binder containing lead compounds.

Swab samples were analysed with FTIR and GC-MS but the results were inconclusive due to contamination. Other imaging techniques did not yield further information on this layer.

ENSOR 2 has been analysed with PXRF and will be analysed with MA-XRF and MA-XRPD in March/April.

Woman with the Upturned Nose and Temptation of Saint Anthony

Research on Ensor's pigments by prof. G. Van der Snickt showed that Ensor purchased 'Carmin fixe de garance' and 'Laque de garance pourpre' with the company of Blockx & fils in 1890; respectively referring to a red and purple natural madder lake. It is thought that Ensor used high-quality materials and therefore used more stable and expensive madders. However, no further research was conducted on the state and possible fading of the used madders in Ensor's paintings.



Delvaux (UIVFP, IRP, UVR, MA-XRF)

The KMSKA carried out multiple imaging techniques. UIVFP shows two (varnish) layers with a different application and fluorescence/nature. Samples were studied by KIK-IRPA (Brussels) by means of optical microscopy, Py-GC/MS and THM-GC/MS. They verify the presence of the following layers: The top varnish layer (an oxidised oil-colophony varnish with traces of beeswax/candelilla wax) and two thin organic layers (Figure 11-Figure 12, (3) and (5), nature undetermined). We want to (1) investigate whether the varnish/organic layers are present either overall or locally and (2) determine the nature of the organic layers to further explore the hypothesis of a reworking varnish.

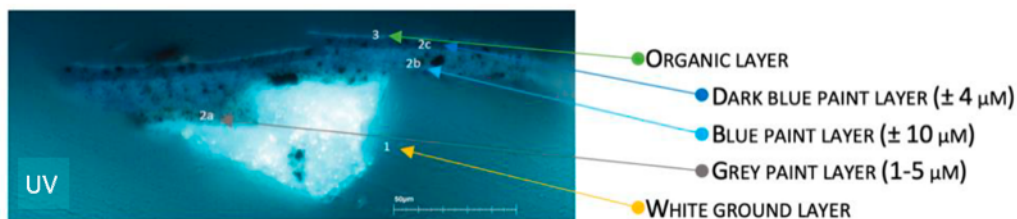


Figure 11: Sample from the sky taken by KIK-IRPA, UV x500 © KIK-IRPA, 2021. Due to disintegration of the sample, different parts were embedded separately. The top varnish layer is not visible in this part of the sample.

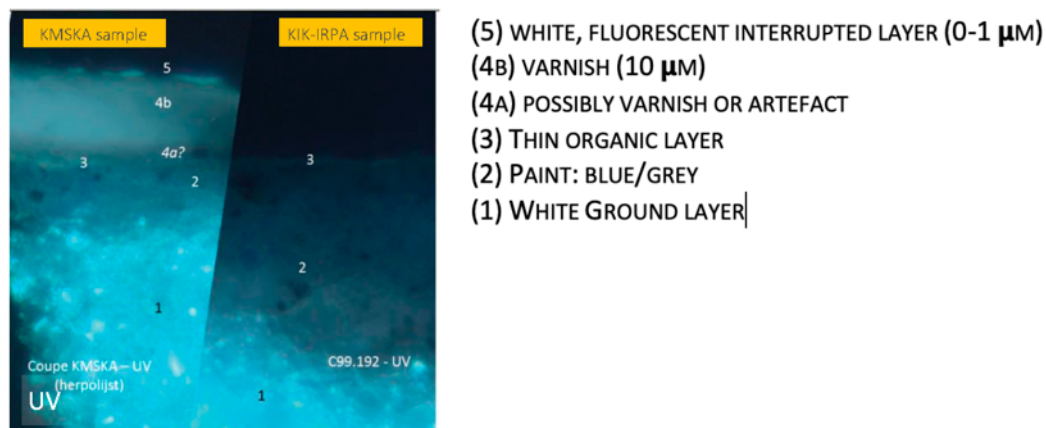


Figure 12: Sample from the sky taken by KMSKA (left), UV x1000 compared to aforementioned sample taken by KIK-IRPA (right) © KIK-IRPA, 2021.

The stone floor lines have been painted over graphite (?) lines. Some were erased by the artist by painting over them (Figure 13), indicating he changed his mind on their position. The IRP seems to reveal a possible underdrawing under the frontal female figure (Figure 14).

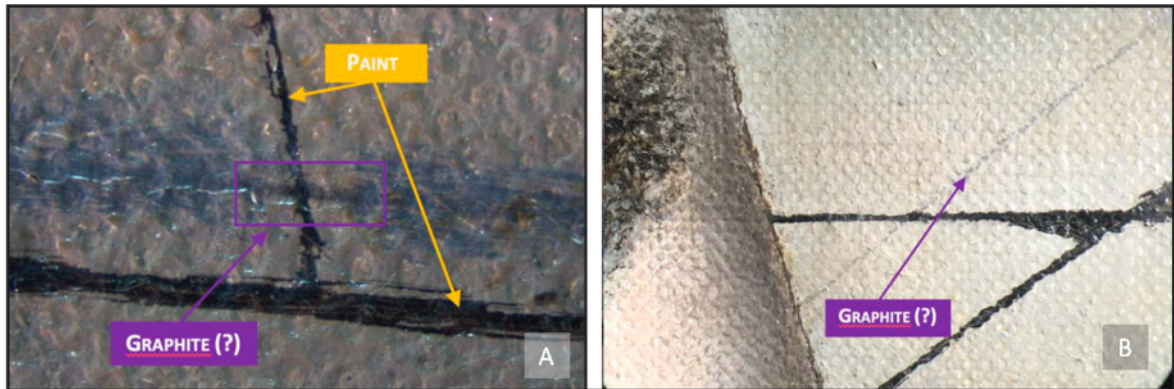


Figure 13: (A) Detail of the stone floor with partially erased graphite line, (B) Unerased graphite.

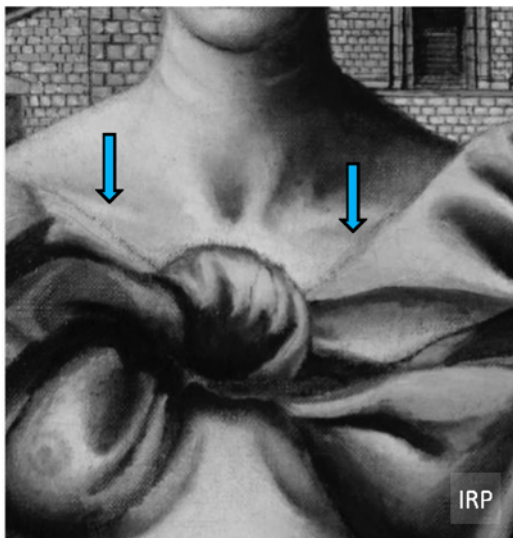


Figure 14: Possible indication of underdrawing © Rik Klein Gotink, 2021

To conclude, MA-XRF has been performed, however, results have not yet been interpreted.



5. *Expected achievements (max 400 words)**

In summary, we hope to collect the following information with the proposed MOLAB-techniques:

Ensor: *Woman with the Upturned Nose and The Temptation of Saint Anthony*

- Identification of the colorants of the lakes
- Indication on the possible fading of the lakes.
- Confirmation or disproval of the presence of metal soaps
- The nature of the materials used for the paint (binding media, pigments).

Ensor: *The Intrigue*

- Information on the nature of the grey layer
- Insights in the condition of the fragile paint layers
- Confirmation or disproval of the presence of metal soaps.
- Indication on the potential use of (artificial) ultramarine.

Delvaux: *The Pink Bows*

- The nature of the materials used for the paint (binding media, pigments).
- Confirmation or disproval of the presence of a reworking varnish.
- The nature of the organic layer underneath the top varnish layer.
- Confirmation or disproval of the presence of an underdrawing + characterisation.
- The nature of the drops in the grey areas around the frontal figure.
- Identification of the structural condition of degraded materials (metal soaps?) and previous interventions

6. *Impact and dissemination plan (max 400 words)**

Communication of the results to the non-expert audience would happen in two steps. The first step is communication of the results on the website and blog of KMSKA.⁴ The second step is integrating the research results in the Online Scholarly Catalogue (OSC) that is being launched in '2023-'24 by KMSKA. The OSC aims to gather all scientific and art historical information about Ensor's work and his contemporaries. This increases access to scientific research and presents it in an understandable way for a broad public.

Up to now, the performed research has mainly focused on art historical, iconographic and stylistic analysis. In view of the high cultural value of the proposed artists, we believe that material-technical research is relevant and necessary. First, understanding the working process and materials would expand the technological knowledge on Belgian modernist painters. Second, the results would prove beneficial for decision-making in conservation projects. Furthermore, it would enable trans-museum collaboration for future research, as the results of the proposed project can serve as a benchmark for Ensor and Delvaux.

⁴ www.kmskablog.wordpress.com
www.kmska.be



The ensuing information about Ensor will be included in a PhD-thesis on the evolution of materials and techniques in his oeuvre. In this PhD trajectory, articles on the grey layer and the use of lakes are planned. The results of the MOLAB research will be integrated into these articles and if possible, published in Heritage Science Journal or Studies in Conservation.

The results about Delvaux will be incorporated in a master's dissertation, focusing on the material-technical build-up of *TPB* by means of a holistic approach to research. It will be the first document elaborating on the technical aspects of Delvaux's practice in his mature period, covering the layers from the support to the top varnish layer. We aim to include the results of this project in upcoming conferences on the materials of modern art, both as (poster) presentations and lectures.

All publications will acknowledge the Iperion HS and MOLAB funding.

7. References (min 5 – max 10)*

1) Van der Snickt, Geert. "James Ensor's Pigments studied by means of portable and Synchrotron Radiation-based X-ray Techniques: Evolution, Context and Degradation." PhD diss, Universiteit van Antwerp, 2012.

2) Mark Leonard and Louise Lippincott, *James Ensor's Christ's Entry into Brussels in 1889: Technical Analysis, Restoration, and Reinterpretation*. Art Journal, Vol. 54, No. 2, Conservation and Art History (Summer, 1995), 18-27.

3) Rios-Casier, Annelies. "Material-technical research on James Ensor's 'The Oystereater'". Master thesis, University of Antwerp, 2020.

4) Decq, Louise. "2021.14659 - Paul Delvaux – Analysis (Microscopy and Py-/THM-GC/MS) of samples of The Pink Bows." Koninklijk Instituut voor het Kunstpatrimonium- Institut Royal du Patrimoine Artistique, 2021.

5) Labarque, Ineke. "Condition Report for Exhibition Loan ": Koninklijk Museum voor Schone Kunsten Antwerpen, 2000.

6) Barthelman, Z., and Julie van Deun. *Paul Delvaux: Odyssee Van Een Droom*. Wommelgem: Paul Delvaux Stichting en BAI, 2007.

7) Ford, Thierry, Magdalena Iwanicka, Elena Platania, Piotr Targowski, and Ella Hendriks. "Munch and Optical Coherence Tomography: Unravelling Historical and Artist Applied Varnish Layers in Painting Collections." *The European Physical Journal Plus* 136 (2021).

8) Kubik, Maria. "Hyperspectral Imaging: A New Technique for the Non-Invasive Study of Artworks." Chap. 5 In *Physical Techniques in the Study of Art, Archaeology and Cultural Heritage*, edited by Dudley Creagh and David Bradley, 198-255. Amsterdam, The Netherlands: Elsevier Science, 2007.

9) RTBF. *Interview De Paul Delvaux*. RTBF, 1972.



Appendix 5: Archival footage

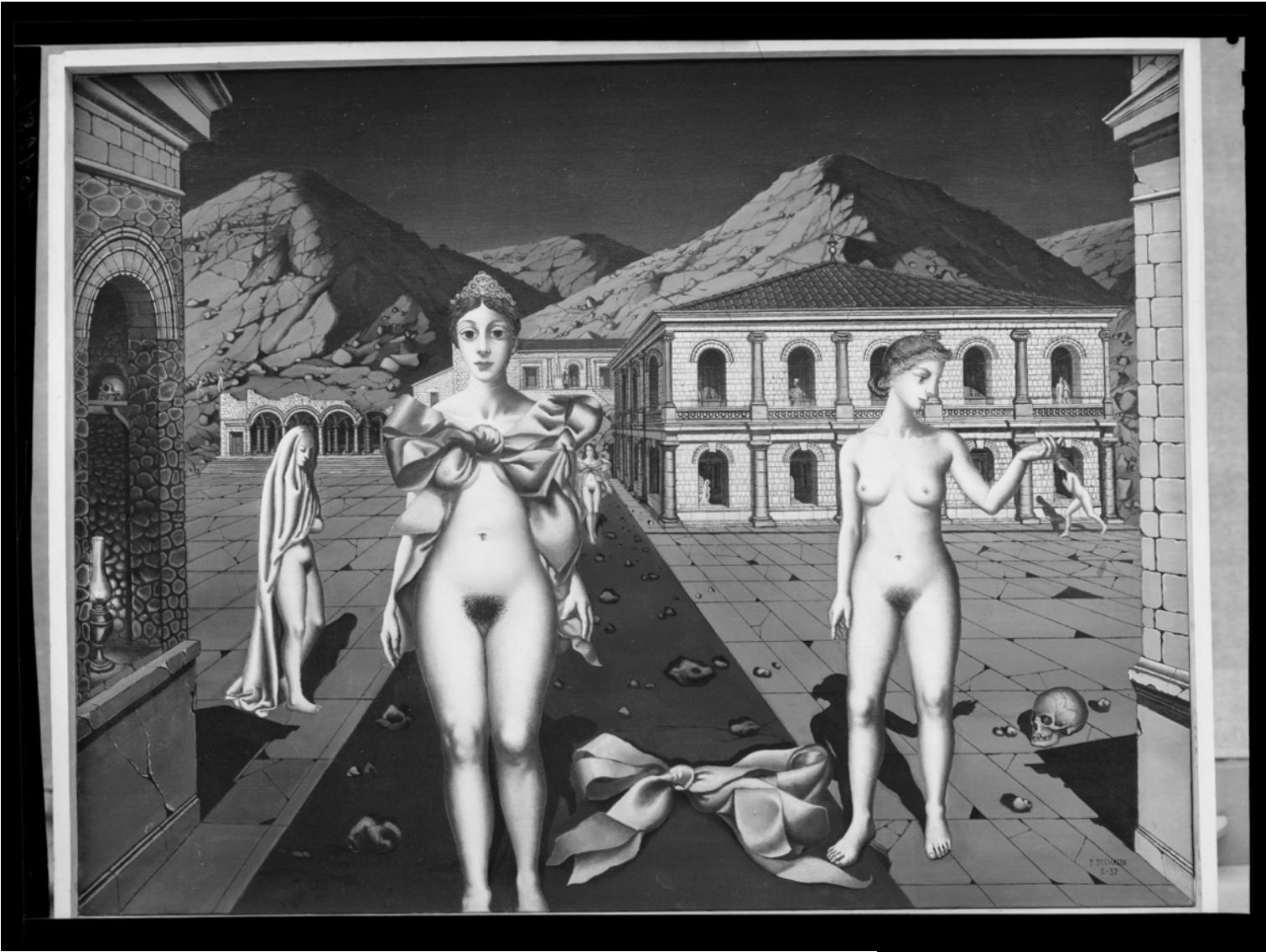


Figure 90: 1946 © KIK-IRPA, Brussel



Figure 91: 1957 © KIK-IRPA, Brussel

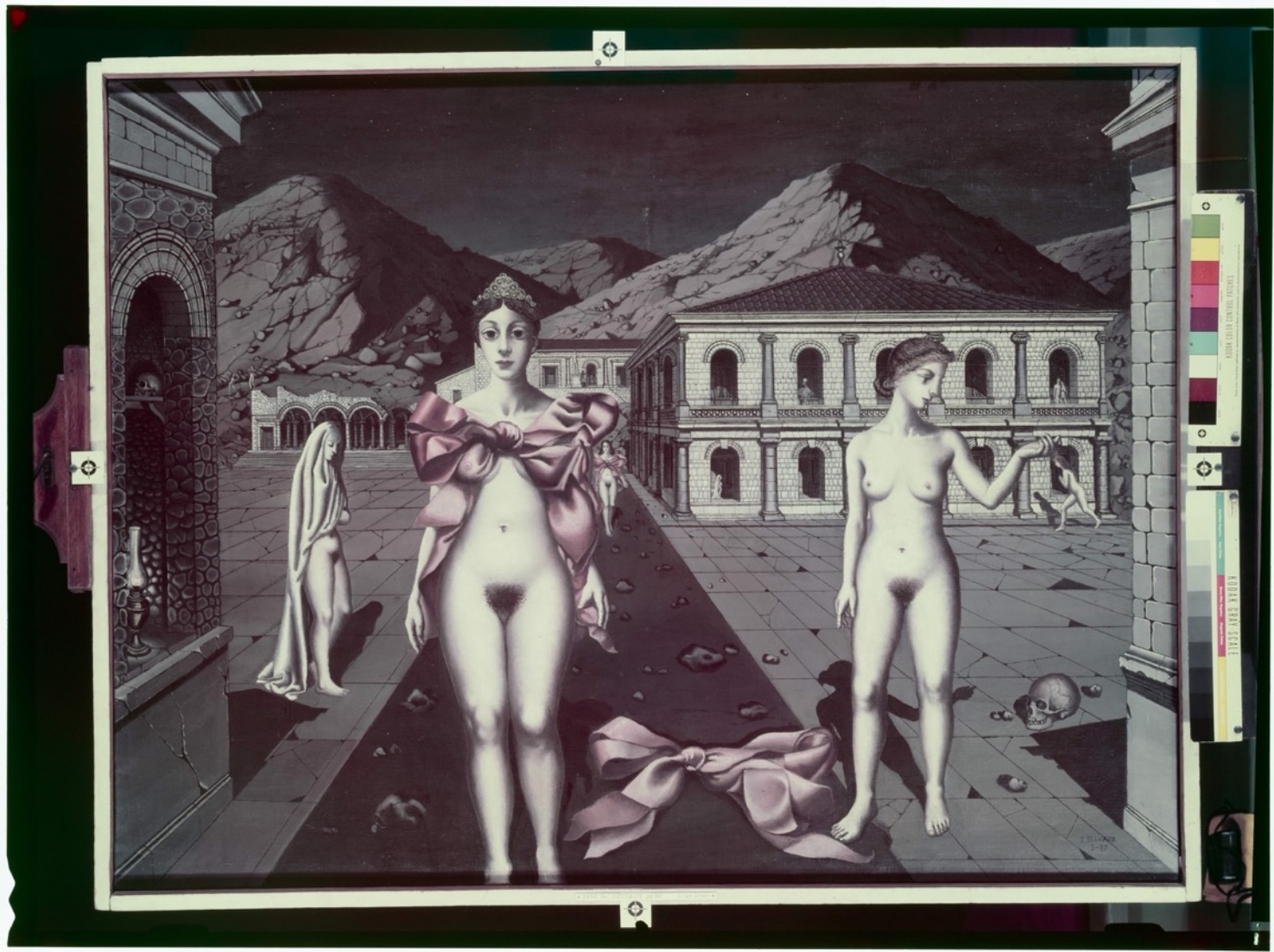


Figure 92: 1972, origineel, © KIK-IRPA, Brussel

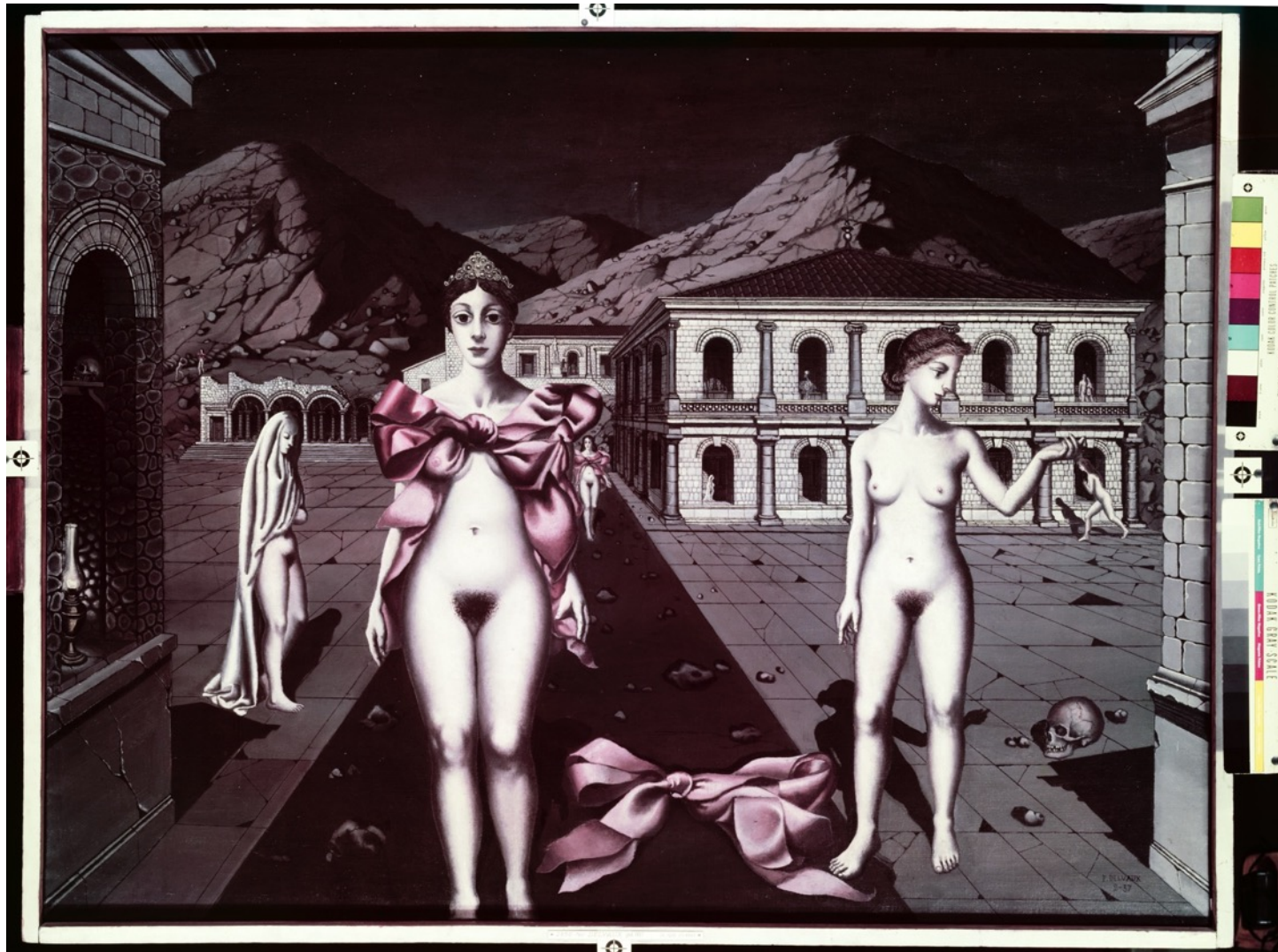


Figure 93: 1972, na beeldbewerking door Foto Schelfhout Antwerpen.

Appendix 6: Visible photography



Figure 94: Visible photography before treatment. ©Rik Klein Gotink



Figure 95: Visual photo after treatment. © Rik Klein Gotink

Appendix 7: UIVFP



Figure 96: UIVFP before treatment. © Rik Klein Gotink



Figure 97: UIVFP after treatment. ©Rik Klein Gotink

Appendix 8: IRP



Figure 98: IRP before treatment. No picture was taken after treatment. ©Rik Klein Gotink

Appendix 9: UVIFP-FC

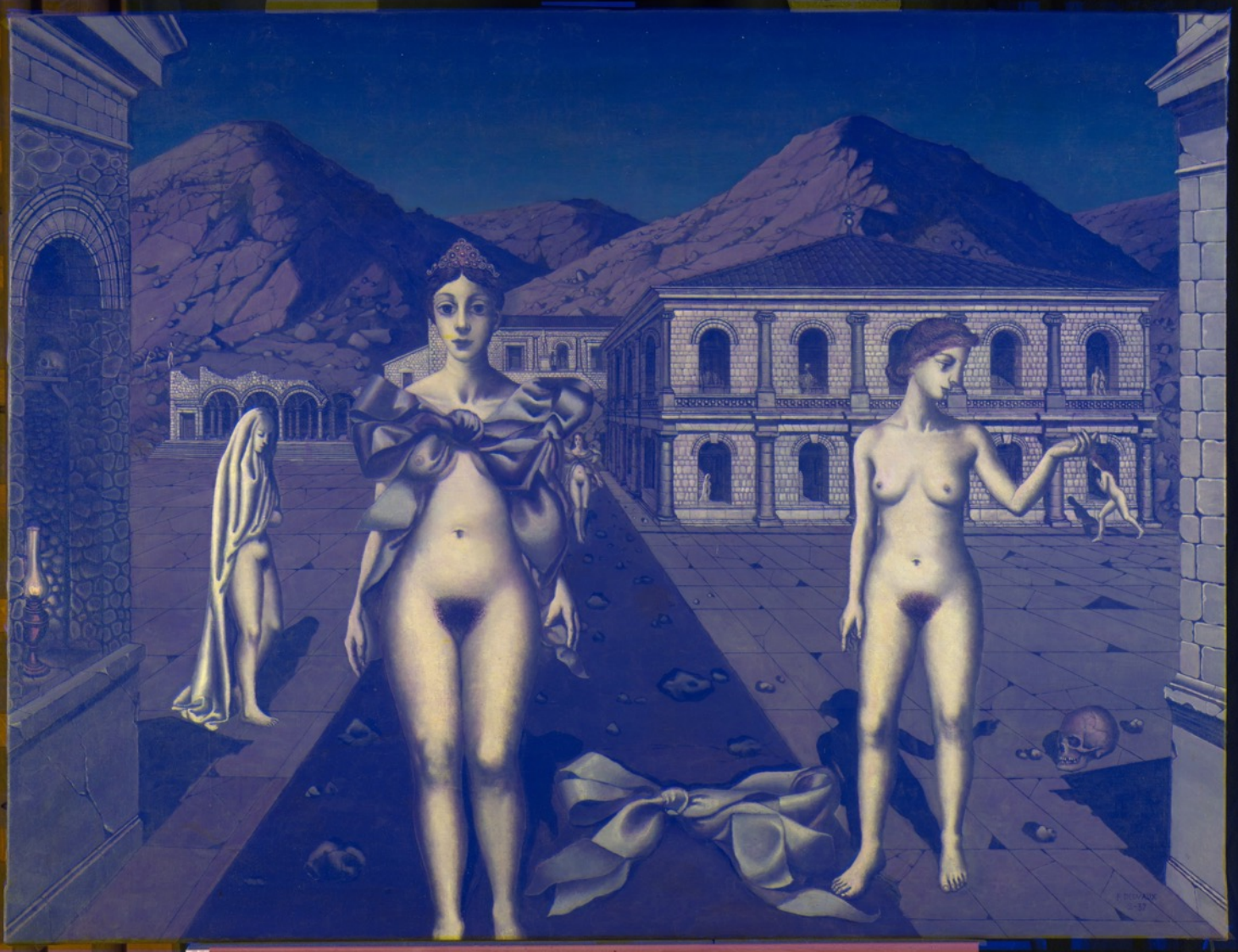


Figure 99: UVIFP-FC before treatment. ©Rik Klein Gotink, adjusted to FC by Eveline Vandeputte

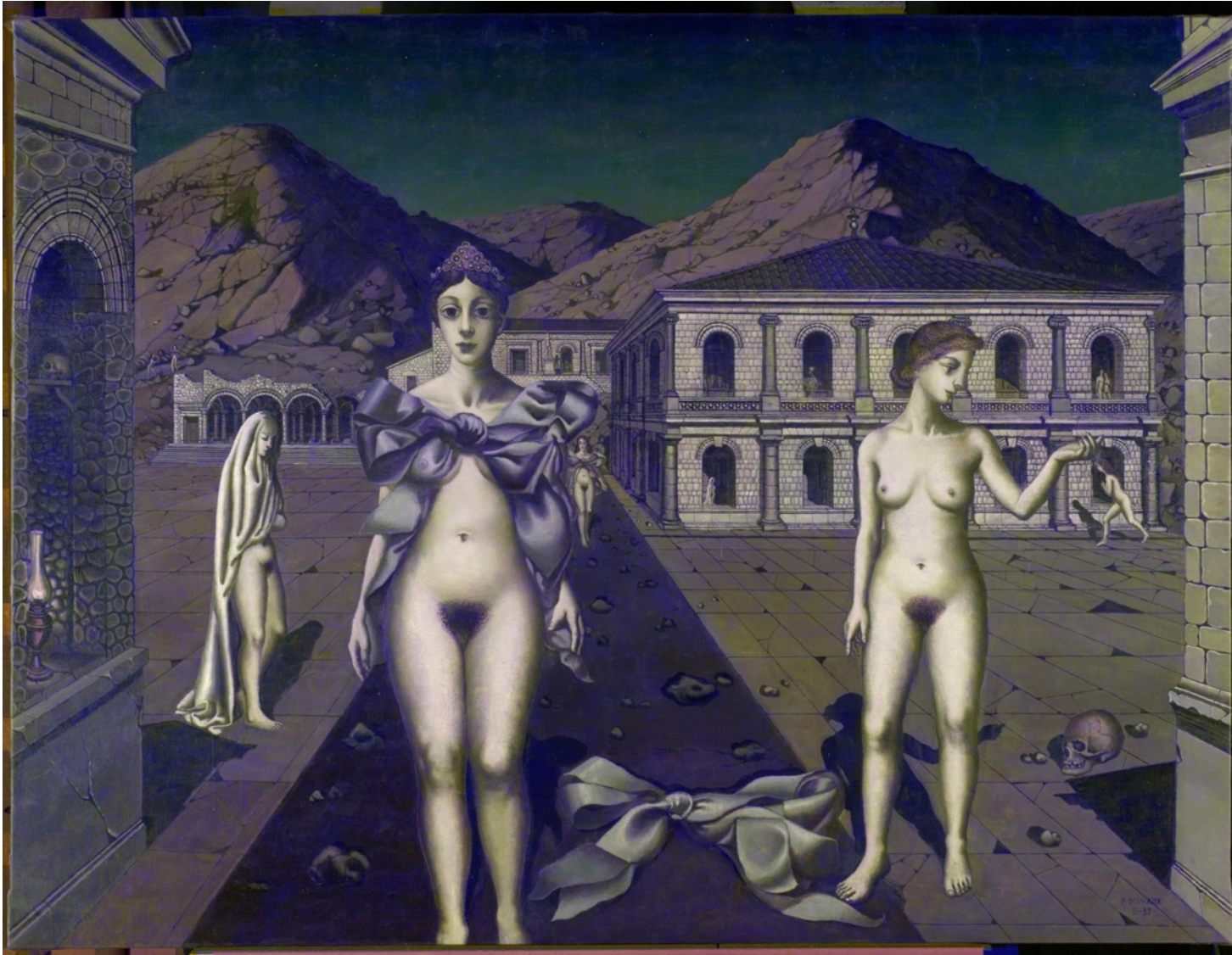


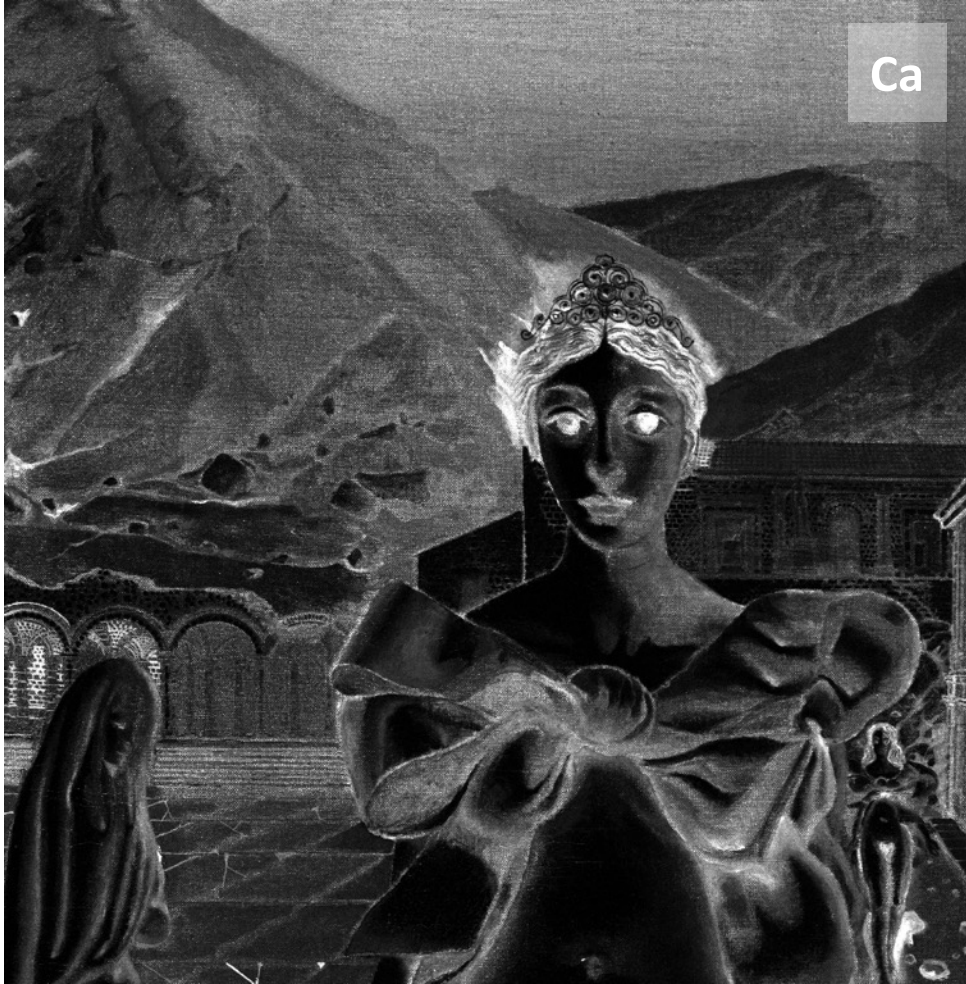
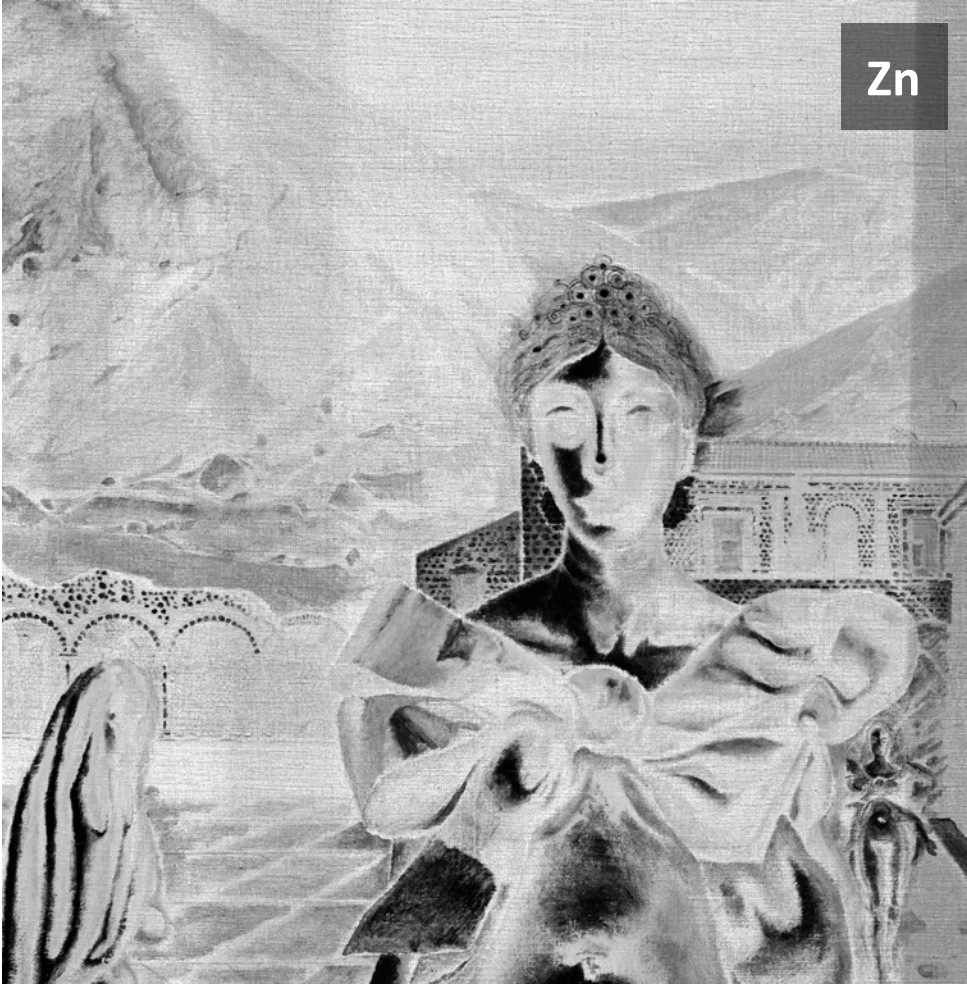
Figure 100: UVIFP-FC after treatment. ©Rik Klein Gotink, adjusted to FC by Eveline Vandeputte

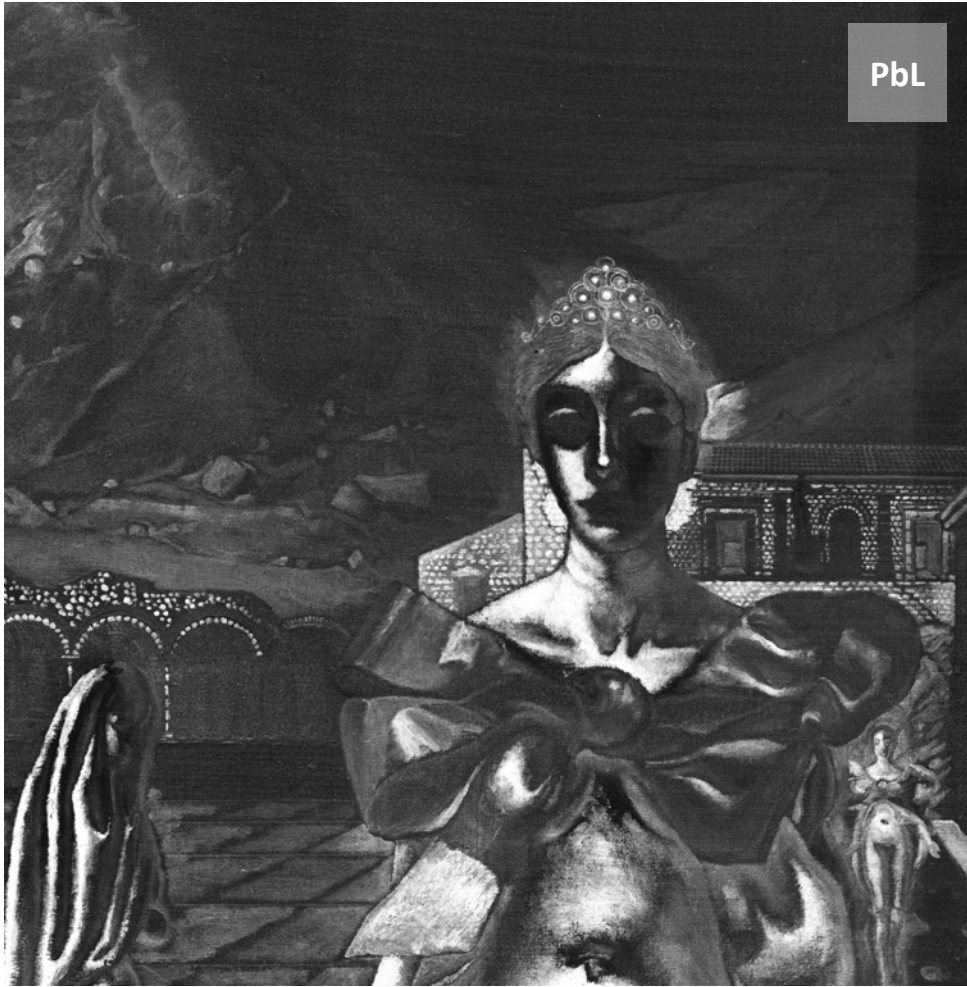
Appendix 10: IRP-FC

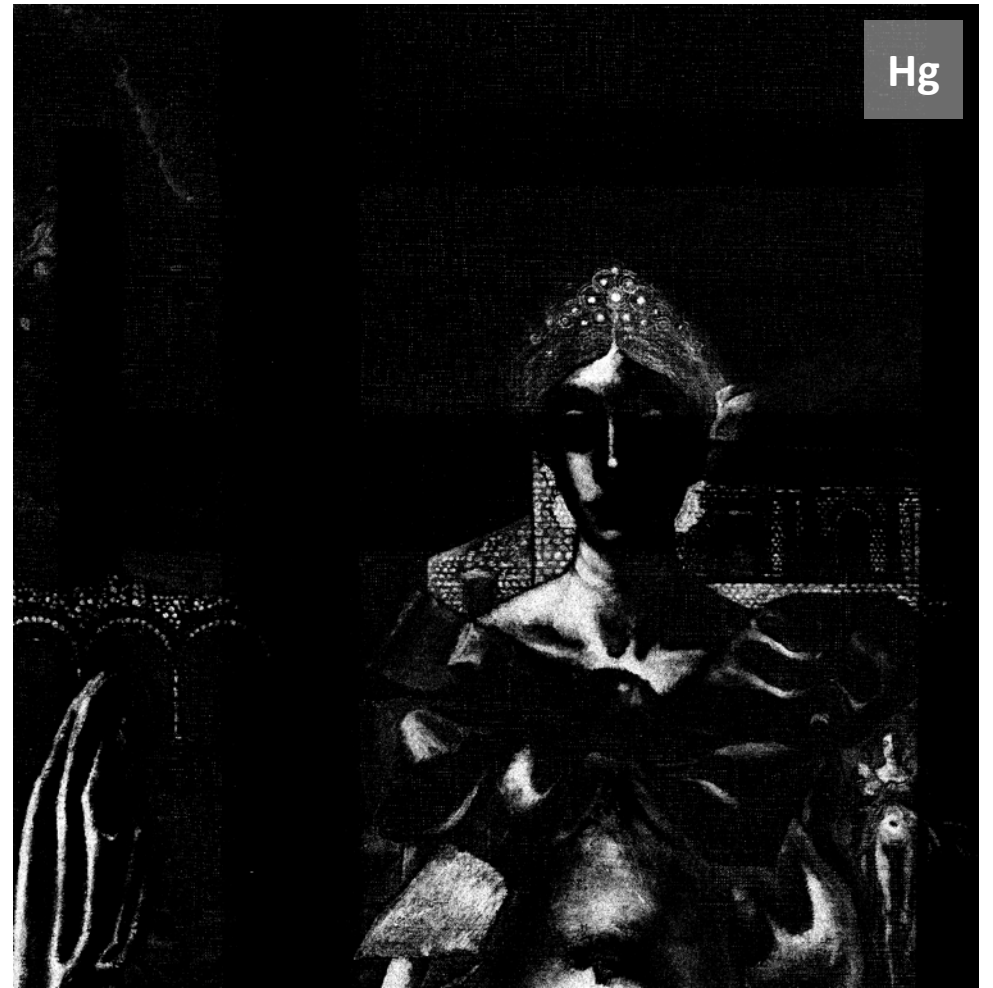
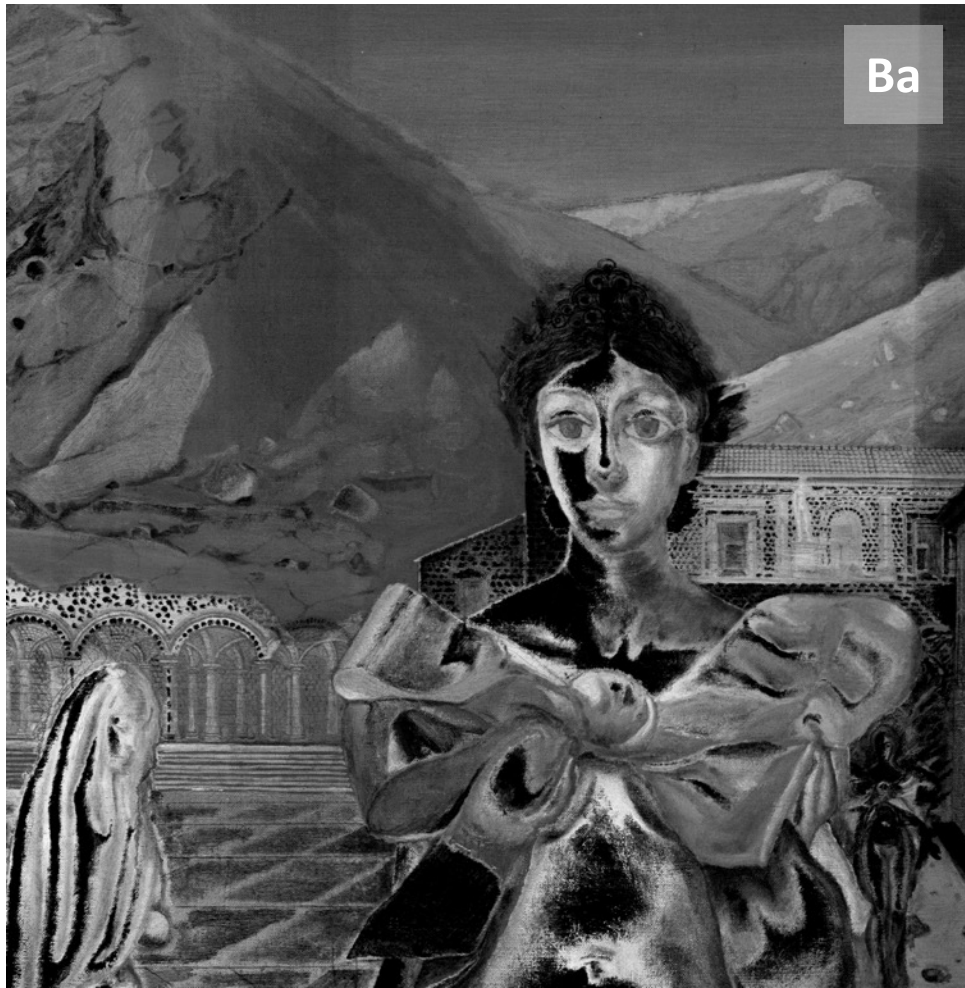


Figure 101: IRFC before treatment. ©Rik Klein Gotink

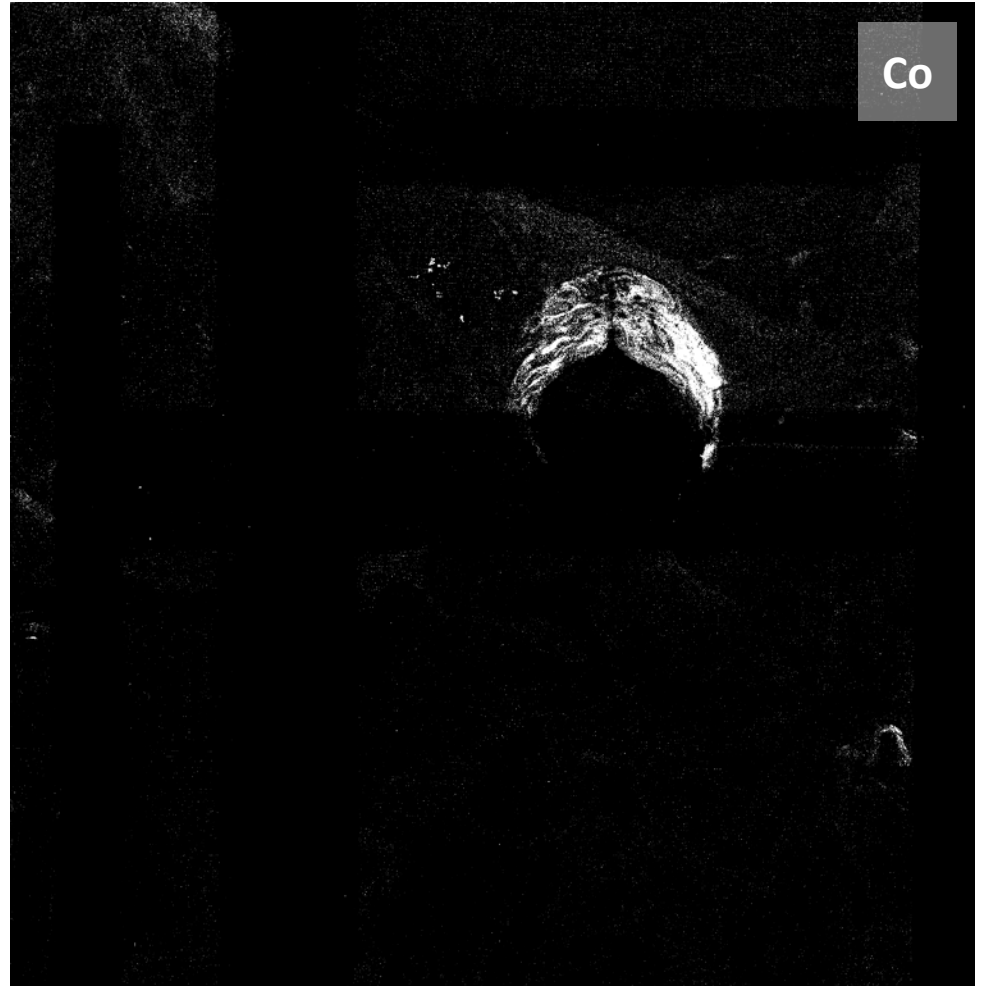
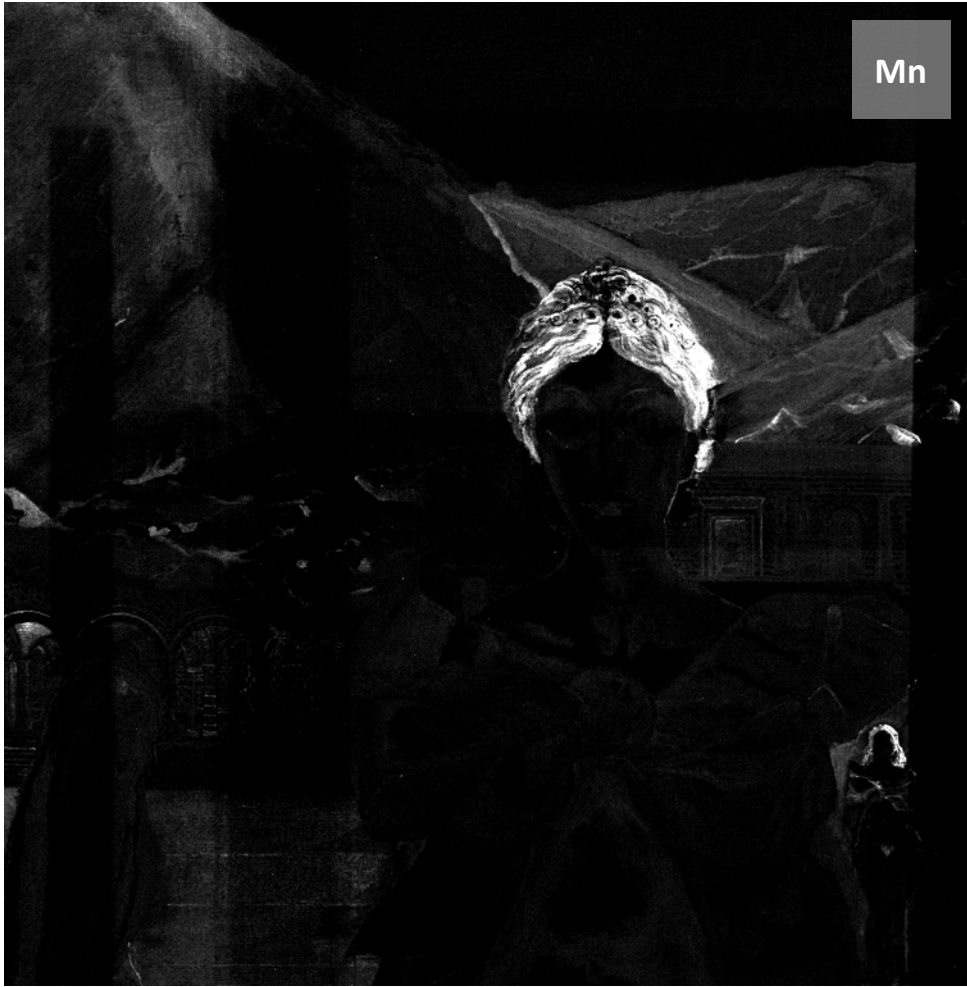
Appendix 11: Ma-XRF scans



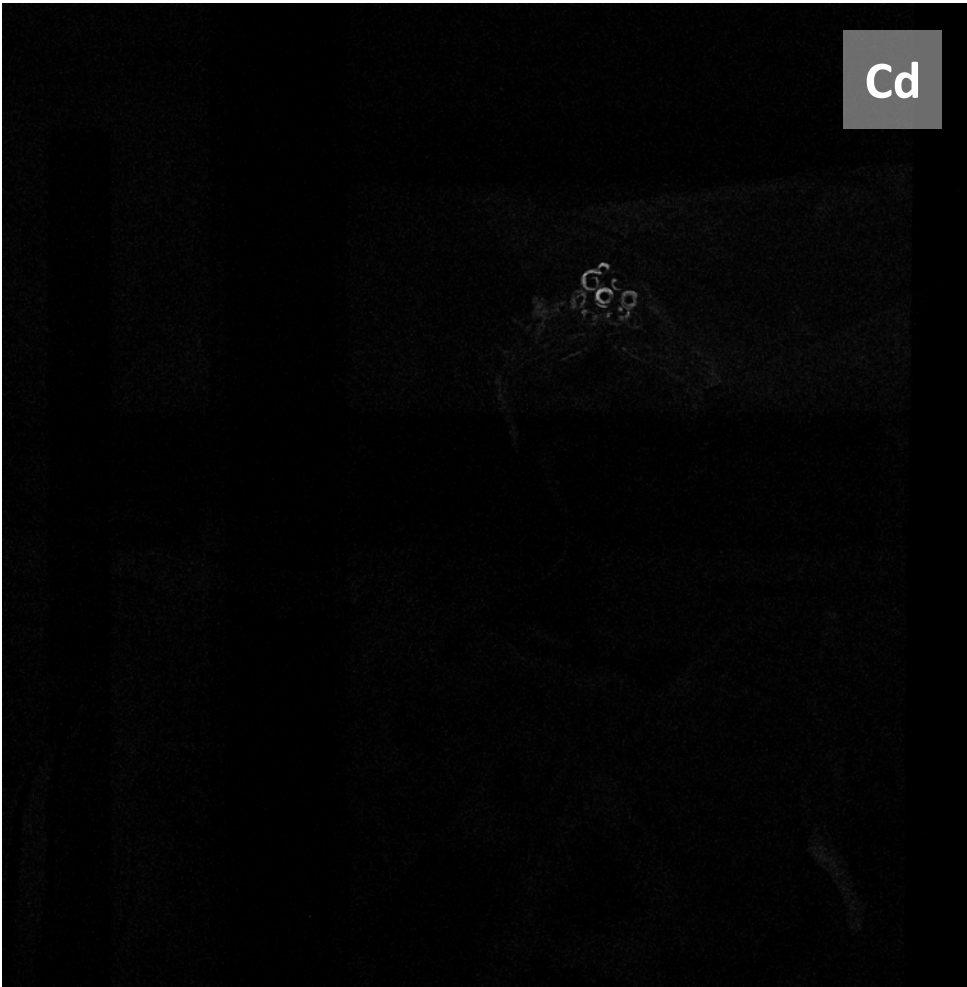




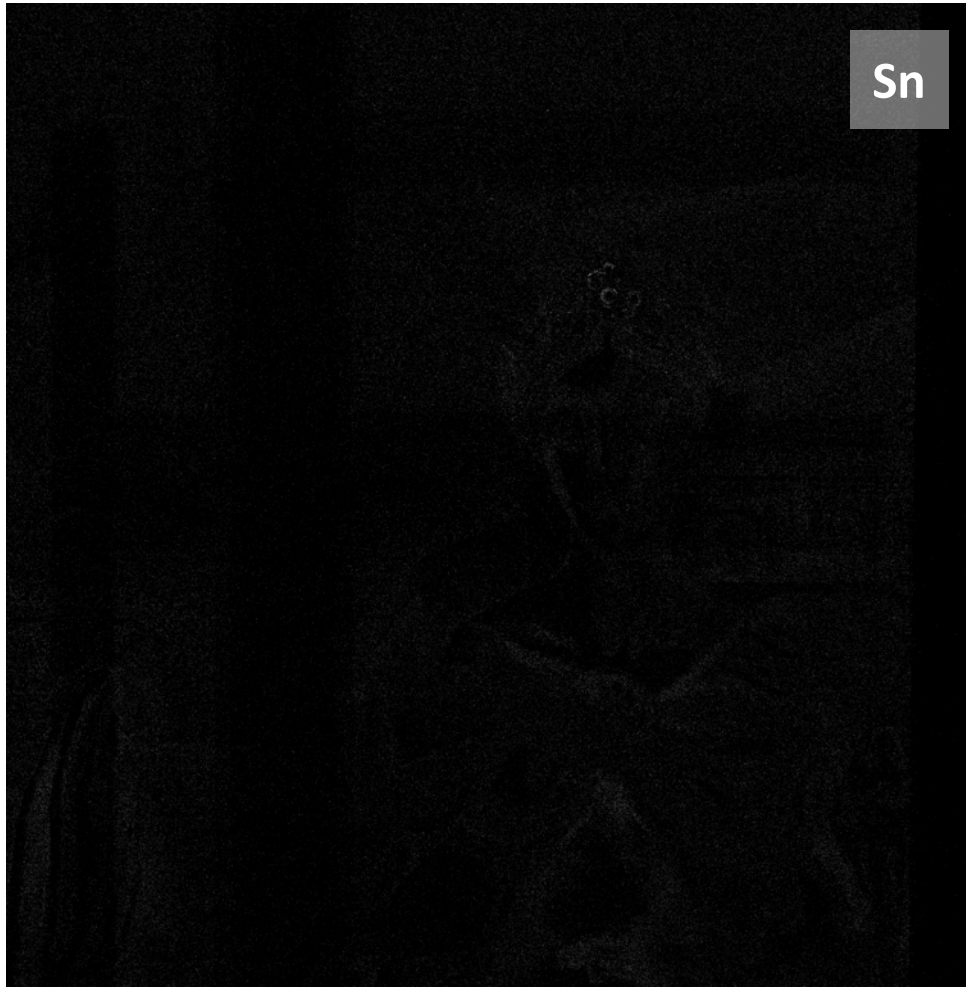




Cd



Sn



Appendix 12: Report Sample Analysis

2021.14659 • Paul Delvaux • De Roze strikken

Gemeente: Antwerpen
Instelling of verzameling: Koninklijk Museum voor Schone Kunsten Antwerpen
Type van object: Schilderij
Titel van het object: De Roze Strikken



Aanvrager: Gwen Borms, hoofd restauratie-atelier KMSKA
Contactpersoon: Gwen Borms
Lange Kievitstraat 111-113 bus 100
2018 Antwerpen
+32 3 575 58 84 +32 497 896 508
gwen.borms@kmska.be

Dossiernummer KIK: 2021.14659
Betrokken cel(len) van het KIK: Departement Laboratoria – Labo Schilderkunst
Verantwoordelijke van de cel(len): Steven Saverwyns
Contactpersoon KIK: Louise Decq
Auteur van het verslag: Louise Decq
Datum van het verslag: 17/9/2021

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Federaal wetenschapsbeleid
INSTITUT ROYAL DU PATRIMOINE ARTISTIQUE
Politique scientifique fédérale

1 Objectbeschrijving

Objectnummer KIK	-
Gemeente	Antwerpen
Instelling	KMSKA
Inventarisnummer	2850
Type van object	Schilderij
Titel van het object	De roze strikken
Toegeschreven aan	Paul Delvaux
Datum	1937
Materiaal	Olieverf op doek
Afmetingen	121,5 x 160,0 cm (zonder lijst)
Eigenaar	KMSKA

2 Doelstelling

Ter ondersteuning van de restauratie van het schilderij, wilt men inzicht krijgen in de lagenopbouw van de picturale lagen. In het bijzonder is er onduidelijkheid over de aard van de vernislaag of vernislagen. De vernislaag of vernislagen, zijn zichtbaar dikker op plaatsen waar de vernis zich kon ophopen boven een opstaande craquelure, wat aangeeft dat allicht minstens een deel van de vernislaag van latere datum zou zijn. Op basis van observatie en ultraviolet foto's, heeft men het vermoeden dat er twee lagen vernis aanwezig zijn: een vrij dikke, onregelmatige, gelige laag die aangebracht zou zijn op een verf die al enigszins verouderd was, en een dunnere, egale, kleurloze vernis. De vernislagen zouden mogelijk te onderscheiden zijn door een verschil in kleur en fluorescentie. De inspectie van een eerste dwarsdoorsnede (voor aanvang van deze studie), lijkt aan te geven dat het de bovenste laag zou zijn die ongelijk en vergeeld is. Op die dwarsdoorsnede was geen retouchevernis aanwezig, en geen oppervlaktevuil onder of tussen de vernislagen.

Als er verschillende vernislagen zijn, is dus de verdere vraag of een originele vernis aanwezig kan zijn. Een vuilafzetting zou bijvoorbeeld kunnen wijzen op een tussentijd tussen het aanbrengen van elk van de vernissen. Men is ook op zoek naar eventueel een lokaal aangebrachte vernislaag, aanwezig tussen verflagen. Als het mogelijk is, zou men ook graag de vernis willen karakteriseren, liefst onderscheiden in samenstelling, op de dwarsdoorsnede of in de organische analyse.



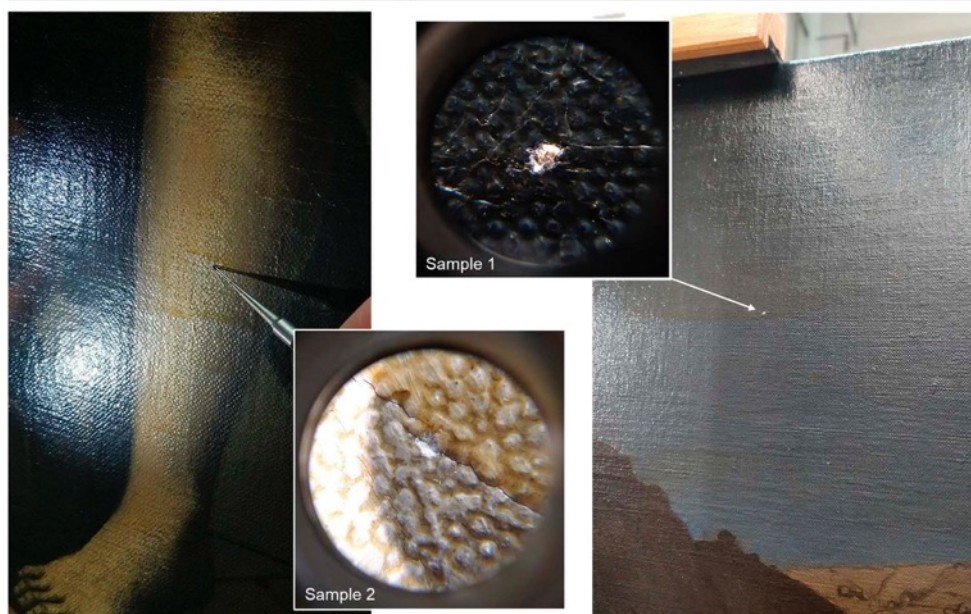
Figuur 1: Het vernis is vergeeld en ongelijk aangebracht. Net boven sommige horizontale craquelures ligt het vergeelde vernis wat dikker, wat mogelijk een aanwijzing is van een latere aanbrenging.

3 Werkwijze

3.1. Staalname

Tabel 1. Overzicht stalen.

	Nummer	Dwarsdoorsnedes	Beschrijving	Type staal	Type analyse
1	P247.051	C99.183; C99.184; C99.192	Donkerblauw, lucht, waar de gelige vernis vrij dik ligt	Dieper staal en poederig materiaal	Microscopie, THM-GC/MS
2	P247.052	C99.185; C99.186	Wit, carnatie	Dieper staal en poederig materiaal	Microscopie, THM-GC/MS
3	(KMSKA)	(KMSKA)	Donkerblauw, lucht. (x:147,5 y:100 cm). Net boven een horizontale craquelure.	Dwarsdoorsnede	Microscopie



Figuur 2: Plaats van staalname van stalen 1 en 2.

3.2 Dwarsdoorsnedes en microscopie

Delen van de twee stalen werden omgezet in dwarsdoorsnedes door ze in te bedden in een Technovit 2000 LC-hars op basis van methacrylaat, dat uithardt onder blauw licht volgens het Technotray CU-polymerisatieproces. Het staal wordt op een reeds gepolymeriseerd kubusje geplaatst en vervolgens bedekt met een tweede laag vloeibaar hars dat vervolgens wordt gepolymeriseerd. Het monster wordt dus volledig ingebed in een transparant blok hars dat mechanisch wordt gepolijst met schuurpapier met korrelgroottes van 200 tot 4000 mesh en vervolgens met de hand fijn gepolijst met schuurpapier (Micro-Mesh) met korrelgroottes tot 12000 mesh tot het monster aan een glad oppervlak ligt. In een volgende stap wordt de verkregen dwarsdoorsnede bestudeerd met een optische microscoop (Zeiss Axio M.1 Imager), met behulp van gepolariseerd wit licht en UV-licht (*excitation bandpass filter* van 390 tot 420 nm, beamsplitter bij 425 nm en emission lowpass filter van 450 nm). Bindmiddelen en

vernissen worden zo beter leesbaar. Een overzicht van deze foto's wordt gegeven aan het einde van dit verslag. Hierbij ook foto's van een coupe die door het KMSKA werd gemaakt en door het KIK werd gefotografeerd.

3.3 Methodologie THM-GC/MS en Py-GC/MS

De verf en vernislagen werden vervolgens geanalyseerd met *pyrolyse gaschromatografie/massaspectrometrie* (py-GC/MS) en *thermally assisted hydrolysis and methylation gaschromatografie/massaspectrometrie* (THM-GC/MS). Bij beide analyses wordt door verhitting het staal afgebroken tot kleinere componenten die vluchtig genoeg zijn voor analyse. Aangezien veel van die kleinere componenten polaire groepen vertonen, die moeilijk te scheiden zijn op de chromatografische kolom, kan worden beslist om tijdens de pyrolysestap een derivatisatiereactie uit te voeren door toevoeging van TMAH (tetramethylammonium hydroxyde). Zo worden polaire groepen gemethyleerd (THM-GC/MS).

De pyrolyse werd uitgevoerd in afwezigheid van zuurstof, in een heliumatmosfeer bij 480°C (Frontier Lab pyrolyse-eenheid model 3030). Eén staal werd niet gederiviseerd en gepyrolyseerd op 550°C, om eventuele synthetische componenten beter waar te nemen. Het staal wordt in een stalen cupje gebracht met, in geval van THM, 5% TMAH in methanol als derivatisatiemengsel. Een Supelco SLB-5ms kolom (lengte 20 m, interne diameter 0.18 mm, filmdikte 0.18 µm) werd gebruikt voor de chromatografische scheiding (Thermo TraceGC). Volgend temperatuurprogramma werd aangewend: 1 min op 35°C, gevolgd door opwarmen aan 10°C/min tot 240°C, daarna aan 6°C/min tot 315°C; deze eindtemperatuur wordt ten slotte 5 min aangehouden. De te scheiden componenten worden uiteindelijk gedetecteerd met een massaspectrometer, die identificatie van de verschillende gescheiden componenten toelaat, en dit met grote gevoeligheid (quadrupool MS, Thermo ISQ7000, gescand tussen 35 en 600 amu, MS op 240°C, transferline op 270°C). De chromatografische kolom werd rechtsreeks met de pyrolyse-eenheid verbonden, zonder gebruik te maken van de klassieke injector. De gasflow werd zo geprogrammeerd dat die verhoogde bij hogere oventemperatuur. Dit zorgt voor een betere resolutie bij hogere temperatuur.

Het resulterende pyrogram werd zowel manueel als semi-automatisch afgespeurd op zoek naar merkercomponenten die indicatief zijn voor natuurlijke harsen, wassen, oliën, proteïnen en synthetische componenten. Hierbij werd gebruik gemaakt van uitgebreide referentiedatabanken. Voor de semi-automatische dataverwerking werd AMDIS (*Automated Mass Spectral Deconvolution and Identification System*) aangewend in combinatie met specifieke AMDIS-target bibliotheken.

Bereiding dwarsdoorsnedes, optische microscopie- en THM-GC/MS analyses uitgevoerd door Louise Decq (1 dwarsdoorsnede aangeleverd door KMSKA).

4 Analyseresultaten

4.1. Dwarsdoorsnedes

In bijlage de foto's van alle dwarsdoorsnedes, bereid uit de twee staalnames, en de foto's van de dwarsdoorsnede bereid door het KMSKA.

Het staal genomen in de donkerblauwe lucht is gedesintegreerd. In de hoop alsnog de stratigrafie van dit staal volledig te begrijpen, werden verschillende deeltjes ingebed. De verschillende dwarsdoorsnedes tonen ofwel het afgesprongen vernis, ofwel de verflagen. We zien (C99.192) onderaan een witte onderste preparatielaag (groenfluorescent). Daarop verflagen (grijs en twee lagen blauw), en een dunne vernislaag (ca. 1µm). In de andere twee dwarsdoorsnedes is enkel vernis te zien: 1 laag (C99.184) of misschien 2 lagen met een weinig vuil ertussen (C99.183), met een dikte van ca. 3µm en 1-2µm. Het staal bereid door het KMSKA bevat wel een volledige stratigrafie van de blauwe lucht, inclusief vernislagen: ook hier is de vernislaag grotendeels afgesprongen, maar deels is de stratigrafie intact. Vóór het handmatig bijpolijsten van de dwarsdoorsnede, lijken zich op de verflagen twee vrij dikke vernissen af te tekenen (onderaan minder fluorescent, erboven meer fluorescent). Na voorzichtig manueel bijpolijsten met fijne grid en fotograferen op grootste vergroting, komt een scherper beeld naar boven: een dunne organische laag, vervolgens een dikke vernislaag. Hierop ligt een onvolledige, heel dunne, witte organische laag. De onderste dunne organische laag, is zichtbaar op beide blauwe dwarsdoorsnedes, maar niet op de stalen genomen ter hoogte van de carnatie. De samenstelling kon ook niet afzonderlijk worden vastgesteld.

De twee dwarsdoorsnedes van het tweede staal, genomen in de carnatie, lijken wel alle lagen te bevatten. In de eerste dwarsdoorsnede (C99.185) zien we opnieuw de onderste groenfluorescente witte laag, vermoedelijk de preparatielaag. Dan de verflaag, die bestaat uit enkele lagen nat-in-nat aangebrachte lagen van grijze, en lichtroze verf. Hierop bevindt zich een eerder dikke vernislaag. De oppervlakte wordt gekenmerkt door een meer uitgesproken fluorescentie (degradatie?) en vuilafzetting. Deze stratigrafie is ook zichtbaar in de tweede dwarsdoorsnede van deze locatie (C99.186). Bijzonder hierbij is dat bij een eerste polijsting de stratigrafie een tweede fase leek aan te tonen: op de verflaag lijkt zich een vernislaag af te tekenen, dan opnieuw verf, en opnieuw vernis. Na herpolijsten blijft van die vermoede tweede fase niets meer over. De meest plausibele verklaring zou zijn dat de eerste foto een niet heel representatieve dwarsdoorsnede was, op een plek waar vernis in een craquelure in de verflaag gelopen was (wat dan wijst op een niet-origineel vernis), al blijft ook een lokale herneming mogelijk. Na herpolijsten van de dwarsdoorsnede is de stratigrafie quasi identiek aan de eerste dwarsdoorsnede van deze locatie (99.185). De vernislaag is op deze dwarsdoorsnede heel variabel in dikte: van 0 tot 220µm dikte. Dit stemt overeen met de observatie van een ongelijk vernisoppervlak bij de observatie van het schilderij.

4.2. THM-GC/MS en Py-GC/MS

Er werden verschillende stalen geanalyseerd met gaschromatografie: drie vernisstaaltjes afkomstig van locatie 2 (carnatie), waarvan eentje niet gederivatiseerd, en 1 staal uit locatie 1 (donkerblauwe hemel). Telkens werd een transparant staal genomen voor analyse, waardoor in principe enkel het vernis / de vernissen werd(en) geanalyseerd. De rapporten van de afzonderlijke metingen worden onder dit rapport toegevoegd.

-locatie 2: run 07-200629-03-tmah480-P247.052-Delvaux2. In dit staal werd een **gekookte drogende olie** aangetroffen (mogelijk lijnzaadolie), en naaldboomhars. Het gaat om een behoorlijk **geoxideerd naaldboomhars** (idox 0.88); de aanwezigheid van 2,4,5,7-tetramethylphenanthrene doet vermoeden dat het naaldboomhars **verhit** werd. Enkele minimale sporen openen de piste van een beperkte aanwezigheid van een synthetisch vernis (ketonvernis en een weinig acrylaat en phthalaat): 2MA-

MMA dimeren, dimehylphthalate, cyclohexanone, 2-methylidenecyclohexan-1-one, ethenylmethylcyclohexanone, cyclopentanone. Geen was.

-locatie 2: run 07-200709-04-tmah480-P247.052-Delvaux2. Dit staal is analoog met de vorige meting. In dit staal werd opnieuw **gekookte drogende olie** gemeten (mogelijk lijnzaad), en opnieuw behoorlijk **geoxideerde naaldboomhars** (idox=0.77; merker verhitting zeer zwak aanwezig). In dit staal werd bovendien ook een wasmengeling aangetroffen: **bijenwas en candelillawas, mogelijk ook paraffinewas** (?).

Acrylaat is hierbij niet vast te stellen (slechts 1 sesquidimeermerker). Cyclohexanon en enkele verwante moleculen geven mogelijk kleine aanwezigheid van ketonvernis aan (geen dimeren of trimeren), en sporen van phthalaten. Alle synthetische merkers in zeer beperkte hoeveelheid.

-Locatie 2: run 07-200709-09-PY550-P247.052-delvaux2. Dit staal werd zonder derivatisatie geanalyseerd, om eventuele synthetische vernissen beter te detecteren. Ook dit staal lijkt vooral op een **olie-naaldboomhars** te wijzen. De sporen die eventueel wijzen op een ketonvernis zijn te zwak om een daadwerkelijke indicatie te zijn van een synthetisch vernis. Eventueel kunnen deze merkers veroorzaakt zijn door een additief of contaminatie in een restauratieproduct?

-Locatie 1: run 07-200709-05-tmah480-P247.051-delvaux1. Aangezien op de twee dwarsdoorsnedes van locatie 1 duidelijk het vernis afspringt waar de dikke vernislaag begint, is het aannemelijk dat hier enkel de relatief dikke vernislaag (en eventueel de fragmentaire bovenliggende laag) geanalyseerd werd, en niet (of beperkt) de onderste dunne fluorescente laag. Dit staal geeft een minder goed leesbare meting. Ook hier is **drogende olie** aanwezig (mogelijk gekookt), en een aanwijzing voor **naaldboomhars** (weinig oxidatieproducten). Geen aanwijzing voor synthetische componenten of was.

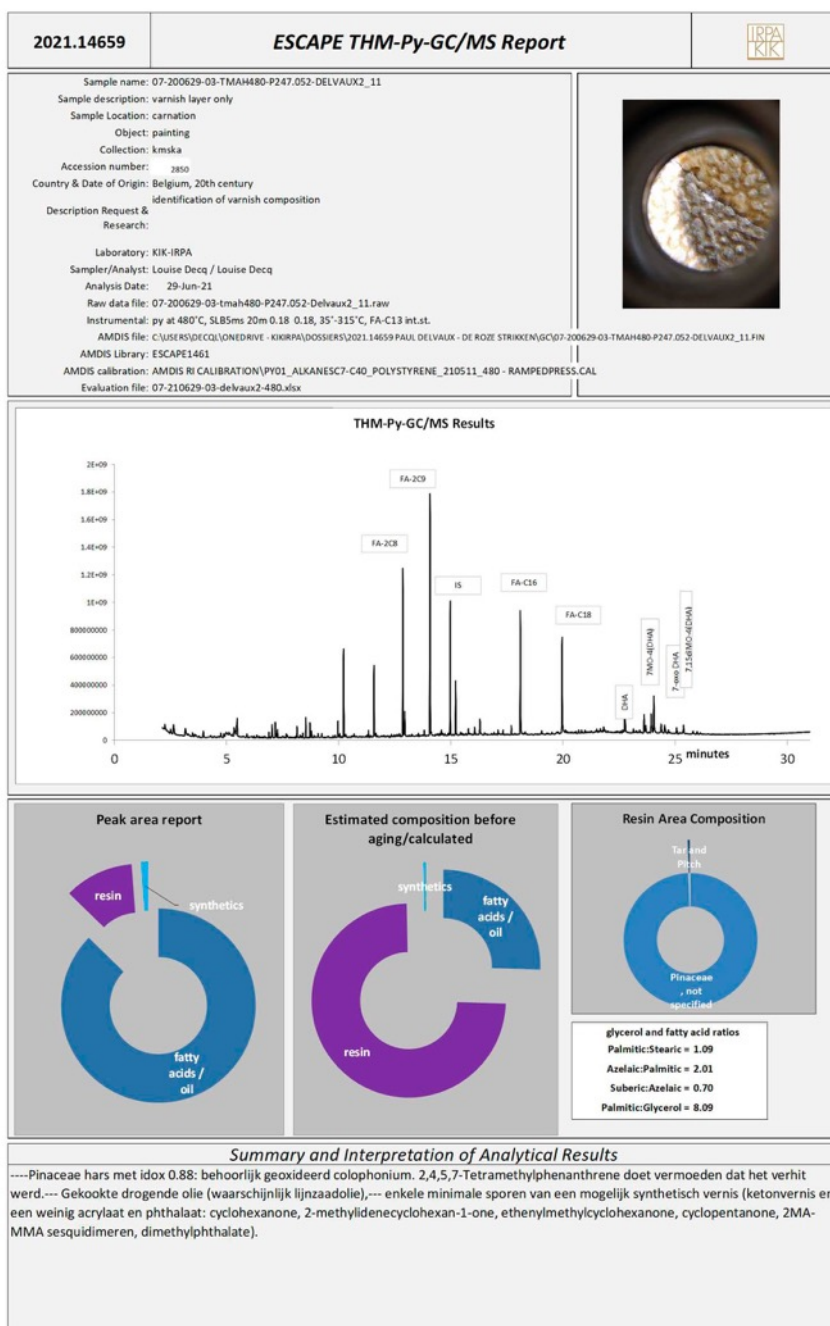
5 Besluit

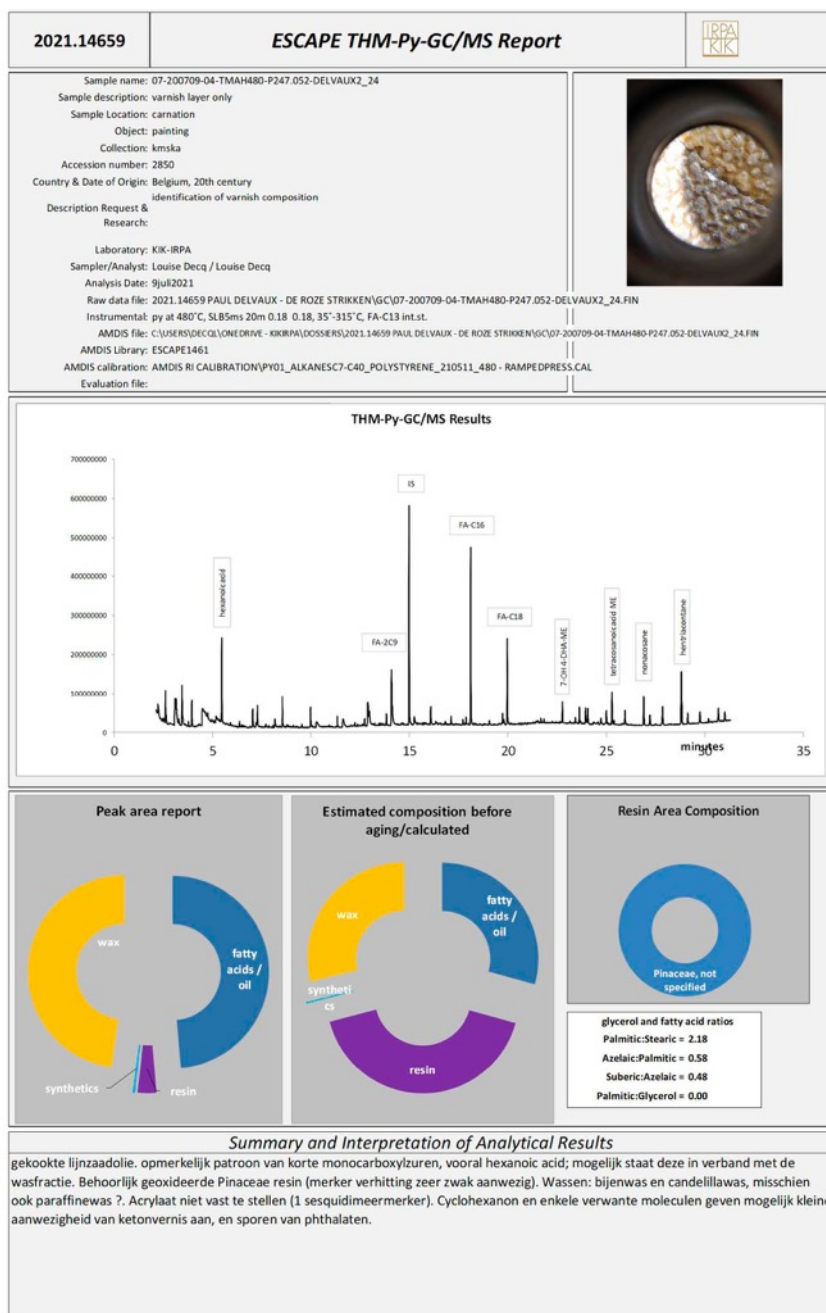
De verschillende stalen tonen een breekbare vernislaag, die niet sterk gehecht is aan de onderliggende lagen (vnl. in de blauwe stalen). Dit vernis is op sommige plaatsen bijzonder dik aangebracht, en vergeeld. Deze karakteristieken en de bindmiddelanalyse wijzen op een **olie-colofonium-vernis dat geoxideerd** is. In de zone van de lucht is onderliggend aan deze laag nog een dunne organische laag zichtbaar, waarvan de samenstelling niet kon worden vastgesteld (misschien drogende olie?). Vuilafzetting is duidelijk aanwezig aan het vernisoppervlak, maar kon niet worden vastgesteld tussen onderliggende lagen. Op één dwarsdoorsnede van de blauwe zone was aan het oppervlak, **op de dikke vernislaag, ook nog een onderbroken, dunne fluorescente laag aanwezig.**

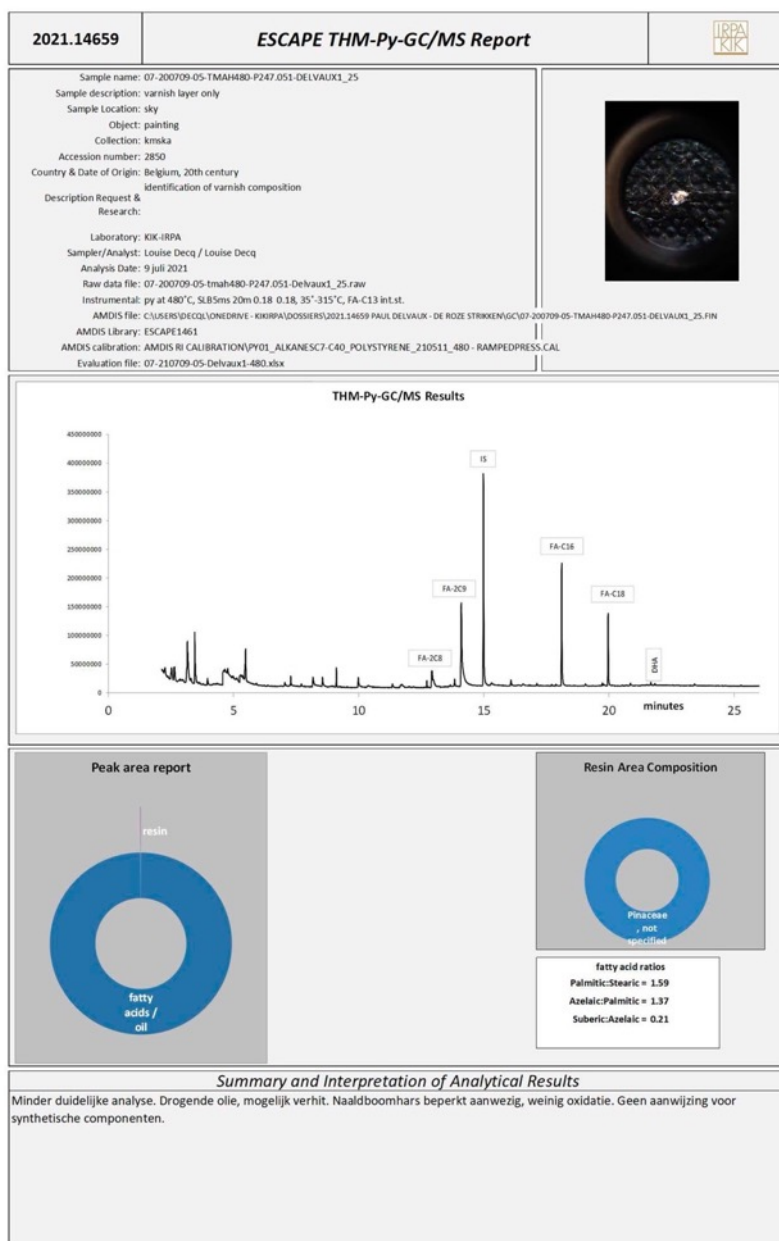
Op één dwarsdoorsnede van het staal genomen in de carnatie, leek aanvankelijk een verflaag aanwezig tussen twee vernislagen, wat op een tweede fase in het ontstaan van het schilderij kan wijzen. Evenwel, de stratigrafie was vrij moeilijk leesbaar; zo was het onder andere niet duidelijk af te lezen of oppervlaktevuil onder en/of op de bovenste vernislaag aanwezig was. Bij het herpolijsten van het staal verdween deze verwarrende stratigrafie volledig. Wat eerst een aanwijzing voor een tweede fase leek, blijkt bij nader inzien eerder een minder representatieve dwarsdoorsnede.

De bindmiddelanalyse van de transparante lagen van beide locaties geeft een vrij homogeen beeld van een **gekookte drogende olie met (waarschijnlijk verhit) colofonium**. Dit is een vrij klassieke combinatie, een vernis met klassiek een eerder dikkere consistentie. Dit vernis staat erom bekend om bij veroudering te vergelen en te verbrokkelen. De bindmiddelanalyse toont inderdaad aan dat het naaldboomhars **sterk geoxideerd** is, wat overeenkomt met de observaties van de restauratoren. In één analyse werd ook **bijenwas en candelillawas** gedetecteerd. Enkele metingen lijken te wijzen op

een beperkte hoeveelheid synthetisch hars. Mogelijk bevindt zich een beperkte hoeveelheid synthetische restant of contaminant op het oppervlak van het werk, maar van een consistente synthetische laag lijkt geen sprake.

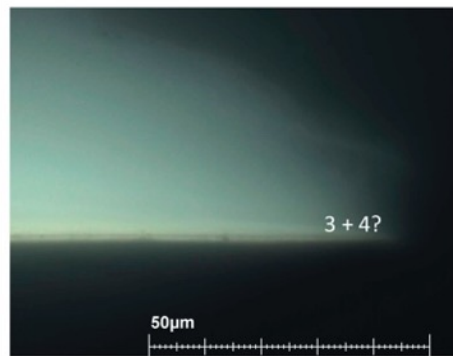




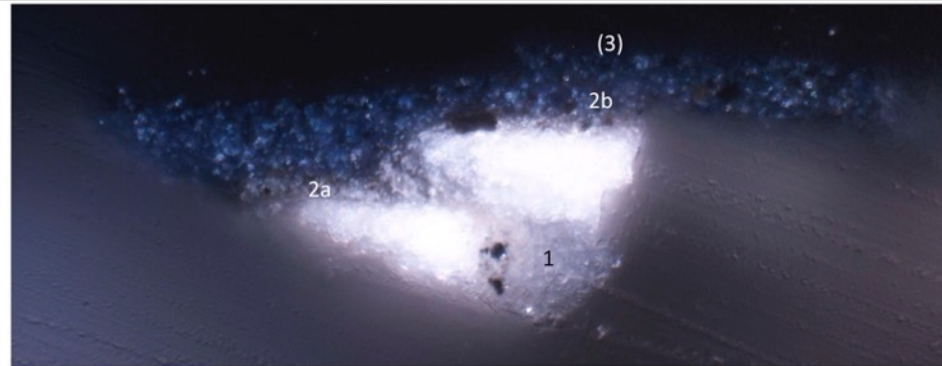


1 • P247.051 • C99.183; C99.184; C99.192
Donkerblauw, lucht. Brokkelig staal.

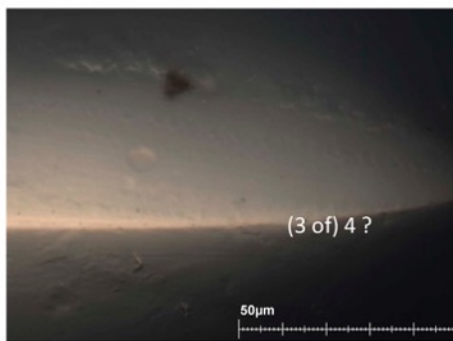
OPTISCHE MICROSCOPIE • UV • 500X C99.183



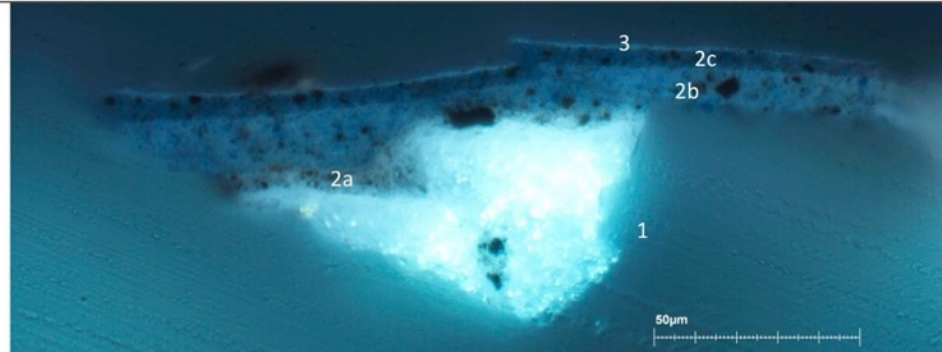
OPTISCHE MICROSCOPIE • POL • 500X C99.192



OPTISCHE MICROSCOPIE • UV • 500X C99.184


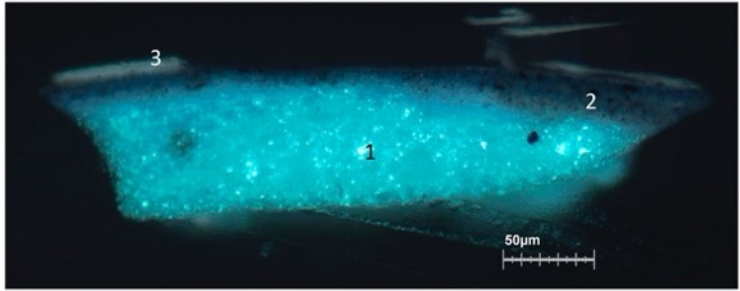
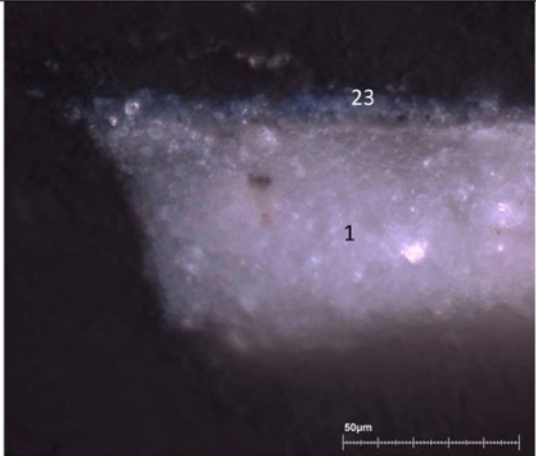
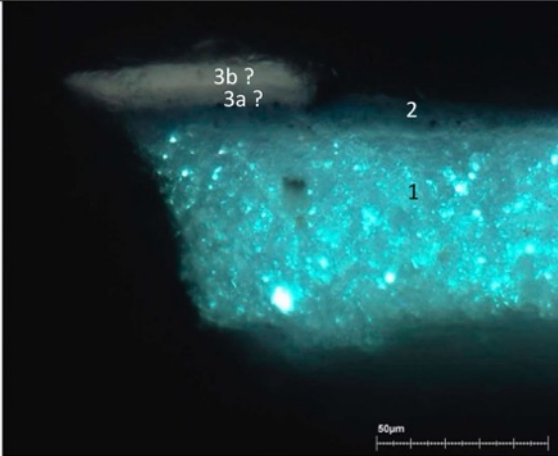


OPTISCHE MICROSCOPIE • UV • 500X C99.192



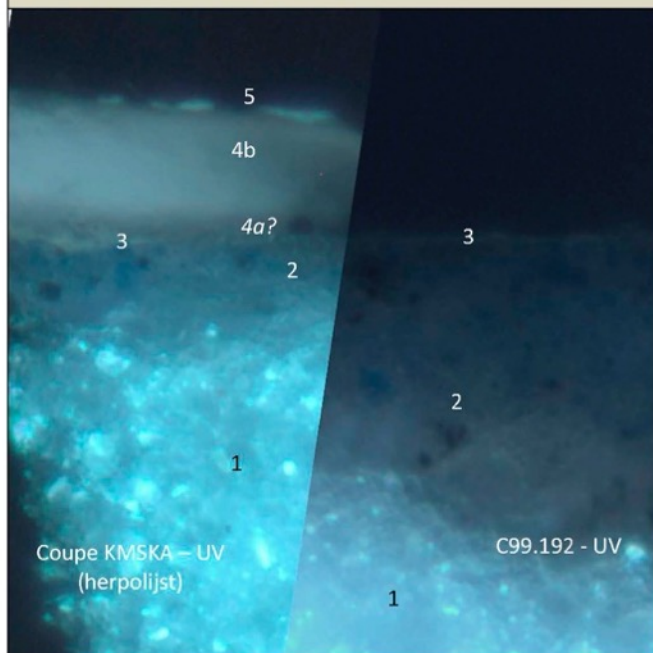
BESCHRIJVING

1. **Witte preparatielaag:** (groenfluorescent); 2. Verflagen: **Grijs** (1-5µm), **Blauw** (ca. 10µm), **Donkerblauw** (ca. 4µm); 3. **Organische laag** (eerste vernis of olielaag?) (ca. 1-2µm) ; (4. *Tweede laag vernis of was?* (ca. 2-3µm?))

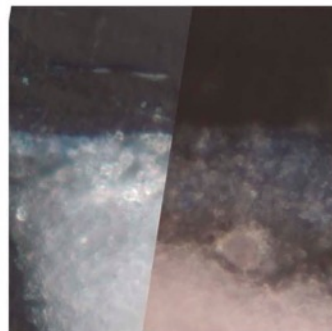
2 • COUPE KMSKA (VOOR HERPOLIJSTEN) Blauwe lucht		
OPTISCHE MICROSCOPIE • VIS • 200X	OPTISCHE MICROSCOPIE • UV • 200X	
		
OPTISCHE MICROSCOPIE • POL • 500X	OPTISCHE MICROSCOPIE • UV • 500X	BESCHRIJVING
		<p><u>Voor polijsten</u> leek dit de opbouw :</p> <p>3b. Vernis (8µm)? 3a?. Vernis (5µm)? 2c. Blauw (10µm) 2b. Blauw (0-15µm) 2a. grijs (0-10µm) 1. Preparatielaag: (groenfluorescent) witte onderste laag.</p>

OVERZICHT BLAUWE DWARSDOORSNEDES • COUPE KMSKA (NA HERPOLIJSTEN) EN C99.192

OPTISCHE MICROSCOPIE • UV • 1000X



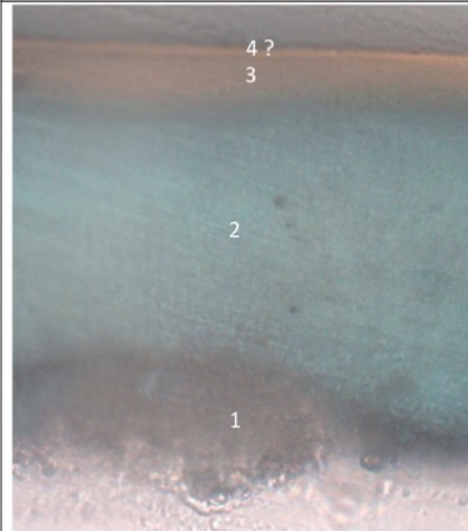
5. witte, fluorescente onderbroken laag (0-1 μ m)
- 4b. Vernis (10 μ m)
- 4a?. Vernis?: iets donkerder, maar lijkt eerder optisch artefact
3. dunne organische laag (Olie? Originele vernis?)
2. Verf (grijs/blauw)
1. Witte preparatielaag: (groenfluorescent)



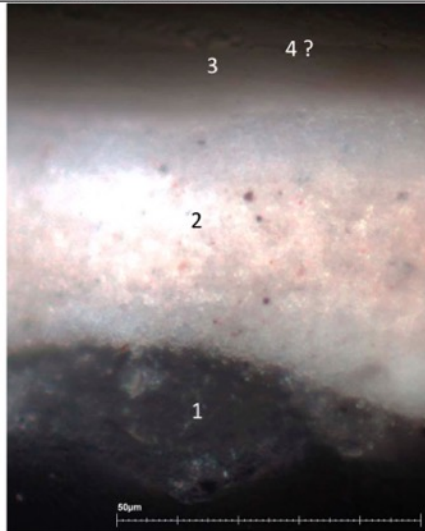
3A • P247.052 • C99.185

Wit, carnatie

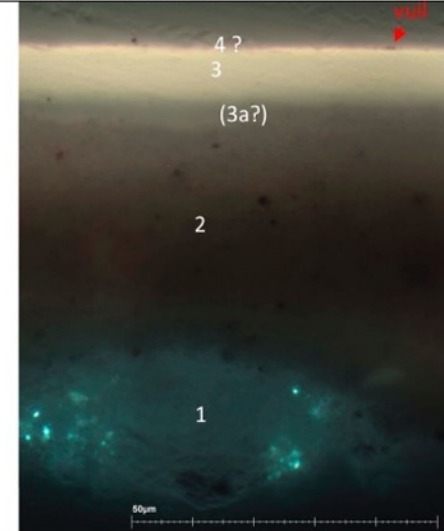
OPTISCHE MICROSCOPIE • TRANSMITTING LIGHT • 500X



OPTISCHE MICROSCOPIE • POL • 500X



OPTISCHE MICROSCOPIE • UV • 500X



BESCHRIJVING

4? *Oppervlakte? Degradatie? Was? Enig oppervlaktevuil*

3. **Vernis** (8µm)

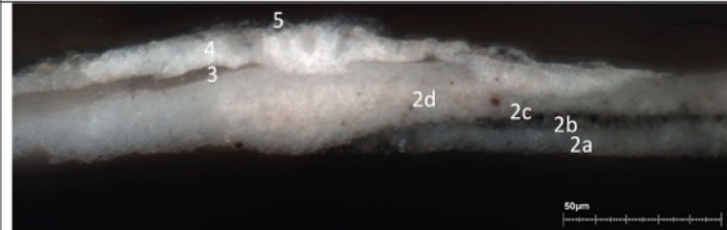
3a?. *Vernis lijkt iets minder fluorescent onderaan, maar eerder optisch artefact*

2. **Verf:** grijze, witte en lichtroze verf (ca. 35µm)

1. **Preparatielaag:** (groenfluorescent) witte onderste laag. (ca. 18µm)

3B • P247.052 • C99.186
Wit, carnatie

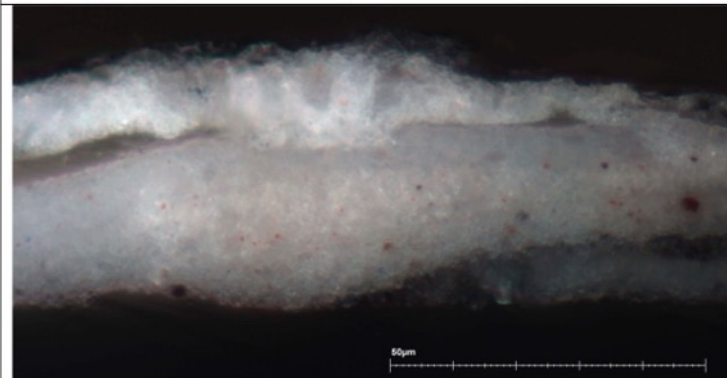
OPTISCHE MICROSCOPIE • POL • 500X



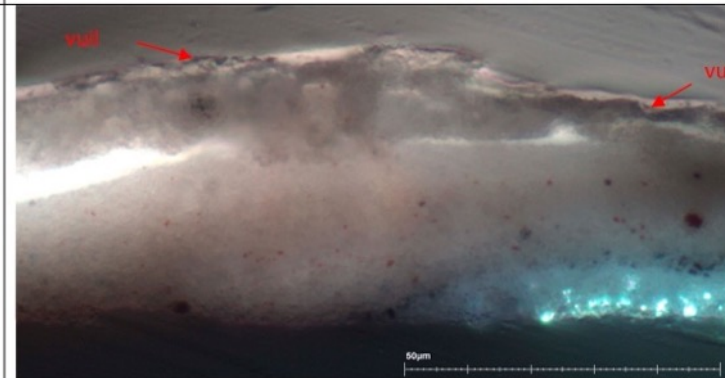
OPTISCHE MICROSCOPIE • UV • 500X



OPTISCHE MICROSCOPIE • POL • 1000X



OPTISCHE MICROSCOPIE • UV • 1000X



BESCHRIJVING

Vuilafzetting

5. Vernis (ca.3µm)?

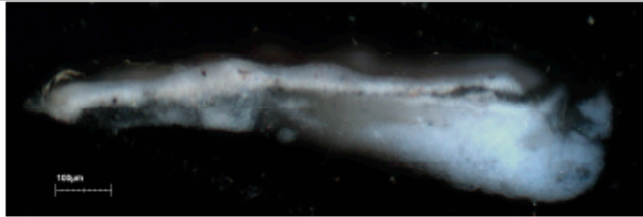
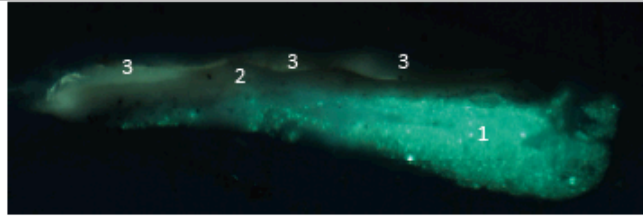
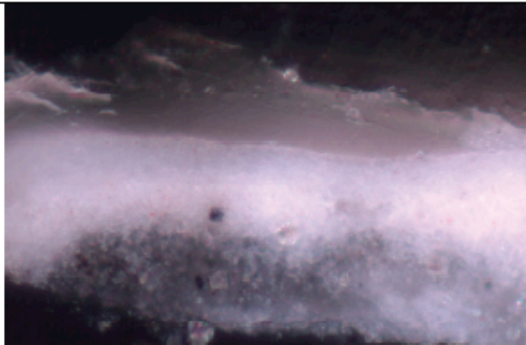
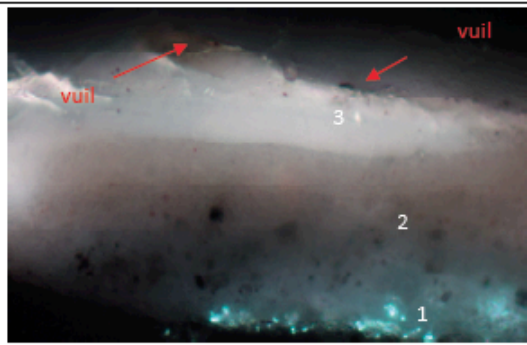
Vuilafzetting (?)

4. Witte verf (0-20µm)

3. Vernis (1-5µm): een transparante, helder fluorescente vernislaag

2. Verschillende verflagen : donkergrijs en een drietal lichte verflagen, nat-in-nat aangebracht. (ca.30µm)

1. Preparatielaag: (groenfluorescent) witte onderste laag.

3c • P247.052 • C99.186 Wit, carnatie -Herpolijst	
OPTISCHE MICROSCOPIE • POL • 500X 	OPTISCHE MICROSCOPIE • UV • 500X 
OPTISCHE MICROSCOPIE • POL • 1000X 	OPTISCHE MICROSCOPIE • UV • 1000X 
BESCHRIJVING 3. Vernis (0-20µm): een transparante, helder fluorescente vernislaag 2. Verschillende verflagen : donkergrijs en een drietal lichte verflagen, nat-in-nat aangebracht. (ca.30µm) 1. Preparatielaag: (groenfluorescent) witte onderste laag.	

OVERZICHT DWARSDOORSNEDES • COUPE KMSKA (NA HERPOLIJSTEN) EN C99.192 (LINKS); C99.185 EN C99.186 (RECHTS) • OPTISCHE MICROSCOPIE • UV • 1000X	
<p>Coupe KMSKA – UV (herpolijst)</p> <p>C99.192 - UV</p>	<p>C99.186 – UV- herpolijst</p> <p>C99.186 - UV</p> <p>C99.185 - UV</p>
<p><u>BLAUWE dwarsdoorsnedes</u></p> <p>5. Dunne onderbroken laag, wit en fluorescent</p> <p>4b. Vernis</p> <p><i>4a?. Vernis lijkt onderaan soms iets minder fluorescent, maar dit lijkt eerder optisch artefact (enkel gezien bij bepaalde focalisaties)</i></p> <p>3. Dunne organische laag Eerste vernislaag? Waslaag?</p> <p>2. Verf (grijs/blauw)</p> <p>1. Witte preparatielaag (groen-fluorescent)</p>	<p><u>CARNATIE dwarsdoorsnedes</u></p> <p>5. Niet aanwezig: dunne, onderbroken laag, wit en fluorescent</p> <p>4. Vernis</p> <p><i>(Vuil / Witte verf / Vernis: mogelijk aanwijzing voor een extra fase, of onrepresentatieve dwarsdoorsnede)</i></p> <p>3. Niet aanwezig: dunne organische laag</p> <p>2. Verf (grijs/rozig/wit)</p> <p>1. Witte preparatielaag (groen-fluorescent)</p>

Appendix 13: Identification of Talens paint tubes

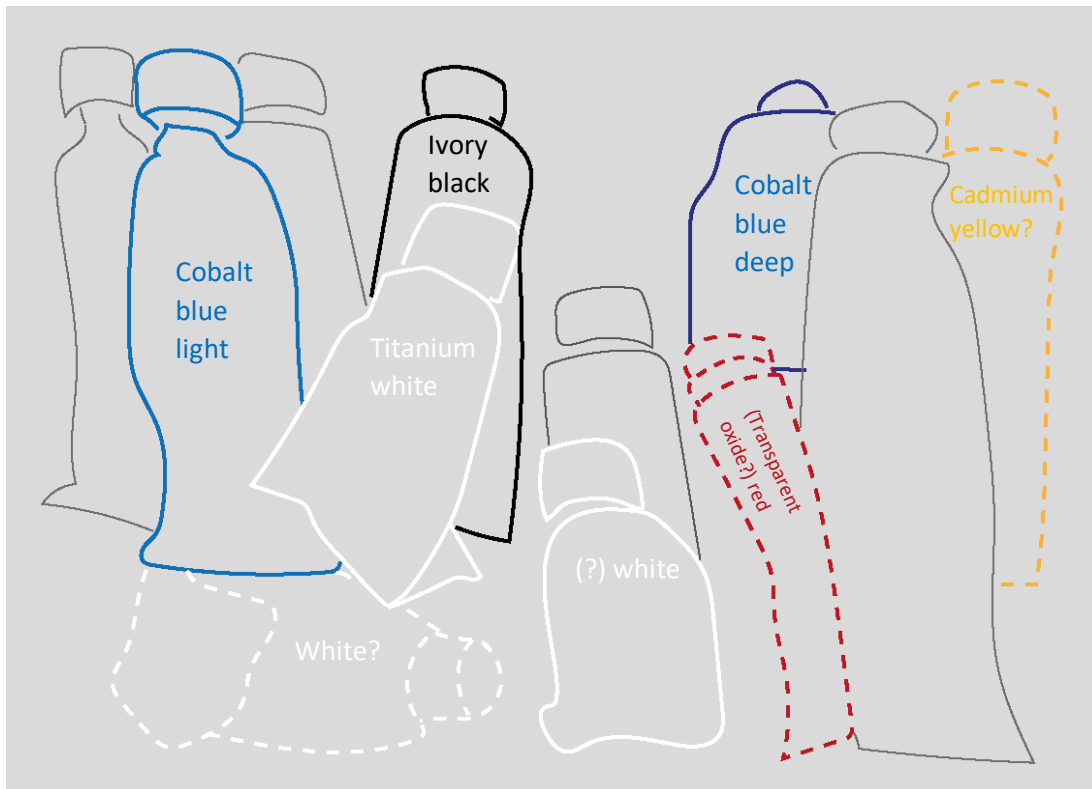


Figure 102: The fully lined tubes are identified; the dotted lined tubes are possible identifications. The thin grey outlined tubes could contain no clues.

Appendix 14: FTIR Spectra

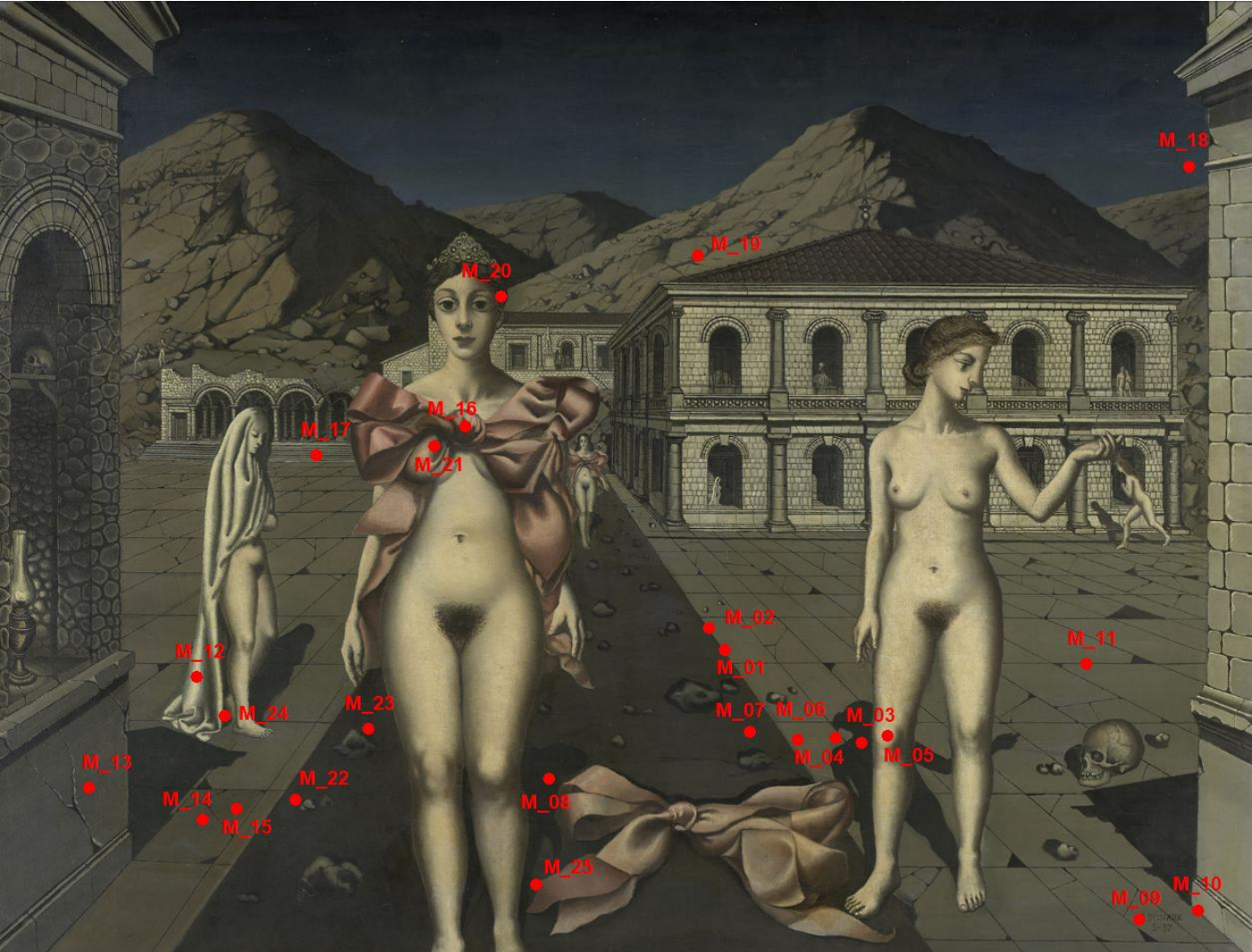
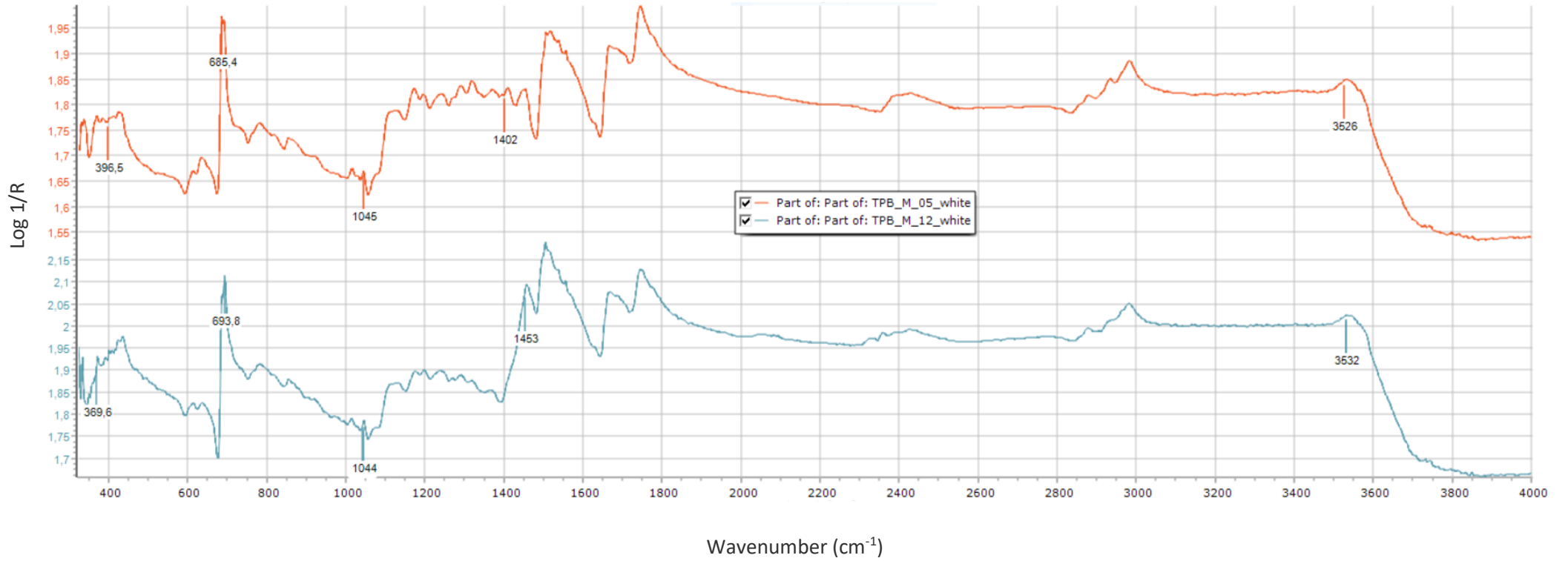
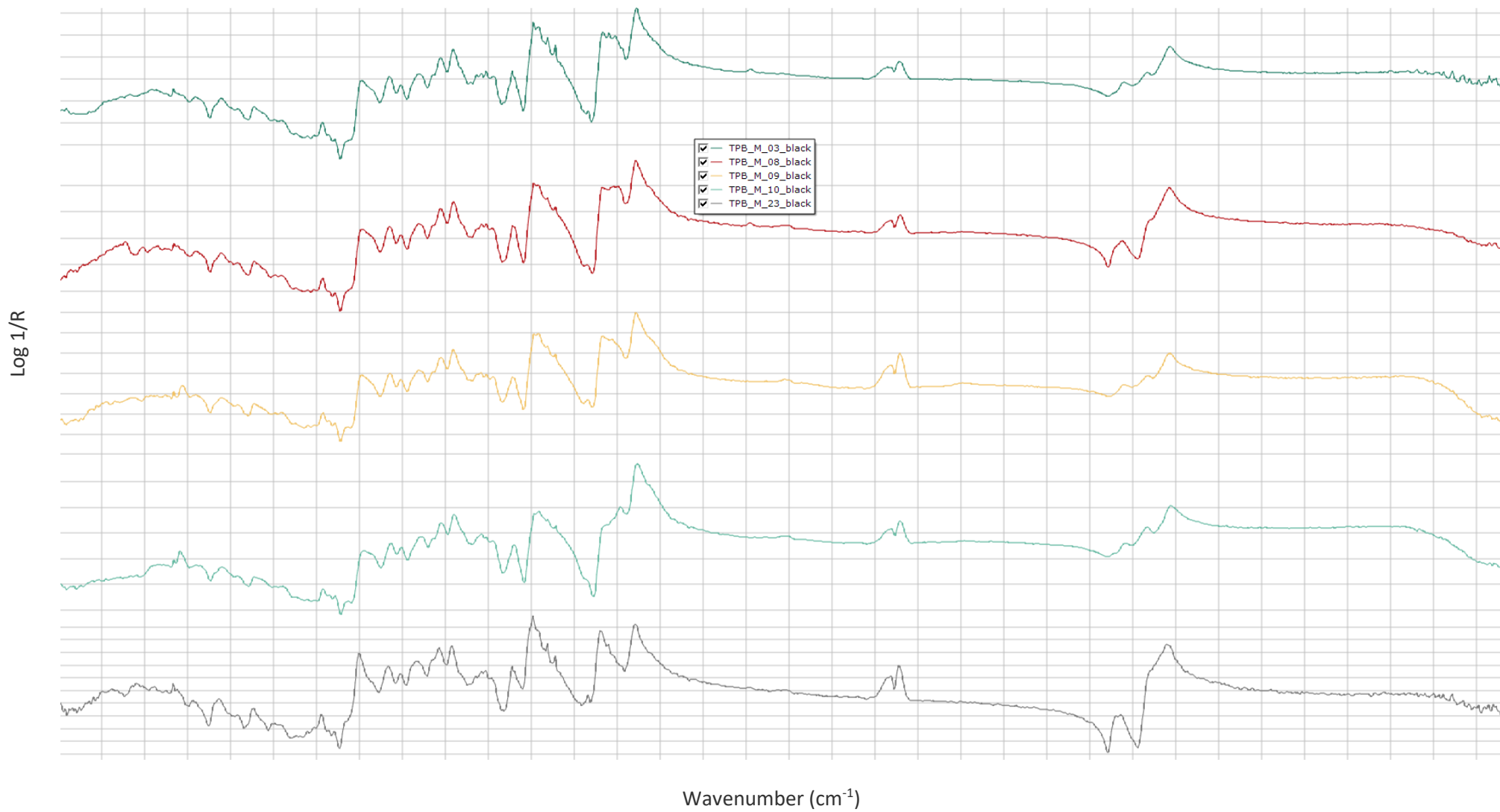


Figure 103: Locations of FTIR analysis.

Lead White - Hydrocerrusite (M_05 and M12)



Ivory/bone Black (M_03, M_08, M09, M10 and M23)



Appendix 15: μ -Raman spectra (532 nm)

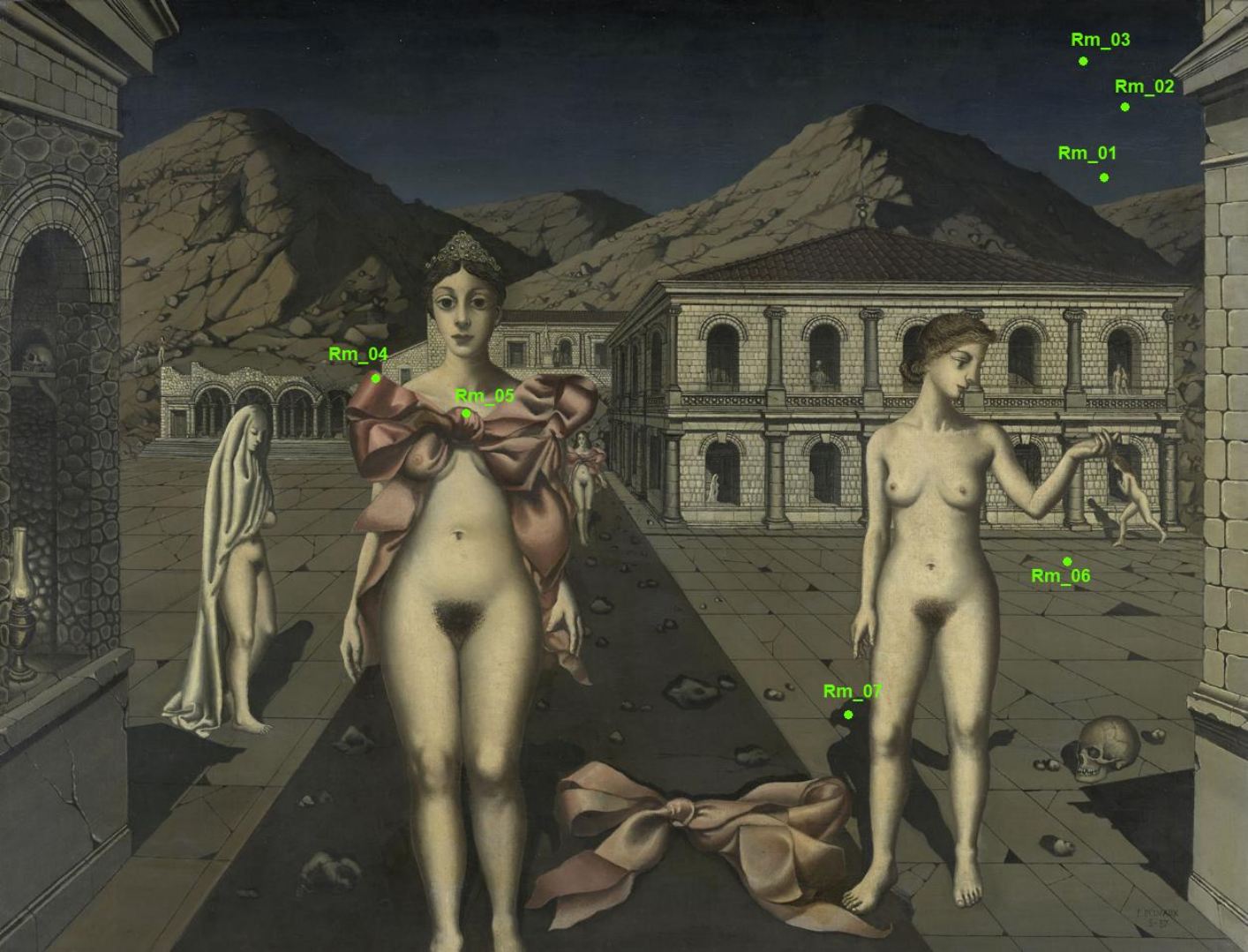
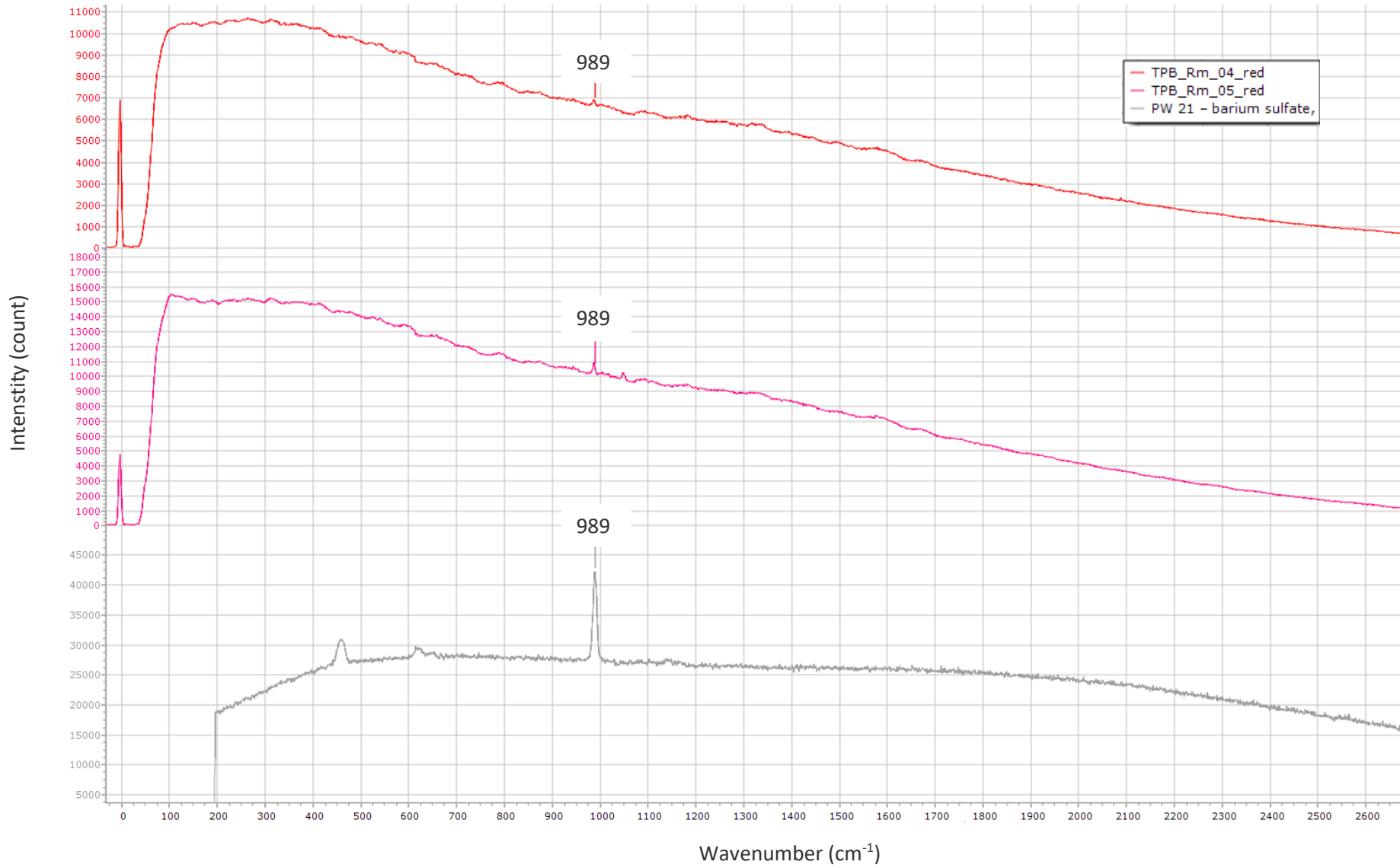
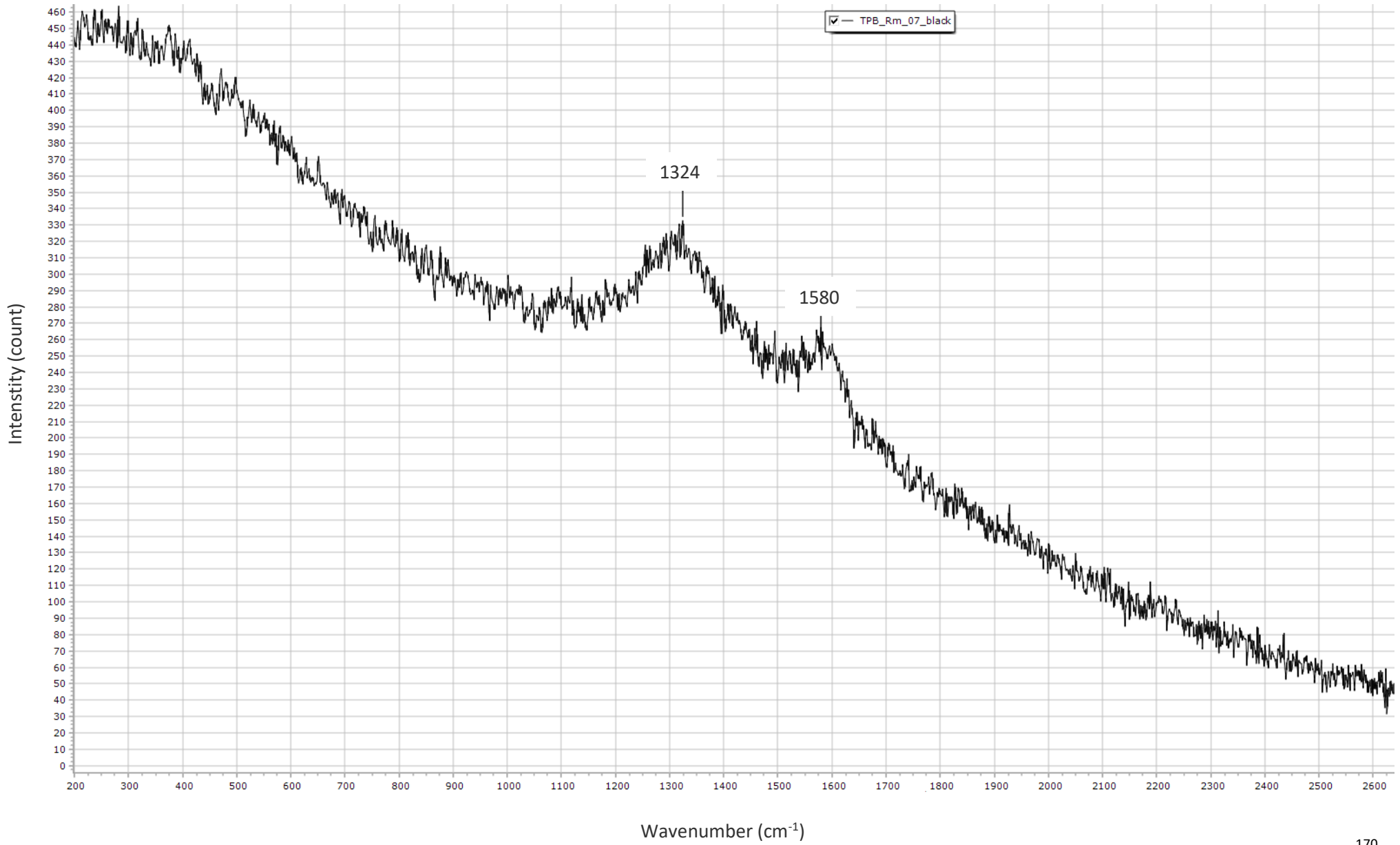


Figure 104: Locations of Raman analysis.

Barium Sulfate (Rm_04 and Rm-04)



Amorphous Carbon (Rm_07)



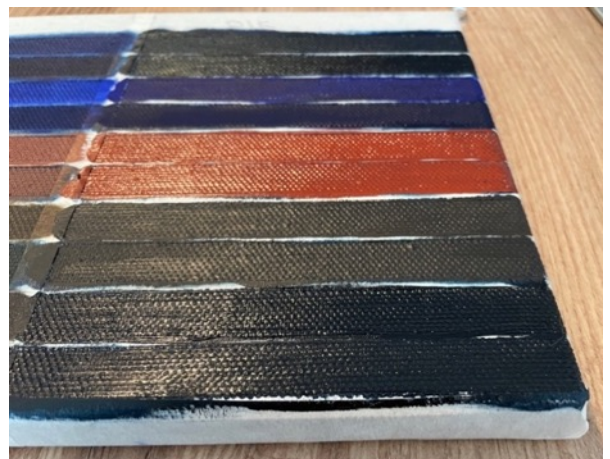
Appendix 16: Pictures of the mock-ups

1. Before coating

1.1. Mock-up 1: industrially prepared ground

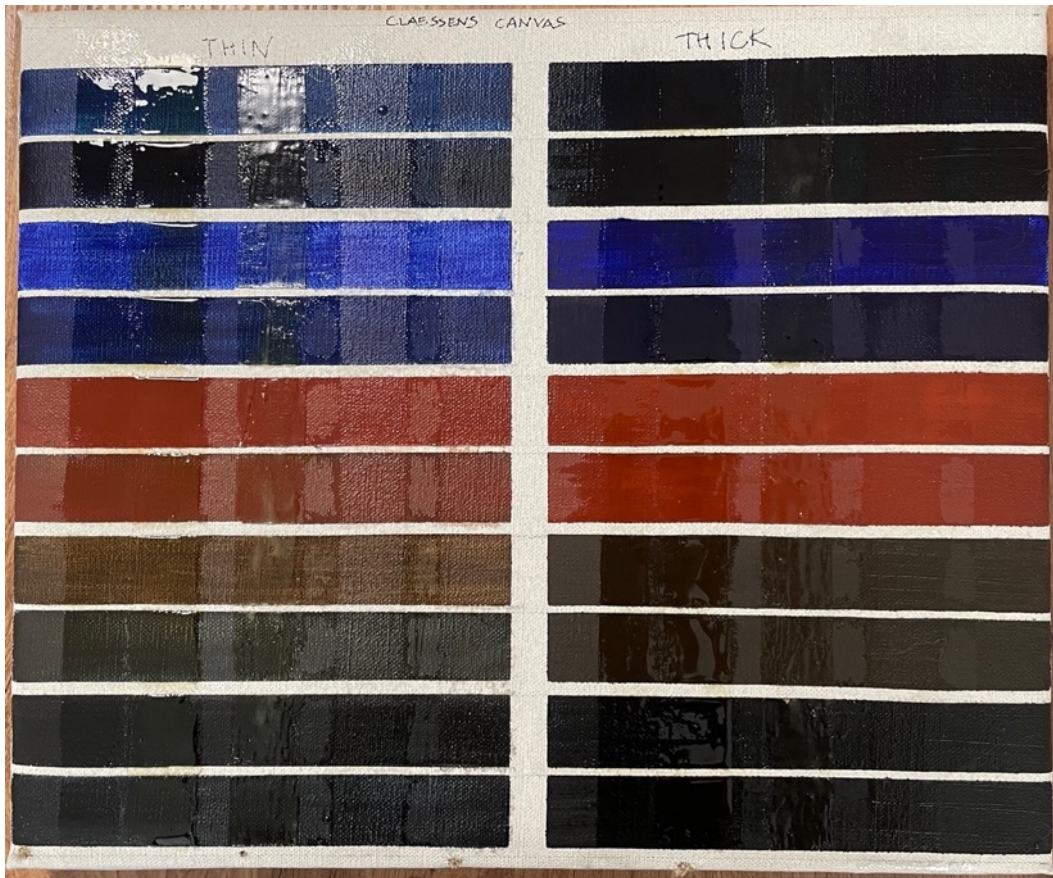


1.2. Mock-up 2: hand-prepared ground



2. After coating

2.1. Mock-up 1: industrially prepared ground



2.2. Mock-up 2: hand-prepared ground



Appendix 17: Saturation assessment on the mock-ups before coating

Legend, with *gloss* defined as ‘there where a reflection of light is visible’:

Table VII: Legend of the saturation assessment on the mock-ups

CODE	EXPLANATION
---	No gloss
--	Very little gloss, in some areas of the sample
-	Little gloss, in some areas or evenly spread across the sample
+	Gloss, in some areas of the sample
++	Gloss, evenly spread across the sample
+++	A lot of gloss

Mock-up 1: industrially prepared ground

COLOUR	ASSESSMENT
--------	------------

	Thin application	Thick application
508	-	++
508+508	-	+
506	---	---
508+506	---	---
339	+	+++
508+339	--	+
408	---	--
508+408	---	--
701	---	++
701+508	--	+

Mock-up 2: hand-prepared ground

COLOUR	ASSESSMENT
--------	------------

	Thin application	Thick application
508	--	--
508+508	--	+
506	---	---
508+506	---	---
339	--	+++
508+339	---	+++
408	---	--
508+408	---	-
701	--	++
701+508	--	+

