



INNOVATIVE APPROACHES FOR THE RE-INTEGRATION OF FIFTEENTH-CENTURY SPANISH PANEL PAINTINGS

María Vicente (1)
Betlem Alapont (2)
Christa Molenaar (3)
Kate Seymour (4)

- (1) Escuela Superior de Conservación y Restauración de Bienes Culturales, Madrid, Spain maria.vicroj@gmail.com
(2) Universidad Politécnica de Valencia, Valencia, Spain. balaponts@gmail.com
(3) University of Amsterdam, Amsterdam, The Netherlands, christamolenaar@gmail.com
(4) Stichting Restauratie Atelier Limburg, Maastricht k.seymour@sral.nl

ABSTRACT

The Suermondt-Ludwig Museum (Aachen) holds five Spanish fifteenth-century panel paintings in their collection. The five panels are all fragments, likely removed from their original settings at the turn of the nineteenth century during the upheaval of the Napoleonic Wars and sold on the art market after extensive restoration.

Three of these five panels have been already treated at SRAL. The additional two will undergo a full conservation campaign in the coming year carried out in collaboration with conservation students from the University of Amsterdam and conservation training programmes in Spain.

A treatment protocol was devised to ensure a systematic and sympathetic treatment, including reintegration. This provided key skill development for the trainee conservators. The removal of non-original surface materials revealed overcleaned and severely damaged surfaces. The integration of these surfaces required an innovative approach to return a sense of authenticity to the artworks, individually and as a disparate group. The subtle shift in gloss and texture between areas of paint and gilding, between different pigments bound in animal glue, egg tempera, and oleo-resinous glazes had been lost. The selection of conservation materials for infilling and retouching aimed to return this ephemeral play on light to the surfaces.

This paper will discuss this innovative approach using the reintegration of one of the set of five panel

paintings: the “Adoration of the Kings” (Inventory number: GK 243) as a case study. The materials were carefully chosen so as not to be mistaken for original materials in the future. The approach entailed thinking out of the box and approaching the filling and retouching stages simultaneously rather than as independent actions. This allowed a more holistic strategy to reintegration than if all losses were filled first prior to retouching.

The filling materials utilised are based on a studio formulation consisting of a novel combination: Arbocel 500 (cellulose fibres) bound in a mixture of Aquazol 500 (poly(2-ethyl-2-oxazoline)) and Methocel A4M (methylcellulose) bound in water. This mixture was used to fill deeper losses and modified with aluminium hydroxide powder to create a surface fill. The protocol used began with testing of the materials to find the right formulation; adaptations for the typology of fill were incorporated into this design. The filler formulation is modified to best adapt to the specific losses in each area of each panel. The decision not to re-varnish the panels allowed filling and retouching to be carried out simultaneously and the different gloss surfaces of individual paint areas to be imitated by modifying the amount of retouching binding media (Aquazol 200 dissolved in ethanol/water). The resulting appearance allows different colour and surface finishes to retain their independent characteristics and returns a more authentic surface finish to the fifteenth-century artworks.

Keywords: Chromatic reintegration; Retouching; Filling; Arbocel; Aquazol; QOR.

1. INTRODUCTION

The Suermondt-Ludwig Museum (Aachen) holds five Spanish fifteenth-century panel paintings in their collection. The panels are undated. A confirmed provenance can only be traced as far back as the late nineteenth century when the group was accessioned. Stylistically they can be attributed to the eastern region of Spain corresponding to the Kingdom of Aragon - a region encompassing Zaragoza, Barcelona and Valencia. The five panels are all fragments, likely removed from their original settings at the turn of the nineteenth century during the upheaval of the Napoleonic Wars and sold on the art market after extensive restoration.

The five paintings come from three altarpieces constructed in three separate workshops. Each workshop has different working practices and materials usages, but all are steeped in the traditional artistic practice of the period. On the stylistically dated later panels, there is a clear innovative use of new Hispano- Flemish painting technologies.

Archival documents held at the museum provide some insight into the provenance of the panels prior to accession. Two panels (GK532 and GK533), originating from one altarpiece, were donated by Dr. Franz Johann Joseph Bock in the late 1880s.



Figure 1 – Side of the frame with the stenciled name of Bock (donor).

The three other panels were donated to the museum in 1914 by Geh. Kommerzienrat Louis (Ludwig) Beissel (1842– 1914), an entrepreneur, cloth manufacturer and friend of Robert Frederick Suermondt (1844–1919), son of the founder of the museum [1].

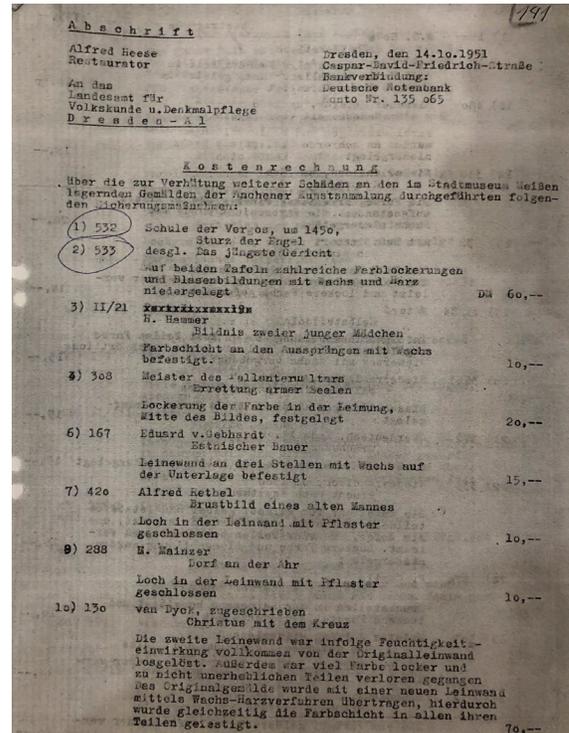


Figure 2 – Archival document describing the treatment carried out in 1951

All the panels have been cut down in size to a ‘unit’ that could be sold independently from the rest of the altarpiece. Structural damages originating from the removal from their original setting had been addressed prior to arrival in the collection (presumably much earlier), and one panel (GK84b) was transferred from its original support in the 1970s. The five panels were evacuated to Dresden during the second world war and were treated there before returning to Aachen in the early 1950s.

Most of them presented non-original varnishes, extensive overpainting and overfilling covering overcleaned and damaged paint areas, as well as



Figure 3 – GK84A, GK84B, GK532 & GK533 (before treatment, visible light)

structural issues. Three of these five panels have been treated at SRAL over the past decade. The additional two will undergo a full conservation campaign in the coming year. The conservation treatment is carried out in collaboration with conservation students from the University of Amsterdam and conservation training programmes in Spain.

With this in mind, a treatment protocol and procedure was devised to ensure a systematic and sympathetic treatment for the five masterworks, including reintegration. The reintegration aimed to stay true, not only to the colour and condition of the original paint layers, but also to the differences in surface gloss and texture that the panels would originally have presented. This provided key skill-development -for the trainee conservators, especially when considering the recovery of the surface characteristics - a very subjective goal that required a non-standard approach to the aesthetic phase of treatment.

The removal of non-original surface materials revealed overcleaned and severely damaged surfaces. These damages could be clustered into different loss typologies ranging from narrow scratches, abrasions, thinning, small to large, shallow to deep. In addition, many original paints were discoloured or faded. The reintegration of these surfaces required an innovative approach to return a sense of authenticity to the

artworks, individually and as a group. The subtle shift in gloss and texture between areas of paint and gilding, between different pigments bound in animal glue, egg tempera, and oleo-resinous glazes had been lost. The selection of conservation materials for infilling and retouching aimed to return this ephemeral play on light to the surfaces, as well as reintegrating the colourful images depicted.

This paper will discuss the innovative approach developed at SRAL using the reintegration of the ‘Adoration of the Three Kings’ (Inventory number: GK 243) as a case study. It was important that the technique developed could be used for all five panels. The materials were carefully chosen so as not to be mistaken for original materials in the future, but able to fulfil the desired aesthetic effect. The approach entailed thinking out-of-the-box, approaching the filling and retouching stages simultaneously rather than as independent actions. This shift in well-established order of execution allowed a more holistic strategy to the reintegration than if all losses were filled first prior to retouching. Furthermore, as a teaching exercise, this project provided a thought-provoking challenge allowing conservation students to augment their retouching skills.

1.1 The Adoration of the Kings

Besides the Bode-Museum (Staatliche Museum zu Berlin), this is one of the few centres in Germany to have Spanish late Gothic period artworks in their collections. This makes the five panels within the Suermondt-Ludwig collection a unique set.

The Adoration of the Three Kings is a fragment. It is likely to be one of the *sotto banco* (or predella) sections of a much larger altarpiece. The artist is unknown but stylistically it is attributed to the School of Ramon Sola II (c. 1445-1502), Catalonia. The panel was donated to the Museum in 1914 by Louis (Ludwig) Beissel (1842–1914). The manufacturing technique is consistent with contemporary traditional Spanish practice, though the painting technique shows the influence of the Hispano-Flemish style that became popular in the latter part of the fifteenth century in Spain. The other four paintings within the Suermondt-Ludwig Collection all indicate aspects of these novel painting techniques.

The support consists of one thick (c. 3 cm), horizontal, pinewood board encompassing the pith. The upper framing decoration, composed of quatrefoil shapes in both corners separated by ten parabolic arches, is constructed by attaching smaller, independent sections of wood directly to the support before the preparatory layers are overlaid.



Figure 4 – GK243: Adoration of the Three Kings (recto) (before treatment, visible light)



Figure 5 – GK243: Adoration of the Three Kings (verso)(before treatment, visible light)

The twisted column placed on the left side is original. It is constructed of a single piece of carved, gilded pinewood (of a different species than the primary support) attached after the painting process. Additional nails now hold this in place. Clearly visible saw marks, observed on the right edge of the panel, indicate that the support originally extended to the right. It is possible that the panel also extended to the left, though the presence of the column suggests that this edge could have been flush with the (missing) *guardapolvo*. The structural integrity of the panel was disrupted by the large horizontal split transecting of both painted surfaces (recto and verso) which required stabilisation treatment.

The front of the panel shows traditional stratigraphy for a fifteenth-century panel painting, conforming to the techniques described by Francisco Pacheco [2]. The support was prepared using a fine woven lined cloth, applied below the layers of *gesso grosso* and *gesso mate*, directly to the wooden surface. The paint application is carried out according to a carefully delineated black ink underdrawing. Areas of gilding were then prepared by applying a layer of light-red coloured bole. The halos, crowns and star are pounced and a different tool is used to texture the brocade drapery of the kneeling King.

The paint medium was egg tempera, except for Madonna's robe which, if traditional workshop practice was followed, must have been executed with the azurite

pigment bound in animal glue. The three Kings are dressed elaborately with gilded brocade cloaks and richly decorated crowns. The effect is created by applying the pattern of the textile using an oleo-resinous medium applied over tooled, gilded areas. It is not likely that this paint surface would have been originally varnished. Evidence of dirt layers beneath superficial varnish coatings lays evidence to this. There is also evidence of extensive retouching applied to hide damages in the surface, especially in the blue robe of the Virgin. The extent is visible in the False Colour Infrared image.



Figure 6 – GK243: Adoration of the Three Kings (recto)
(before treatment, false-color infrared image)

A later addition, also in pinewood, has been attached to the lower border, supporting the lower gilded framing edge and enclosing two original hand-forged nails. A textile overlap has been applied to the reverse of this section and later applied restoration wooden fixtures serve to reinforce the join. This addition is testimony to the removal of the panel from its original setting and preparation for sale at auction.

The reverse of the panel is also painted, though this is not likely to be original to the construction period. The painting shows the saintly figure of Melchisedec holding bread and a jug. The applied ground and paint on the reverse extends over the later applied piece of textile bridging the gap between the original support and the later addition. The ground layer was applied to the surface prior to painting but not sufficiently to smooth out the traces of woodworking tools used to

prepare the reverse of the panel. The paint layers are matt and are unvarnished, though areas of ultraviolet-induced fluorescence are present. We date these additions to the beginning of the nineteenth century when many churches were looted during the Napoleonic wars. There is evidence of later applied fills and retouches indicating that the reverse of the panel has also undergone a restoration campaign in the past. While not contemporary to the obverse, this depiction has become part of the object and was treated with the same respect as the obverse.

The condition of the obverse decorative surface is intermediate - some areas are well preserved while others have suffered considerable damage. Damage typologies vary from superficial scratches and abrasions to deeper structural issues relating to cracks and splits in the primary support. One larger section of the (upper) framing elements have been badly damaged by insect infestation and was missing. Other damages relate to past treatments. The painting has been cleaned in the past and as a result paint layers, glazes, and gilding have been overcleaned. The reverse showed similar typologies of damage and thus the same methodology could be applied to reintegrate this surface.

The challenge was to mask areas of loss using a filling system that could imitate different surface textures and return a subtle and specific use of opaque colours and glosses to emulate the original artistic technique. The variety of damage types required a filling system that could easily be adapted to the differing depths of the losses and textures of the surrounding areas. Respecting the original aesthetic appearance and artistic practice involved the decision not to varnish the artwork. This decision added a facet of difficulty to the retouching phase as differences in gloss could not be reduced or adapted with the application of a final varnish layer. This meant that a retouching medium that could be applied to match surfaces of shifting gloss and texture was desired. A novel methodological approach was devised which allowed filling and retouching to take place non-consecutively. Materials were selected for their ability to produce a wide range of surface textures and used in adaptive formulations to make the most of subtle differences in application.

2. MATERIALS AND METHODS

2.1 First steps of the conservation treatment

Initial treatment consisted of the structural repair of the severe longitudinal split running with the woodgrain and multiple minor splits in the end grain. The circa 3 cm thick support made this a challenging operation, but it was necessary to return structural stability to the painting. This operation was further complicated by the necessity to retain the painted reverse. The curvature of the panel was enhanced by the natural warping of the thick wooden support. This prevented a full closure of the split partially on the front and the complete reverse of the panel, although the resulting 'v' shaped opening was minor. A gap-filler adhesive consisting of fish glue extended with 1:1 (w:w) ground coconut shell powder and phenolic micro balloons [3] was used to accommodate the lack of closure in the panel structure. Posterior surface cleaning, overpaint and varnish reduction were carried out.

2.2 Reintegration: filling

The decision not to re-varnish the 'Adoration of the Three Kings' panel allowed filling and retouching to be carried out simultaneously. The different gloss surfaces of individual paint areas could therefore be imitated by modifying the texture of the underlying fill and the amount of retouching binding media utilised. The resulting appearance allows different colour and surface finishes to retain their independent characteristics and returns a more authentic surface finish to the fifteenth-century artwork.

Our approach aimed to bring the level of any loss, whether shallow or deep, to the same plane as the original surrounding surface and mimic the surface texture. The viewer's eye would, therefore, not be caught by any differences in topography. A range of infill formulations based on combinations of Arbocel 500 (cellulose fibres), bound in a mixture of Evacon R (ethylene vinyl acetate dispersion) and Methocel A4M (methylcellulose), and further bulked with Portafil A40 (aluminum hydroxide pigment) were tested³. Formulations could be modified for use in deep fills or for areas where higher gloss was needed. Therefore, a variety of formulations was developed that dealt with more structural or surface requirements. A combination of layers could be used in deeper fills, with the first

application consisting of higher proportions of Arbocel 500. Higher gloss areas used a greater proportion of the binding media to bulking agents.

The ingredients for the filler were selected because they could not be confused (analytically) with materials used in the original manufacture of the panel, and more importantly, because their mechanical properties would not generate new tensions in the artwork. The selected filler is, thus, a studio formulation that to the authors' knowledge is not reported elsewhere. The firsts uses of some of this materials for this purpose in spare institutions such as the Opificio delle Pietre Dure [4], which inspired the further improvement of the filling mixture in order to refine its former known properties.

The protocol used began with testing the formulation to find the right proportions for the variety of damage types and establish the variants required to emulate the different typologies.



Figure 7 – Tests made it over wood to try the different variants of the filling proportions

The experience gained during testing encouraged our methodology to be refined. The filler is easy to apply and presents little shrinkage on curing. This seemingly soft and fluffy filler dries to a flexible but stiff, airy structure. The structure and mechanical properties of the fill have similar consistencies to *papier mâché*.

As the proportions of the filler mixture vary considerably, it is not possible to provide a single recipe, however 'standard' formulations that had consistent working properties were developed. We will discuss next the individual ingredients and underlying reasons for their selection. We have clustered the materials into their function: bulking agents and binding media.

Binding Media

Methocel A4M: methylcellulose with a viscosity of 3000-5500 mPa.s, 3% in H₂O (20 °C). The chemical nature of this binding medium is like that of the main bulking agent Arbocel cellulose fibres. This promotes affinity and stability. Methocel A4M was selected due to its ease of swelling in water and availability. The viscosity of the 3% solution in water is relatively low. This allows good wetting of both bulking agents used in the formulation. The inclusion of this material, and the high-water content, dictate the rheology of the formulation and are, thus, the key to the fluidity and flow of the formulated filler. The working properties of the fill are therefore directly related to the proportion of this component. However, the cellulose ether and viscosity could be modified if looking for alternative variants.

Evacon R: this is an ethylene-vinyl acetate dispersion. This material is formulated for the conservation sector [Ref 5: CXD (2021)]. It contains no plasticisers and a small percentage (0.05%) of calcium carbonate. Research has shown that it mixes well with cellulose ethers [6]. This material was added to our formulation to increase the cohesive properties and provide a higher flexibility to the cured filler. Its presence also ensures good adhesive bonding to the loss edges and makes it easier to load pigments and colour the mixture. The combination of Evacon R and a cellulose ether have been used at SRAL for over a decade as a combination binder for aqueous fillers.

The proportion of the two binding agents was modified depending on the depth and location of the losses. A putty-like consistency was used for the deeper losses, whereas a smoother more fluid variant was required for the shallower losses. A mixture of 60% - 40% Methocel A4M (3% in water) and Evacon R respectively gave the best results for the deeper losses as this allowed our bulked filler to bond well to the wooden support. However, deep losses were not filled in one application. The first, bottom layer contained a higher proportion of Arbocel fibres, whilst for the second, upper layer the percentage of this component was reduced. The higher binder content provided increased adhesive strength which guaranteed the perfect base to build up our filler structure. The mixtures containing less Evacon R gave improved handling for the final skimmed surface application of the filler and reduced any possible tensions within the underlying and surrounding areas of

the artwork piece as the filler cured. To work the surface of our layered structure a wet cotton swab was used to enhance the mechanical adhesion between layers. The final surface could be also worked the same way with help of other tools to flatter the filler.

Bulking agents

Arbocel fibres: these come in different lengths from 700 µm to 200 µm. We used Arbocel 500. This bulking agent can absorb compressive, bending and torsional stresses, which turns it into the perfect matrix for fulfilling the gaps in our current wooden support. The cellulose, in addition to lignin, conforms to the major forming material of the panel and would continue and adapt in the best way the rheological forces the filler will be exposed to. Therefore, the Arbocel cellulose fibres met the requirements and alike the nature of the wooden painting support. The chemical structure of the fibres allows them to expand and contract, adjusting the filler to the gap without applying tension to the wooden support nor the ground layers. Furthermore, these short-staple fibres with high elasticity will prevent the formation of shrinkage and joint cracks on curing and over time.

Aluminium hydroxide: this was added as a bulking material to our formulations designed for surface fills. This addition allowed us to modify and smooth the final surface of the filler after curing. The ratio of the bulking agents have a direct effect on shrinkage and ease of removal. The binding media remains water-soluble, which assists in the removal of excess material aiding the successful levelling of the surface. The refractive index of aluminium hydroxide (RI 1.57) is such that it produces little 'haloing effect' when removing excess from the surrounding original surface. The inclusion of aluminium hydroxide also facilitates the future identification of this intervention as it cannot be chemically confused with the original material used for the ground - calcium sulphate.

Results: Testing Filling Formulations

The first tests exploring the working properties of the Arbocel fillers formulated for the deeper losses revealed the sensitivity of this material to water-based environments. Tests showed that the natural shrinkage of these fibres, as water content is lost, needs to be compensated with a higher proportion of bulking agent in the upper applications. Yet the specificity of our filler

working properties shifted the approach from a bulk filler to a stratigraphic one. Here the layers of the filler were applied in sequential steps, allowing the previous layers to dry prior application of the next one. Thus, a two-step process for filling was employed, with the formulation modified accordingly. Additional aluminum hydroxide was added to create smoother fills. These retained a porosity similar to that of gesso and created a surface on which the retouching media could be applied.

2.3 Reintegration: retouching

The surface texture of the obverse and reverse panel differed subtly. Additionally, neither surface was uniform in gloss. The dominant shifts in gloss on the obverse can be associated with the different typologies of materials used to construct the panel: gilding, tempera paint and oleo-resinous glazes. The differences in gloss on the reverse were less. The decision not to apply varnish after cleaning meant that the surface gloss differences were maintained. A retouching system was required that could be easily adjusted to the gloss of the surrounding area. We required a medium that could be either matt or glossy and did not alter considerably on drying or change colour on ageing. The medium should retain solubility in water or alcohol.

We selected QOR watercolours for initial [7]. These are readily available in a wide range of colours as artistic materials for painters and can be easily modified with the addition of a supplementary binding medium. More importantly, studio formulations can easily be made by dissolving the binding medium in water or water/ethanol solutions to produce a wide range of coloured paints with slightly different drying characteristics. The luminosity and brilliance of the pigments bound in this medium are maintained on drying and matches closely with that of egg tempera. The binding medium of the QOR colours is Aquazol®.

Aquazol®: this is a synthetic resin, poly(2-ethyl-2-oxazoline), which is available in different molecular weights first produced by Dow® Chemical in the late 1970s. It has a broad solubility in water and polar organic solvents, and retains its solubility over time. It has been used in conservation since the 1990s as a consolidant, adhesive and binder for inpainting [8]. The properties that make it ideal for use as a watercolour binder also make it an

excellent medium for retouching. QOR colours (of which there is a range of 83) have been developed by Golden Paints. Aquazol® (variants 50, 200 and 500) is available from most conservation suppliers.



Figure 8 – Retouching tests made it over the previously arbocel tests

The self-formulated binding medium can be easily mixed with dry pigments. Formulations based on water and water/ethanol mixtures can deliver a wide range of paints that produce surfaces with differing degrees of mattness or glossiness. A variety of studio formulations were trialled and in combination with the different typologies of fillers as described above. Results were promising as higher gloss surfaces could be achieved with a higher proportion of binding medium, which matched the surface glance of the oleo-resinous glazes originally applied over gilding, and matter surfaces could be attained by decreasing the amount of binding medium, matching the matter tempera paints. Colour matching could be achieved by selecting and mixing modern pigments with spectral appearances close to those of the fifteenth century.

The visual perception of the painting was deteriorated by several white blached areas that appeared as halos across the pictorial surface. We tested to improve those aesthetic damages with our in-painting and recover through it the original painting perception while respecting the artwork patina.

3. RESULTS AND DISCUSSION. METHODOLOGY: FROM TESTING TO PRACTICE

The same approach was utilised for both the recto and verso of the panel. Treatment was carried out consecutively by three trainee conservators, Christa

Molenaar, Betlem Alapont and María Vicente, as part of their training at SRAL. The three students (all authors in this paper) came from three different University degree programmes, respectively the University of Amsterdam (Amsterdam), Universidad Politécnica de Valencia (Valencia), and Escuela Superior de Conservación y Restauración de Bienes Culturales (Madrid). The three students' time at SRAL studios did not overlap with each other. Test boards and formulations were left for the subsequent student and repetitions of the experiments allowed each student to become familiar and comfortable with the innovative system. Tips and tricks were passed on providing a good base for developing skills and prowess in filling and retouching. The methodology utilised differed from that taught previously to each student in that no varnish was employed that unified the surface gloss and saturation of the paint, nor was filling completed prior to retouching. The lack of varnish proved the most novel challenge as 'mistakes', such as overfills or mismatched colour, had to be removed directly from the original surface. These mishaps could be removed or modified easily with water, which applied in a controlled manner was not dangerous for the original surface. The flexibility of the system allowed different zones to be completed before moving on to other areas. This deviates from traditional filling and retouching techniques where first the former is completed prior to the latter. Dividing the tasks in such a manner allowed for a more holistic approach to the reintegration of the pictorial surface.

4. CONCLUSIONS

This case-designed, new methodology aimed to develop a reintegration system that would be suitable for all five panels. This was considered important as all five panels are part of the same collection and could be exhibited together, as a set or individually, amongst artworks from other times and regions. The fills and inpainting needed to be consistent in appearance, but variable in application, to achieve slightly different surface textures and glosses as a unifying varnish would not be utilised. Each of the five panels presents different aesthetic challenges, and thus creating a single, set formulation was not possible. The formulations were designed to be easily adjusted to achieve as wider range of surface characteristics as possible. The variables considered were stiffness v fluidity, matte v glossy,

smooth v rough and dense v porous. These differences were achieved through experimentation and slight modification of the constituent components of the fill (Arbocel, Evacon R, cellulose ether and aluminium hydroxide) and of the retouching system (QOR v dry pigments+medium, diluent). The study through practical testing and material research managed the successful treatment result visible while contemplating the all five panels back on display. For further testing and research we would like to suggest studying the applicability and stability of the method in larger areas.

The highly skilled retouching technique forced us to master the balance between the dry pigments and colours. This method besides the mattness of the non-varnished painted surface was one of the most challenging matters from the retouching stage, but a perfect case of study for our own personal and professional future references.

This training has been of great value for the students, not only regarding their retouching skills but improving their etiological vision and conservation approach for their further professional careers. The flexibility of the method allowed the trainees to resume cleaning treatments in some areas as a result of a further understanding of the complexity of the composition and the required improvement on those selected sections. Thus, regaining the more likely original appearance of the artwork.

Finally, the unusual workflow and knowledge sharing exercise this innovative project presented should be highlighted. The sharing and active collaborations of all parties involved in the study strengthened the importance and indispensability of practise and skill acquisition, as well as knowledge transmission and communication within the conservation field.

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NOTES

ⁱ Titles *St. John the Evangelist Drinking from the Poisoned Chalice* (GK84a) and *The Beheading of St. John the Baptist and the Feast of Herod* (GK243), *The Fall of the Rebel Angels* (GK532) and *The Last Judgement* (GK533), Suermondt-Ludwig-Museum, Aachen.

ⁱⁱ The severely abraded and damaged condition of this paintlayer supports this assumption.

ⁱⁱⁱ The recipe of this combination varied substantially depending on the needs of each area requiring filling.