

## Eggs, Milk, and Fish: A Practical Investigation of Artists' Use of Fixatives

### ABSTRACT

This investigation is an extension of research conducted for the paper "The discovery of a fixative on graphite drawings by John Constable" which was presented at the Institute for Conservation (ICON) Edinburgh Conference in July 2006. While the previous paper sought to analyze and identify the fixative layer present on the Constable drawings, this research focuses on practical matters associated with the preparation and application of protein fixatives to the surface of graphite drawings.

For the purposes of this investigation, recipes and application methods are based on somewhat-fragmented historic references and on the clues found during research into the Constable drawings. Egg white, milk, and isinglass solutions were made and applied to graphite drawings using traditional methods such as dipping, brushing, and spraying.

The application procedures were documented digitally with still and moving images. Sample sets were made for purposes of visual comparison and identification. This investigation of early fixatives is continuing. The following paper summarizes early results.

### INTRODUCTION

My interest in fixatives began in 2003 when I had occasion to examine three graphite drawings dated 1803 by the artist John Constable (1776–1837). I was intrigued by a transparent, colorless fixative layer present on their surfaces. The coating is very difficult to see under normal lighting conditions, but has a surface sheen that is revealed by raking light (fig. 1). Surface analysis by attenuated total reflection (ATR) and fiber-optic pipette (FOP) spec-

troscopy confirmed the presence of a protein layer over the media (Williams 2005).

Other works by the artist were examined and a consistent use of fixative was found (Weir et al. 2007, 113–122).<sup>1</sup> Several references suggested that this activity may well have been part of Constable's regular art practice, including a partial recipe for an albumen solution found inserted into one of the artist's sketchbooks with the notation "will sett black lead" (Reynolds 1984, 54–55)<sup>2</sup> and a report by a witness observing the artist using isinglass to set his sketches (Leslie 1951, 253).<sup>3</sup>

The presence of a fixative coating on an early nineteenth-century drawing, while not unusual, can limit any desired conservation treatment and raise some intriguing questions about artists' practice of the period. Conservation and art literature describes the use of fixatives for early graphic media on paper, but references to specific substances, recipes, and application techniques for fixatives over graphite are few (Meder 1978, 159–160).

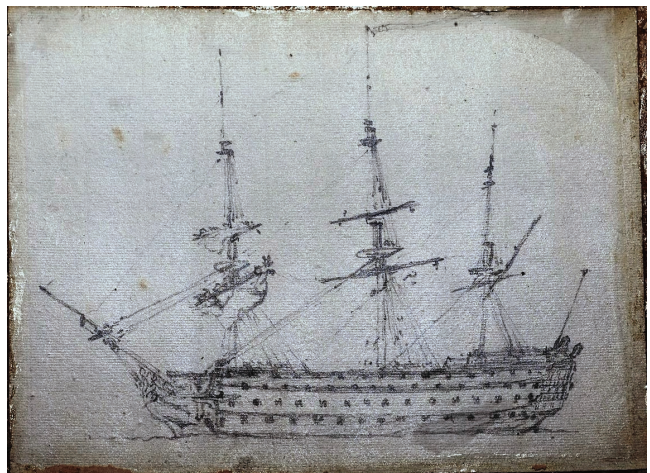


Fig. 1. High-contrast image showing the application pattern of the fixative. John Constable, *Broadside View of the H.M.S. Victory in the Medway*, 1803. The Thomson Collection, Gift 2003, Art Gallery of Ontario. (Photo: Sean Weaver)

Presented at the Book & Paper Group/ICOM-CC Graphic Documents Joint Session, AIC 35th Annual Meeting, April 16–20, 2007, Richmond, Virginia. Received for publication Fall 2007.

The focus of this investigation was to study the individual materials, their method of application, and their effect on graphite media. My interest was in the practicalities of making and applying a fixative to sensitive media. Using clues from the research conducted on the Constable drawings and with some reference to ingredients mentioned in the artists' manuals of the day, I chose to include egg white, isinglass, and milk in my study.

The chemistry and use of foodstuffs in artists' materials is well recorded in many historic and contemporary handbooks and manuals but most references to these materials are made in relationship to the art of painting or to pastel painting rather than the activity of drawing on paper. These three common early ingredients—egg white, milk, and isinglass—are mentioned in recipes that serve a variety of purposes, such as pigment binders, glazes, varnishes, sizes, and adhesives, to name a few (Carlyle 2001). On paper they appear as coatings, in the form of sizes, varnishes, and fixatives. By the end of the eighteenth century, artists' handbook recipes indicate the use of additional ingredients such as alcohols and gums (Bontinck 1944, 151–158). To form a base for later comparison I chose to use very simple recipes with one main ingredient and only the addition of water as needed.

Three sets of graphite drawings were created (of three drawings each) for the test applications.<sup>4</sup> Several grades of graphite pencils (Staedtler Mars lumograph) were used to produce drawings in the manner of artists of the era that were sketchbook size and executed on a handmade laid paper (Langley 1985 made by Barcham Green) that had a surface and weight similar to the eighteenth-century writing paper used by the artist J. Constable. An uncoated sample of the paper was used as a control for comparison tests.

## SOLUTION PREPARATION

### Skim'd Milk

There are a number of artists who have used milk as a method of fixing media. Gainsborough (1727–1788) employed a milk fixative as one step of his varnishing technique for watercolors, advising in a letter of 1773 that after making the black and white sketch, “when you see your Effect, dip it all over in skim'd milk; put it wet on [your] Frame [just glued as before observed] to let it dry.” After describing several other stages, he signs off with “Swear now never to impart my secret to any one living—” (Gainsborough 2001, 64).

When we do find other references to the use of milk as a fixative, it is most often described as being skimmed. The separation or skimming of milk and cream is a simple process that results in a fat-reduced liquid desirable for the purpose of fixing.

I was able to obtain raw, unpasteurized milk from a local farm from the first morning milking of a Guernsey cow. It

was separated the same day, following the instructions in Mrs. Beeton's 1861 *Book of Household Management*, and placed in a cool spot, letting the cream rise to the top. The cream was carefully poured off and the skimmed milk (undiluted) was ready for use.

### Egg White

The method of preparation of egg white remains simple and unchanged since the time of Cennini, who advises painters that

in order to give one of your works the appearance of being varnished within a short time, without actually being so, take some white of egg, beaten as thoroughly as possible with the whisk, so that it comes out a good solid foam; let it distill for a night. Take the part that has distilled, in a little new dish and lay it all over your works . . . (Cennini [1437]1960, 99–100).

Heritage hen eggs were obtained from the same local farm and prepared in the manner described but mixed with half their volume of distilled water to make the solution more liquid.

### Isinglass

If we look at the uses for isinglass during the late eighteenth and early nineteenth centuries, we see what types might have been readily available to artists for making up the various recipes in the handbooks of the day that suggest “isinglass” as an ingredient (figs. 2a-b).

The term “isinglass” refers to a pure form of gelatin obtained from the inner membrane of the swim bladder or sound of several species of fish, with that taken from the Russian sturgeon fish being the most pure, valuable, and considered to be of the best quality. It is important that a distinction is made between other substances, such as fish glue or animal gelatin, and Russian isinglass, as the former do not possess the unique qualities of true isinglass.

The major use of isinglass during this period is listed historically as fining, which is a clarification process for beer and white wine. Isinglass was used for this purpose due to its unique fibrous properties that are not found in regular animal gelatin. Shredded isinglass was a common ingredient in pantries of the eighteenth and nineteenth centuries. It is prepared from the inner membrane of the swim bladder and readily dissolves in water, has no smell or taste, and was desirable for its ease of use in making very clear jellies and confectionary and as a thickening agent. The convenience of shredded isinglass from the pantry would have provided the artist with a fast method for making up small amounts as needed. Mrs. Beeton makes it clear that there is a distinction to be made between this type of isinglass and adulterated gelatins disguised as pure isinglass (Beeton [1861] 1986, 711).<sup>5</sup>





Fig. 2a. Dried Salianski Russian isinglass (Photo: Joan Weir)

Another unique characteristic of isinglass is its ability to reflect prismatic colors in certain types of light. It is possible that this is due to the presence of specific crystal types found in the swim-bladder tissue. These crystals may be the source of the opalescent coloring and account for a sparkling quality associated with the isinglass coatings (Jackson 1774, 6, 9). This characteristic is currently being investigated.

While there are recipes that use isinglass as a base to which alcohol and gums are added, isinglass diluted just with water can serve very well as a size and, as this investigation demonstrates, as a transparent fixative for graphite. Russian isinglass was prepared as described in conservation literature and a 1% solution was made for application testing.<sup>6</sup>

### Graphite

Graphite as an artist's medium appears in art handbooks of the eighteenth and early nineteenth centuries, usually then called "black-lead" or "plumbago," although we know it to be carbon. The history of the use of graphite is an interesting one but not a focus of this current paper; however, I would like to make several points that relate to graphite and the investigation of fixatives.

The graphite available to artists at the end of the eighteenth century varied in quality. Pure graphite—such as that valued from the Borrowdale mines in England—had a different character on paper than the early composite pencils developed and manufactured throughout the eighteenth and nineteenth centuries. Graphite of the period was manufactured with materials such as clay, wax, sulfur, resins, or other binders or fillers. The range of hardness and darkness of color varied greatly. There was much discussion about the merits of using such a difficult medium that varied so much in quality (Dinsdale 1748).

The application of a fixative to graphite does saturate and change its naturally shiny appearance to a velvety black, as can be seen in the tests performed in this study. This darkening in tone was seen as very desirable by some



Fig. 2b. Shredded culinary isinglass (Photo: Joan Weir)

artists. However, this change in appearance can be quite dramatic and can increase its resemblance to other black drawing media such as black chalk (fig. 3).

### SUPPORTS

It is desirable to have as flat a surface as possible for the execution of a graphite drawing, especially if the sheet is large or if the drawing is to take place out of doors. Drawing manuals of the early nineteenth century recommended laying paper down on board or forming blocks of sheets that could be cut off one at a time (Harding 1838). Certainly these methods would be necessary to avoid unwanted smearing of the medium, and other systems would be necessary to stretch dry any paper to which a surface fixative might have been applied.

It should be noted that upon first examination of a graphite drawing any preparatory actions of this sort may not be readily apparent, and some clues to the use of a fixative may be the trimming of the edges of a sheet and its subsequent laying down onto a secondary support.



Fig. 3. Image of brush application over graphite showing left side saturated and right side uncoated. (Photo Joan Weir)

## APPLICATION TESTING

Before the test applications by brushing and spraying, each drawing was pinned at the corners to a backing of foam core. After application the drawings distorted but were left pinned to air dry. Dipped test sheets were partially air-dried, then pinned at the corners to the foam core supports and left to air dry.

Although spraying is the first method which comes to mind when people think of a fixative application method, the Constable drawings showed some evidence of brush application. The third method chosen to investigate was the dipping method that was mentioned in some artist's handbooks (fig. 4).

Dipping was accomplished by simply touching the drawing surface to the solution in a rocking motion. Because of the excessive amount of liquid applied by this method, care needed to be taken to prevent the paper from rolling up.

For my spray application test, I adapted the method invented by A. J. Loriot in 1753 and published by the French Royal Academy of Painting and Sculpture in 1780.<sup>7</sup> It is a simple method that can deliver a very fine, controlled spray with the correct tools and some practice. Several coats may be applied and dried successively until the desired finish is achieved.

For brush coating it is important that the brush used is not too soft-bristled but has long hairs that can hold enough liquid when loaded to pass over the width of the drawing in one stroke. During testing, the loaded brush was wet but not dripping. The brush was reloaded after each pass in order to prevent drying of the bristles, to prevent any touching and smearing of the image media. Any pooled areas were smoothed out to the margins. This method of application was done fairly quickly as the paper tended to distort before drying and flattening out.

Additional applications may be made after the first coat is dry if desirable.

## RESULTS

Before discussing the results I want to emphasize that the majority of these coatings when dry are very difficult to detect. They are often best seen with raking daylight or a light that you can move around easily at low angles over the surface. It is best to look at these coatings under a number of lighting conditions to become familiar with their characteristics. Often they can have the appearance of sizing in the paper; consequently they are very difficult to capture photographically.

## Dip Coating Method

The egg-white solution formed the poorest coating by dipping, as it was full of bubbles and missed areas. Repeated dipping to try to coat the missed areas resulted in a thick, uneven layer that distorted the paper severely and left pooled areas of yellow solution and resulted in areas of flaking. Much of the drawing was uncovered. (It is possible that the solution was not liquid enough for the paper to absorb.) The dipping method caused immediate curling of the supports but upon air drying the sheets were remarkably in-plane (fig. 6).

Both the milk and isinglass dip coats were more successful. The milk coating was visible because of a slight pooling of the liquid along the edges of the application. Of the three types, the isinglass dip coat was the most successfully formed—virtually invisible and the least distorted upon drying.

The dipping method was difficult to control and often left areas uncovered where air had been trapped. It was more difficult to handle the sheets as they curled immediately and had to be pinned to a support for final drying.

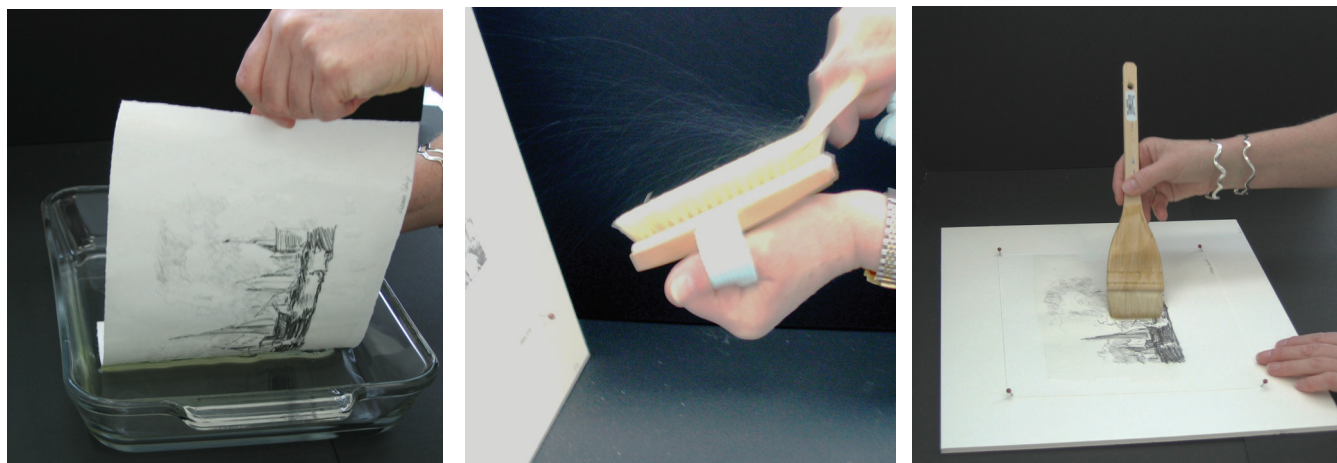


Fig. 4. Methods of application tested: (a) dipping, (b) spraying, and (c) brushing. (Photos: Maria Sullivan and Marie-Eve Thibeault)





Fig. 5. Detail of dip application of egg white solution (wet). (Photo: Joan Weir)

Care had to be taken not to deposit solution on the verso as the sheet would adhere to its carrier.

#### Spraying Method

For both the egg-white and isinglass solutions this method proved to be totally unsuccessful due to the almost immediate production of a foam instead of a spray (fig. 6). (Solutions with the addition of alcohols may not exhibit this problem but were not included at this stage of the investigation.) In contrast the milk solution was easily applied by this method, although it beaded up on the surface first and the application had to be completed in four passes, with drying between each pass. The milk surface had a very faint speckled appearance under raking light. Of all the methods this one caused the least overall distortion, but the application method formed a rather incomplete coating and was the most labor-intensive.

#### Brushing Method

The most unexpected results were with the brush coating method. Amazingly, all solutions could be brushed over the graphite drawings with little to no smearing of the media (fig.7).



Fig. 6. Spray application of egg white created foam droplets. (Photo: Marie Sullivan)

The milk solution was applied first using a very soft-haired, absorbent brush that tended to dry out halfway across the drawing. This resulted in some movement of the graphite in the darker areas. The brush was changed to a slightly stiffer-bristled brush for the remaining two drawings (as mentioned previously), and both the egg-white and isinglass applications had no visible smearing of graphite. The milk brush coating gave the paper a warmer tone. As expected, the egg-white solution had a very slight yellowish tone, and there was fair amount of distortion and slight stiffening of the sheet. The isinglass coating is the most interesting as it was very difficult to see once dried. The one-percent solution sealed the surface well without stiffening the paper (fig. 8).

There is a slight distortion of the sheets from this method but if any of these three brush-coated drawings were trimmed and laid down, it would be hard to tell that they had indeed been fixed. Under magnification there are some characteristic visual clues. Minute sparkles scattered over the isinglass-coated sheet sometimes can be seen glistening on the graphite surface, but otherwise their presence could easily be attributed to sizing in the paper. The milk-coated sheet has a definite low sheen and a saturated surface appearance. The egg-white solution appears



Fig. 7. Macro of brush application showing no smearing of graphite: (a) egg white, (b) isinglass, and (c) milk. (Photos Joan Weir)



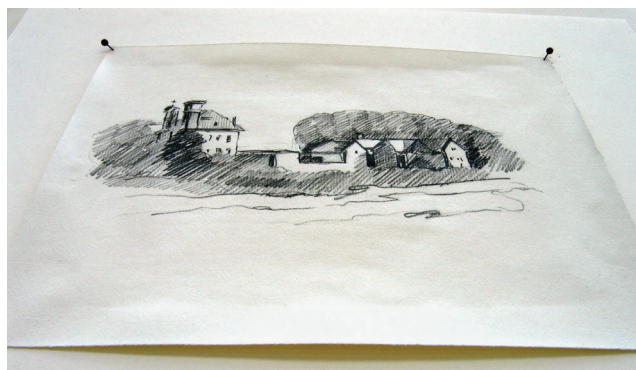


Fig. 8. Brush application of isinglass (a) wet and (b) dried. (Photos: Joan Weir)

a little more glossy and is yellowish in color but resembles the milk in saturated appearance.

#### Comparison Testing

I had occasion to use the test samples when examining a drawing by the artist Johann Christian Reinhart (1761-1847), dated 1818.<sup>8</sup> It is quite large, at 48.2 x 63.8 cm. It is described as being executed in graphite and black chalk on laid paper (fig. 9).

This drawing has been trimmed and mounted onto a secondary sheet of good-quality, heavy laid paper. A decorative border has been applied at the edges, with the left and right sides added as separate strips.

The media appear quite black, varying in tones of grey and black with a thick, rich quality. There are lines that have roughened the surface, almost scraping it. When first looking at the work one can notice right away the clarity of the image. The white areas of the paper appear very clean and the lines very sharp. There is no obvious shine or gloss to the surface. Could this work have been fixed?

Comparisons with the test paper and sample drawings showed a very strong visible resemblance to the test drawing coated with isinglass. The tiny crystals were seen in certain areas of the medium and support. Some of the medium appears very black and other areas are grey, suggesting that perhaps a fixative was used as part of the drawing method (fig. 10).

While this visual comparison is suggestive, confirmation of the use of a fixative would require more research and analysis. Identifying isinglass as the specific protein in such a coating is a more difficult but exciting challenge. New testing methods for identifying specific proteins have been recently developed and are now being adapted to study materials found on paper supports (Heginbotham et al. 2006). We are anticipating that this testing will help in the identification of our coating. Research continues on the use of protein-based fixatives, adding to the knowledge of historical drawing practice, artists' materials, and techniques for the technical examination of art works on paper.

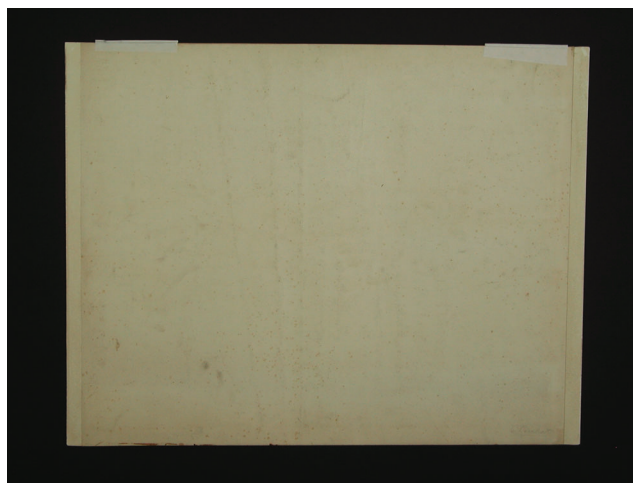


Fig. 9a. Recto showing added decorative border. Johann Christian Reinhart, *In the Park of the Palazzo Chigi, Ariccia*, 1818. Chalk and graphite on laid paper on a secondary paper support. Art Gallery of Ontario. Purchased as a gift of the Marvin Gelber Fund, 2005.

Fig. 9b. Verso showing left and right side strips. (Photos: Joan Weir)

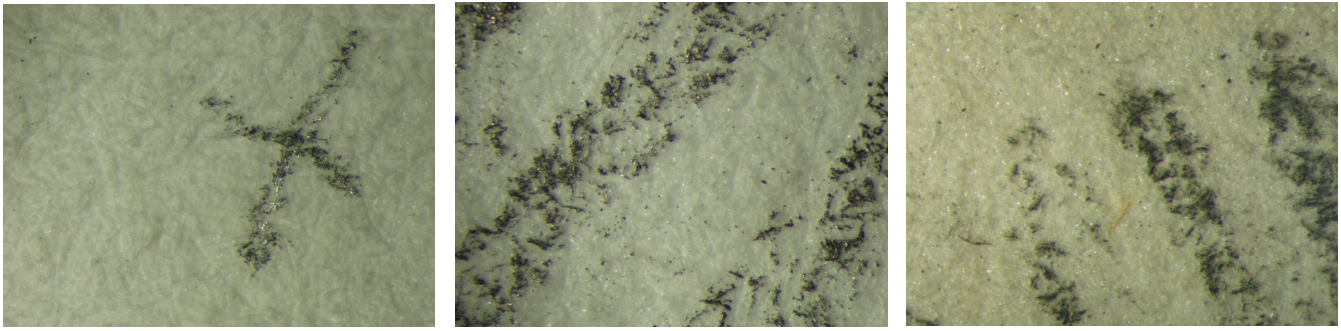


Fig. 10. Macro shots taken with same magnification and under the same lighting conditions: (a) control sample, uncoated; (b) isinglass brush application; (c) Reinhart drawing. (Photos Joan Weir)

#### ACKNOWLEDGMENTS

I would like to acknowledge the help and support of the following people at the Art Gallery of Ontario: Margaret Haupt, deputy director of collections and head of conservation; Brian Gravestock, mountmaker; Marie-Eve Thibeault, assistant paintings conservator; Maria Sullivan, conservator of paintings, Canadian art; Jennifer Rieger, historical site coordinator, the Grange House; and Sean Weaver, photographer. Special thanks to Mrs. Gail Sheard for her generous support.

#### APPENDIX: DESCRIPTION OF THE LORIOT SPRAY APPLICATION METHOD

Loriot. 1780. *Secret de fixer le pastel, inventé par Mr. Loriot, & publié par l'Académie Royale de Peinture et de Sculpture, en 1780.* (Renou, 20 Avril 1780.) Paris, France: Veuve Hérisant. <http://dzsr1.sub.unigoettingen.de/contentserver/contentserver?command=docconvert&docid=D290406> (accessed July 4, 2007). Unpublished trans. M.-E. Thibeault, 2006–7.

To start the operation of fixing the pastel, everything being prepared and the brush humidified with the mixture still warm, one must present the face of the brush at a distance of 8 to 10 inches of the picture, passing the curved part of the iron stick, in a manner to press slightly the hair by one of the corners of the iron stick, always in the same direction, in pulling constantly towards ourselves, where the result will be, due to the position of the brush, a sort of vapor or dew almost imperceptible, will be projected by the straight flight at each hair onto the picture, and that the blend of esprit-de-vin and glued water, penetrating simultaneously the pastel, will come necessarily to an end to fix it.

Continue to pass successively the brush dampened with the mixture with the same care, meaning always in compressing it, with the aid of the iron stick, on all of the surface area of the picture, taking care of dipping the brush in the mentioned mixture, each time we realize that it

needs to be dampened again. When all the surface area of the picture is impregnated with this dew, let it dry, and then start the operation in the same order and the same manner a second and even a third time, because a greater amount is not necessary.

But note that “this operation does not exempt the glazing of the pastel picture, as usual.”

#### MATERIALS

Salianski Kremer Isinglass Glue (# 63110)  
Kremer Pigments  
247 West 29th Street  
New York, NY 10001

#### NOTES

1. Drawings from the Tate Gallery, British Museum, Victoria and Albert Museum, and National Gallery of Scotland were examined and are listed in a table format. (See Weir et al. 2007.)
2. This recipe appears to be for an albumen solution. (See Reynolds 1984, entry 20.43.)
3. Leslie refers to an observation made in 1834 regarding Constable's practice of setting his “sketches” with isinglass.
4. Special thanks to Art Gallery of Ontario Mountmaker Brian Gravestock for supplying pastiche drawings for testing.
5. Beeton describes methods of testing to tell if isinglass has been adulterated.
6. Isinglass was prepared with Salianski Kremer Isinglass Glue using the recipe in the 2005 Kremer Pigments catalog.
7. For a translated version of the method see Appendix.
8. Johann Christian Reinhart, *In the Park of the Palazzo Chigi, Ariccia*, 1818. Chalk and graphite on laid paper on a secondary paper support. Art Gallery of Ontario. Purchased as a gift of the Marvin Gelber Fund, 2005.

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