

An Investigation of a Group of Mid-19th Century French Carpet Designs

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I. Introduction

This paper describes the investigation of, and the proposed conservation treatment for, a group of mid-19th century French carpet designs from the collection of the Cooper-Hewitt Museum (accession numbers 1954.23.1-40). They are catalogued as cartoons for woven carpets from Paris, France, and are dated to the middle of the 19th century. They were given to the Museum by John Judkyn in 1954. The majority of the designs are attached to secondary supports. Although it was not readily apparent, the secondary supports suggested the designs were once assembled in an album. The following examination, stylistic evaluation, and analysis of internal evidence lead to this conclusion. The evidence presented also helped to determine the designs were part of a single album rather than a compilation of designs taken from various albums.

Description: Of the 42 separate designs, 14 are single-sided with one design to an album page and 28 are double-sided with a design attached to each side of an album page. All but four of the designs are adhered to medium weight, blue, antique laid paper. Remnants of a blue paper attached at various points to the backs of three of the others suggest that they too were attached to album pages. The fourth and smallest design has no attachment remnants and is loose. Most of the designs are larger than the album page and were folded to fit the album when originally mounted.¹ Thus, approximately one-half to two-thirds of a design is attached to the album page and the other portion is folded inward, onto itself, to conform to the size of the page. Five of the smaller designs have not been folded and are mounted centrally on album pages. To complicate matters, the orientation of the double-sided designs is sometimes different on each side, some being mounted vertically and others horizontally. Of the 28 double-sided mountings, 22 are unrelated designs on either side of the page, and the other 6 are related.

All the designs are hand-painted with matte, opaque paint (some have underdrawing in either graphite or chalk) on machine-made white wove paper. Eight of the designs comprise several sheets of paper joined together by a small overlap. Several of the designs are backed with an intermediate sheet attached to the secondary support. There are numbers written in ink on the pages; others are written on the back of the folded designs. The numbers are random and reach 1395, so it was concluded that the designs are selected from a much larger set of samples.

Various other inscriptions in French are found on the folded backs of the designs. Three mention a manufacturers' name: Messrs. Réquillard, Roussel, and Choqueil. Two of the inscriptions note that these specific designs were sold or given in property to the named manufacturers, and one indicates the manufacturers' address. Four of the designs are signed by the artists

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Protán, Virolet, and Zipélius. The dates 1847 and 1848 are inscribed on two designs.²

Condition: Both the single-sided and double-sided designs are unevenly attached to their mounts. They have large creases and cockling from mounting, and are unnecessarily rigid as a result of too much adhesive. The double-sided objects have, of course, twice the adhesive and therefore increased rigidity. Adhesives have also been overused to mend tears. The sections that fold out have suffered from handling and use. In most cases there are large tears, the fold lines are weak or split, and there is ingrained surface dirt. There are also large creases on these sections possibly from being held incorrectly in the album. The folded out portion is the only area where the previous repairs can be seen on the back. In addition, the majority of the album pages have folded edges and losses. All of the supports have much surface dirt and the white and blue supports have discolored over time.

Generally, the paint is loosely bound to the support. Over time pigment has offset onto designs which were in contact with each other. The folding of the support has also caused cracking and flaking. In the areas of thick impasto there is substantial paint loss. Only two of the objects exhibit severe flaking in large areas of the design; the majority of the designs have flaking around the area of loss, occurring mainly at the outer edges of the support, at the peaks of folds and creases and in the areas of impasto. The remaining designs have sustained some small, partial losses, but are otherwise stable.

Storage and Handling : The designs were stored folded in solander boxes as they were received. As noted earlier, most of the objects are double-sided. They are difficult to handle because the folded portions unfold and flap open, so that when the object is turned over to view the design on the verso, damage is caused. Any handling of the designs causes the paint to lift from the surface. During the survey, the designs were unfolded and placed in map folders between sheets of glassine. Color and black and white photographs were taken of each design and used to determine the correct orientation (vertical or horizontal). By placing and repositioning the photographs, it was determined whether the designs had counterparts or repeat patterns.³ After examining the designs, it was determined that removal of the secondary supports from the designs would be necessary in order to reduce distortion. Also, separation would make it possible to view related designs together, and thus exhibit each design as a whole. A means to carry out treatment had to be established.

II. Mid-19th Century French Carpet Design

During the mid-19th century, France produced both its traditional handwoven carpets, the Aubusson and Savonnerie, and cheaper mechanically-woven copies of them. The traditional carpets, originally named after their place of origin, differed primarily in their weave. Aubusson is a flat woven, tapestry carpet, and Savonnerie a thick-pile carpet. Eventually, the carpet names came to describe the weaves rather than their place of manufacture.⁴ The coarser, mechanically loomed carpets were woven in narrow strips ranging from 18 to 36 inches; the repeating patterns were then matched and the strips sewn together. Often the joined strips were framed by a border.⁵

Moquettes are another type of carpeting woven in long narrow strips. Sometimes called "French carpet by the yard", moquettes were also produced by hand or on mechanical looms in the mid-19th century. Though moquettes were made of the same materials as carpets, they were more finely woven. Later in the century the term moquette came to describe a type of very fine machine woven cut-pile carpet.⁶ Moquettes were very fashionable in the 1850s in France, and found many uses: "These moquettes may be applied to a hundred different purposes. For wall-hangings, chairbacks, sofas, and other pieces of furniture, perhaps no material is so gracefully appropriate, as being soft and pleasing to the touch, and eminently durable."⁷ Produced on a large scale in France from the 17th century onwards, they originally imitated Oriental carpets and, in the 18th century, changed to the naturalistic patterns characteristic of European design.⁸

The Carpet Patterns: To arrive at the functioning design for the loom, the artist first made a drawing or painted pattern.⁹ The scale of the pattern and the width of the repeat was determined by the loom employed to produce the carpets.¹⁰ When ready for production, the pattern was rendered onto square ruled paper and was called a mise-en-carte.¹¹ The term, mise-en-carte, refers both to the pattern and to the paper itself, called point paper in English.¹² Point-paper is divided into a series of squares, with every eighth, tenth, or twelfth line, both vertically and horizontally, showing more prominently than the others. Every square of the ruled paper contains vertical lines corresponding to the warp threads and horizontal lines corresponding to the weft threads. Once the pattern was transferred to the point-paper the weaver could set up the loom with the correct proportions.

All but one of the designs under discussion appear to be full-sized painted patterns, or cartoons, that precede the mise-en-carte. The variety of sizes among the designs in the group suggests they may have been intended for different sized products: from large carpets to smaller moquettes. Some of the designs have been squared off with graphite or chalk lines on top of the original, evidence of transferring or tracing onto a point-paper in preparation for weaving.¹³

Examination revealed that three of the torn designs had been previously mended on the verso with point-paper. The point-paper is printed with an engraved plate divided into ten squares in each direction and in one instance includes the inscription "10 en 10 pour Tapis". This provides further evidence that the designs were for carpets and were intended to be woven on the Jacquard loom since point-paper was always used in this type of weaving. The majority of the designs have recognizable repeating patterns and, in one case, directions are given for the correct placement of the pattern to allow the repeat to function.

The majority of the designs fall into the period of rococo and Gothic revival styles. Revived during the 1830s, these styles were used for everything from carpets and wallpaper to furnishings and ornamental decorations.¹⁴ Stylistically, the designs can be grouped into four broad categories. The largest category consists of designs marked by cartouches, lattice, and scroll-work embellished with naturalistic flower and plant motifs. These are most reminiscent of Savonnerie carpets which are decorated with naturalistic ornaments that appear to protrude from the flat surface. The second category is similar except the design elements are more delineated and stylized and, overall, more associated with the Gothic Revival. The third category depicts naturalistic floral motifs, such as roses and daisies with exaggerated use of strong "S" and "C"

shaped curves and wide arches popular in the rococo revival style. The fourth category consists of non-naturalistic flower and leaf forms which were also commonly used in the rococo revival style. While the sinuous curves and sweeping arches of the style are similarly employed, these designs stand out because of the fantastic plant forms. The differences in styles represented could indicate that these patterns, besides being the artists' original designs, were used as samples to be shown to customers. Considering that France was the leading country in decoration, and its designs were exported to many other countries, it may be assumed that the styles paralleled the international demand.

Three factors suggested the designs in the collection of the Cooper-Hewitt Museum were, at one point, assembled together in the same album or sample book. First, similarities were found in the color and manufacture of the album pages; for example, two of the album pages reveal a watermark belonging to a Parisian firm, D. & C. Blauw, listed as papermakers in the early-19th century.¹⁵ Secondly, a fiber analysis of the album pages revealed great similarities, and, finally, an analysis of the adhesive used to assemble the album showed likenesses as well.¹⁶

Although there was no proof the firm of Mssrs. Réquillard, Roussel, and Choqueil (noted in the inscriptions) was responsible for having the sample book made, it does seem quite likely. When the 42 separate designs were grouped by their repeating patterns 27 designs were formed. Three of the 27 patterns were inscribed with the Réquillard name, and two note that these specific designs were sold or given in property to the named manufacturers. Also, examples of work they produced is contained in an Art Journal article from 1850 that includes several engraved illustrations very similar to a number of designs in the subject group.

III. Analysis of paper fibers, pigments and binders

Given the complete lack of conservation literature on the topic of carpet designs, a scientific analysis of the materials proved to be the only way to provide an objective description of their content. Identification of the material components of the designs and comparison of data on treatments affecting these materials would enable the conservator to establish certain safe parameters for treatment.

Accordingly, an analysis of fiber content, pigments and binders was performed, both to provide an objective description of the supports, palette, and binding media used by the designers, and to indicate a rough developmental sequence of the designs. A representative group of six designs was selected on the basis of stylistic continuity and color of the paint used. One of the six was dated 1847, providing a point of reference as a basis of comparison of similarities and differences among the designs.

Stylistically, two methods of establishing the object-ground relationship within the design could be observed. One relies on the off-white color of the paper to act as a value base, the other uses a background color painted under or around the design elements to create the negative space around each element. In most cases the paint is applied in layered, overlapping coats, especially on the flowers and leaves which are rendered more realistically by the addition of

shadows and highlights. This is very similar to the method used for wallpaper production; one type of paper had a colored ground laid on it, and the other was not prepared.¹⁷ A number of the designs have a glossier white paint that has been used exclusively to correct apparent mistakes and to put the white highlights on some of the flowers.

Analysis of the binding media using the Fourier-transform infrared spectrometer showed that the paint was distemper, and the paint used for corrections was probably casein.¹⁸ Distemper, a water-based paint with glue, size, or starch as a binder, was traditionally used to paint or print wallpaper by hand, and its use was continued with the advent of mechanization.¹⁹ Casein was used to edit mistakes because it provides good opaque coverage.

Further analysis of the pigments unfortunately provided no additional guidance in dating the designs, since all of the pigments were in common use well before our 1847 reference date.²⁰ On the other hand, the supports did give some information concerning the age of the designs.

The carpet designs are all painted on paper characteristic of the machine-made paper most in use in the mid-19th century. The paper is thin and bears the distinctive pattern of the woven wire cloth on which it was made. The album pages are all hand-made antique laid blue paper. Several of the designs are backed with a secondary support also made of hand-made paper. Interestingly, the mixed use of hand-made and machine-made paper was common in the wallpaper industry.²¹ This collection suggests the use of both types of paper by textile designers as well.

Paper-making in the 19th century was affected by several issues. The main one was the need to find a substitute for the raw material, rag, which was quite costly. The eventual solution involved the addition of wood pulp to the raw product. This solution led to a dramatic reduction on the cost of wallpaper, thereby increasing affordability.²² A list of the components used in wallpaper production near mid-century included straw, straw and wool, manila hemp, cotton and linen rag.²³ After 1850, ground wood and chemical wood were used in increasing proportions.²⁴

A fiber analysis carried out on each of the selected designs, as well as on the designs to which they were attached back to back, showed that all of the primary supports contained a high percentage of the bast fibers flax, hemp or ramie. Chemical wood and ground wood fibers were also found in very small percentages in several of the primary supports analyzed. The design dated 1847, however, contains only rag fibers, which helped to confirm the date since no wood fibers are present. The designs that contain ground wood were assigned a date after 1851. Finally, only one set of back-to-back designs showed a meaningful difference in fiber content. One design consisted of all rag fibers, and the other contained ground wood. This might indicate these designs were placed into the album at different dates. Analysis of the album pages revealed a great similarity in fiber content, another indication that they are part of one album.

The consistency of the data drawn from the analysis of the fiber content, pigments and binders, along with the historical information presented, points to an acceptable date of the mid-19th century. There is, however, insufficient data to provide a developmental sequence for the designs. Scientific analysis of the various components of the designs revealed that the materials

used were similar if not identical to those used in the production of wallpaper during that period. Indeed, even the adhesives used to assemble the album were found to be very similar to adhesive samples taken from a similarly dated wallpaper attached to linen.²⁵

IV. Conservation

When considering conservation of the carpet designs, three characteristic problems emerged: 1) flaking paint; 2) the fact that they are mounted centrally on album pages, or back to back on album pages; 3) creases and cockling caused by the mounting. Each was addressed by testing four designs representative of the above problems. The aim here was that treatments found to be effective on these designs could then be applied to the entire group. The tests enabled selection of the most suitable materials for carrying out the conservation treatments and of the most suitable techniques in applying them. The tests also established the treatment limitations. The main limitation was imposed by the unfortunate combination of a weak primary support, a superior strength adhesive, and the water sensitive media used on all of the designs.

Examination also revealed several less significant problems which were resolved in a variety of ways. For removing surface dirt and unwanted transferred pigment from the painted surface, a variety of erasers and techniques were tested. A light rolling with a kneaded eraser over the paint surface proved most successful. On the verso, vinyl erasers could be safely used.

Several methods were employed for removing mold. In one, a scalpel was used to extirpate or dislodge the mold. In the second, a kneaded eraser was used in a lifting motion. The combined use of these two procedures was most successful.

Parchment size (The Bookbinder's Warehouse, Inc.), [H₂O, Acetic Acid, Ethanol 1:33:33:33], and 1.5% Ethulose 400 (Conservation Materials), [H₂O, Ethanol 50:50] were most effective in resolving the more significant problem of flaking paint. Both stabilized existing paint flakes while maintaining the paint's original appearance. During testing it was determined that the Ethulose 400 would be more effective on the areas with large paint flakes. In contrast, parchment size was used in areas that showed smaller sized flakes. These consolidants were applied by methods most adaptable to the problem: larger paint flakes afforded enough area for brush application, while a spray method was employed on the smaller flakes to avoid damage from manipulation.

Large creases on the folded portion of the designs were accessible so moisture was applied, and the areas were flattened between blotters and weight to remove them. The problem of creases and cockling could not, however, be addressed until the album pages were removed from the designs.

Removal of an album page from a single-sided design was undertaken as a preliminary step prior to the more complex problem of the separation of a double-sided design. Three methods were carried out and evaluated. Each involved the application of moisture to the adhesive layer followed by mechanical manipulation with a microspatula. Moisture was applied by brush,

by ultra-sonic humidifier, and by hand-held steamer. The last method was the most effective, albeit very slow, in removing the backing. This procedure was done systematically by peeling the backing paper at an acute angle beginning in the lower right corner and progressing upward and left. Having verified the effectiveness of the steam method on the single-sided designs, a similar procedure was employed on the double-sided designs with the exception they were suspended when the steam was applied.

To avoid potential transfer of the paint, a double-sided design was attached to a Dutch strainer.²⁶ A paper extension or collar was attached to the outside edges of the design. Since the paint was applied out to the edges of the paper an adhesive had to be chosen that would not affect the paint layer when attaching the collar. A water based adhesive could not be considered, since steam was to be applied in this procedure. An acrylic-based adhesive reversible in ethanol, proved the best choice, since all the colors were known to be stable in this solvent.

After verifying that it could be removed with ethanol with little pigment particle offset, acrylic heat set tissue (BookMakers) was chosen as the best method for mounting the design on the Dutch strainer. In order to reinforce the thin heat set tissue strip, Japanese paper (Okawara machine made) several times wider was attached along its length, with the tacking iron, leaving a 1/4" width exposed for adhesion along the edge of the design. The heat set tissue and Japanese paper strips were then fitted around the perimeter on the front of the design and on as much of the back of the design as possible and attached with the tacking iron. Blotters and weight were applied to the strips for a period of about 12 hours to ensure contact between the design and the attached strips.

A wooden strainer was assembled to fit the dimensions of the designs with the attached strips. The Japanese paper strips were attached to the strainer with masking tape. The use of masking tape made it possible to manipulate the paper strips so they could be tightened if necessary in the subsequent treatment. The strainer with the object intact was then lifted and the rigid support and weights removed. Finally, the strainer was placed into a wooden frame that was made to hold the strainer upright. The object had to be in this position before the steam was applied so the effect of the steam could be carefully monitored on both sides of the object.

The album page together with one design was lifted at the lower left corner, and the steam was applied as described above for removing the backing from the single-sided design. The results however were not as satisfactory when applied to the double-sided design. The process of swelling the adhesive with the steam was extremely slow, and the accumulation of moisture affected the paint layer.

Further tests carried out to determine if the tenacious adhesive was solvent sensitive failed to produce a solvent capable of swelling the adhesive.

To summarize, treatments were established for removing surface dirt, unwanted transferred pigment and mold; and for consolidating flaking paint, removing creases, and removing adhesive from the paint surface. It was also established through testing that the secondary supports could be released from the single-sided designs with a steam application, although this

process was extremely slow. Another method that could be considered is the mechanical removal of the secondary support with a scalpel, followed by adhesive removal. Although it was established that enzymes could not be used to release the adhesive it is possible that a poultice could be used to swell the adhesive. Experimentation with poultices, including the use of a heated poultice, might lead to a successful method of adhesive removal.

Subsequent treatments such as humidifying and flattening the designs to reduce distortions, and overall lining of the thin primary supports, would be contingent upon the success achieved in removing the adhesive layer from the backs of the designs.

Given the quality of the supports and their large size, and the fragile condition of the paint and its inability to withstand excessive moisture, it is recommended that the double-sided designs be left intact.

The tears and weakened areas and the losses along the edges of the support could be treated in the conventional manner: the tears mended with Japanese paper and wheat starch paste, and the losses filled with a comparable paper. The paper inserts and the paint losses along the creases could be inpainted.

Once those treatments which are possible are carried out, a significant improvement of the designs will be readily apparent. This together with placing the designs into better housing would fulfill the treatment objectives of promoting a stable physical condition and improving the appearance of the designs.

As noted earlier, viewing the designs required removal from the cases and unfolding. Simply providing solander boxes large enough to accommodate the unfolded designs stopped the continuous damage from folding. Glassine was placed on the painted surfaces to prevent pigment from offsetting and surface abrasion. Map folders slightly smaller than the inside dimension of the solander box were also utilized to further separate each object; this ensured minimal movement in the box, and provided a support for safer handling.

V. Conclusions

These designs for carpets and moquettes are significant in that they are the original artists' designs and cartoons for the final woven products. They also provide a record of the processes involved in transferring a design to a usable pattern for the weaver.

Historical research provided insight into the manner in which the carpets and moquettes were produced and therefore a better understanding of how the designs were used in the production process.

In compiling information on the historical use of artists' materials for comparison during the scientific analysis of the carpet designs, it was found that the methods used were scarcely documented. The examination revealed however, that the supports and paints were similar to

those used at the same time in the production of wallpaper; the latter provided better documentation, which was used in the comparison.

Uniformity was found to exist in the design materials and their application in the entire group. The various conservation problems presented by the designs were addressed by testing four designs representative of each problem, with the aim that treatments effective on these designs could be applied to the entire group. The tests enabled selection of the most suitable materials for carrying out the conservation treatments and of the most suitable techniques in applying them.

The fact that the double-sided designs could not, at this stage, be safely separated means they will continue to show evidence of once being part of a sample book. Although much of the historic significance was lost when the book was disassembled, there is the possibility that this group of designs are part of a larger set. The specific materials used in the mounting, album pages, and adhesive may provide evidence to link these designs with those of other collections.

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Endnotes

¹ The designs range in size in height from 14 7/8 inches to 27 1/2 inches (37.8 cm x 69.8cm) and width from 36 inches to 28 1/2 inches (91.4 cm x 72.4 cm). One centrally folded design measures 43 3/4 inches x 17 1/8 inches (111.2 cm x 43.5 cm). The album pages are all approximately 30 inches x 21 inches (76.2 cm x 52.5cm).

² The inscriptions are as follows: accession no.1954.23.6: "Vendu en propriété a Mssr. Roussel, Requillard, et Chocqueil/ le 2 janvier/1847/ E. Protán." 1954.23.15: "Mssr. Roussel Requillard...20 rue Vivi[enne]." 1954.23.40: "Livré en toute propriété à Mssrs. Requillart et Boupel et Aouguet(?)/ Paris le 2 Decembre/ 1848/Virolet." The inscriptions suggest a change in the partners' names within the years 1847 and 1848. For further information see: "The Carpet Manufacture of Messrs. Réquillard, Roussel and Choqueil," *The Art Journal*, Vol.12 (1850), p.122.

³ The pattern analysis was done by Sandee Miller, an intern at the Cooper-Hewitt Museum.

⁴ Helene Von Rosenstiel, *American Rugs and Carpets: From the Seventeenth Century to Modern Times*, (New York: William Morrow and Co.,1978), p. 178.

- 5 Helene Von Rosenstiel and G. Winkler, *Floor Coverings for Historic Buildings: A Guide to Selecting Reproductions*, (Washington, D.C.: Preservation Press, 1980), p. 230.
- 6 Von Rosenstiel, op. cit., p. 272.
- 7 "The Carpet Manufacture of Messrs. Réquillard, Roussel and Choqueil," loc.cit, p. 122.
- 8 Jeanne G. Weeks and Donald Treganowan, *Rugs and Carpets of Europe and the Western World*, (Philadelphia, New York, and London: Chilton Book Co., 1969), p.94.
- 9 Richard P. Wunder, "Some Observations on Textile Designs in the Cooper Union Museum," *Chronicle of the Museum for the Art of Decoration of the Cooper Union*, Vol.2, No.8 (June 1956), p.254.
- 10 William Watson, *Textile Design and Colour: Elementary Weaves and Figured Fabrics*, (London, New York, Toronto: Longmans Green and Co.,1930), p.270.
- 11 See H.A. Elsberg, "The Textiles of Lyons, Their Designs and Designers," *Bulletin of the Museum of Fine Arts*, (1932), p.30. See also Wunder, loc.cit., pp. 253-255; and "Vocabulary of Technical Terms: Fabrics." (Lyons: Centre International D'Etude des Textiles Anciens (CIETA), 1964), where mise-en-carte is defined as "a pattern on square ruled paper which serves as a guide for setting up the loom. This term is generally applied only to patterns for a draw loom or a Jacquard loom."
- 12 Susan Lambert, *Drawing, Technique and Purpose: An Introduction to Looking at Drawings*, (London: Trefoil Books, 1984), p.120.
- 13 The size of the squares range from 1 inch x 1 inch (2.54 cm x 2.54 cm) to 7 inches x 6 1/2 inches (17.8 cm x 16.5 cm).
- 14 Catherine Lynn, *Wallpaper in America: From the Seventeenth Century to World War I*, (New York: W.W. Norton and Co., 1986), p.359.
- 15 Edward Heawood, *Monumenta Chartae Papyracea Historium Illustrantia: I. Watermarks*, (Hilversum, Holland, 1950) p.418.
- 16 Fiber analysis was carried out using a polarizing light microscope. The iodine based "C" stain was used for the microchemical tests. See B.L. Browning, *Analysis of Paper*, (New York: Marcel Dekker, Inc., 1969), p. 46. For information regarding the adhesive analysis see endnote 25.
- 17 *The Paper Hanger, Painter, Grainer, and Decorator's Assistant*, (London: Kent and Co., 1879), p.15.
- 18 Mary Baker, Dianne van der Reyden, and Nancie Ravenel, "FTIR Analysis of Coated Papers", *The Book and Paper Group Annual* , vol. 8, (American Institute for Conservation of Historic and Artistic Works,1989), pp.1-12. Dr. Mary Baker, Research Chemist, CAL/MSM Smithsonian Institution conducted this analysis. The methods she used are outlined in the above article.
- 19 Max Doerner, *The Materials of the Artist: and their Use in Painting with Notes on the Techniques of the Old Masters*, (San Diego: New York, London: Harcourt Brace Jovanovich, Inc., 1934), pp.222-223. See also Phyllis Ackermann, *Wallpaper: Its History, Design and Use*, (New York: Frederick A. Stokes Co., 1923), p.104.
- 20 Analysis was done with the polarizing light microscope and microchemical tests. Following this, 12 samples were randomly chosen from the total number of samples (80) for analysis with a scanning electron microscope (SEM) with an energy dispersive x-ray analyzer attachment (EDXA). A summary of the microscopically identified

pigments follows: Lead white, Raw sienna, Bone black, Lamp black, Organic red, Blue verditer, Green verditer, Ultramarine (synthetic), Chrome green, and Chrome yellow. The SEM analysis showed inert white pigments or extenders comprising part of each sample.

21 Lynn, op.cit, p.300.

22 Ibid.

23 Ibid.

24 William J. Barrow, *Permanence/Durability of the Book-V: Strength and Other Characteristics of Book Papers 1800-1899*, (Richmond, Va: W. J. Barrow Research Laboratory, 1967) p.14.

25 Letter from Mary Baker to Sarah Dove, Sept.1,1990. This information relates to unpublished research done by CAL staff members Mary Baker and Dianne van der Reyden. The samples were analyzed with the Fourier-transform infrared spectrometer (FTIR), and found to be a clear mixture of a protein and a polysaccharide. In the analysis the polysaccharide was further characterized as starch by a comparison with reference spectra and the adhesive was identified as "pasta paste". To fully identify the components of the "pasta paste" further analysis using gas chromatography and amino acid analysis would need to be carried out. See Dr. Umberto Baldini and Sergio Taiti, "Italian Lining Techniques: Lining with Pasta Adhesive (and Other Methods), at the Fortezza da Basso, Florence," trans. Italian Cultural Institute, in *Conference on Comparative Lining Techniques: Proceedings of the Symposium in Essex, England, April, 1974*, by the National Maritime Museum (England: National Maritime Museum, 1974), p. 6-7, p.81-82. The recipe for the paste is included; the ingredients are glue, water, several varieties of flours, turpentine, ox gall, alum, and molasses or honey.

26 See *The Paper Conservation Catalogue*, Media Problems 3, Backing Removal 29, (The American Institute for Conservation of Historic and Artistic Works, Washington, D.C., 1988), p.9.

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