PHOTOGRAPHIC REPRODUCTIONS USED TO REPLACE DECORATIVE VENEER LOSSES ON A SMALL SEWING BOX

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Introduction

A sewing box was submitted to CCI for treatment by the Newfoundland Museum. As is the case with many objects in museum collections, little is known of the history of the sewing box. It was probably brought to Newfoundland from England late in the 19th-century, and it was later acquired by the Museum.

The outer surface (Fig. 1) and some of the inner surfaces of the sewing box were veneered in an intricate design of ivory, wood, and tin. Repeat designs were created with varying sizes of veneer pieces, many less than 2 mm in width (Fig. 2). Some of the smaller ivory pieces had been dyed green. Compartment lids and the border around the mirror inside the box were also decorated with similar designs.

This decorative technique, known as "Piqué", was popular in India, particularly in Bombay (hence another term, "Bombay mosaic"), as a method of decorating objects for export. The technique has been traced to India from Persia, however its place of origin and earliest dating is unknown. The process is similar to that used to produce wood banding. The patterns are produced by cutting triangular or rhomboidal sticks of materials such as mother-of-pearl, ivory, tin, and wood (usually ebony or sandalwood) longitudinally. The sticks are glued together and the block is thinly sliced across the grain. The individual design pieces are then glued to a paper base to form a complex pattern (Lincoln 1971). Pieces of the paper base were visible in loss areas of the sewing box.

Analysis confirmed the components of the sewing box veneer as ivory (both natural and dyed green), tin, and wood. Copper concentrations identified in the green sample, were probably from verdigris, an acetate of copper, which was recommended in *Dick's Encyclopedia of Practical Receipts and Processes* to produce a green dye for ivory (Dick undated).[1]

Condition

The veneer on the outside of the box was in very poor condition. Damage included large and small areas of loss, tenting, cupping, and the partial release of old adhesive.

Damage was due mainly to the hygroscopic nature of the wood carcase and the ivory. The large ivory plate on the lid had split longitudinally with the wood substrate (Fig. 3). The ivory edges had cupped along the split. Individual pieces of patterns were missing, as was a large section of repeat design. On the sides of the box, individual pieces and whole sections of veneer were loose or missing. Most of the ivory plates had warped and were curling away from the carcase. An envelope containing individual veneer pieces accompanied the box, however it was impossible to establish the original position of each piece.

The veneer surfaces on the inside of the sewing box were in surprisingly good condition and required only a light cleaning. There was no discernible difference in colour density between the inside and outside veneer materials.

General Treatment

Treatment involved many steps. This paper concentrates on the materials and techniques for replacing the veneer losses. The other treatment steps are described only briefly.

1. Stabilizing Extant Veneer

Natural glue had been used to adhere the original veneer surface to the wood carcase. The first step was to stabilize the extant veneer. A technique used for relaying wood veneer (VonReventlow 1988) proved ideal for this purpose. To resecure tented and loose areas, warm water and ethanol (1:1 v/v) was brushed over the surface. The water absorbed into the underlying paper layer and softened the old adhesive. Gentle pressure was then applied using fingertips or a flat-ended dental tool. Where reactivation was not sufficient, warm hide glue was brushed over the surface after applying a few drops of ethanol to improve penetration. The adhesive was then manipulated with fingertips into the crevices. Residual adhesive on the surface was removed.

The warped ivory plates were flattened by covering them with a dry blotter, followed by a damp blotter, plexiglas, and weights. After they were flattened, attempts were made to readhere them to the carcase. A plate adhered with hide glue released within 24 hours. A small hair crack appeared on a plate adhered with a 25% solution of Acryloid B-72 in 95% ethanol. The adhesion was reversed since it was obvious that the warping could not be corrected.[2]

To protect the protruding plate edges on the sides and on the lid, the crevices were filled with a mixture of beeswax, Ketone Resin N and microcrystalline wax W445 (4:1:1 v/v), and dry pigments. Photographic replacements were not considered for this area because of the uneven surfaces of the cupped ivory.

2. Replacing Small Veneer Losses

Losses of one or a few pieces from a pattern were filled using either a) suitable replacements from the envelope of unidentified pieces, or b) extant individual pieces that had protruded along the borders of a large loss area and that had been removed. Removing or repositioning pieces to even the edges of larger loss areas was considered justifiable because it would have been extremely difficult to cut a photographic replacement section into intricate shapes (Figs. 4, 5).

Photographic Reproductions

Photographic reproductions have been used successfully to replace missing wood inlay banding on furniture. The technique has also been successful for replicating a banjo head skin and a needlework firescreen panel (Sheetz 1986).

Reproducing the many veneer losses of the sewing box with three-dimensional materials would have been a very long and tedious process. The photographic reproduction technique seemed a timely and ideal approach to replacing the larger areas of loss. Another advantage of this technique is that the replacement material is readily identifiable as non-original.

1. Colour Matching

It had been hoped that colour photographs would reproduce the tones of the natural and dyed ivory, the wood, and the tin. However, a satisfactory colour match was not possible. The colours of the original materials therefore had to be applied to the black-and-white photographs in some manner.

Altering the dilution of selenium toner used in the printing steps was considered for reproducing the colour of the natural ivory. Selenium toner has a dual effect; it changes the image tone and it increases the permanence of the image (CCI 1986). The 1:20 dilution recommended in CCI Note 16/6, *Processing Contemporary Black-and-white Photographic Films and Papers,* provides the latter effect without noticeably changing the tone of a black-and-white photograph. Longer washing times or stronger concentrations of selenium toner were not expected to have a detrimental effect on the photograph.3

2. Preparing the Black-and-white Photographs

Jeremy Powell, Senior Scientific Recording and Documentation Technologist, Analytical Research Services Division, CCI, carried out the tests and provided the reproduction photographs.

Photographs of extant sections of the various veneer designs were produced as closely as possible to a one-to-one scale using Kodak Plus-X Panchromatic 4 x 5 Professional film. The film was processed in full-strength Kodak D76, a general purpose black-and-white film developer, followed by stop bath and fixer, all at 21ºC.

To establish the degree of tone variation produced by different concentrations of selenium toner and washing times, a number of prints were made on Kodak Ektamatic SCF photographic paper, a fibre-base paper from high-quality wood pulp, alpha cellulose, (Stroebel et al. 1986). The steps followed those recommended in CCI Notes 16/6 (1986).

Printing Steps:

1. Development--for approximately 90 seconds, with constant agitation
2. Stop bath--for 30 seconds
3. Fixing--2 baths of 5 minutes each, using Eastman Kodak General Purpose Fixer
4. Washing-- i) 5-minute rinse
   ii) treatment with hypo clearing agent for 3 minutes
   iii) wash for 20 minutes

At this point, the printing steps for the test photographs diverged from the recommended 1:20 dilution of selenium toner and 3-minute washing time. Different concentrations of selenium toner and washing times were then tested as outlined in Table 1.

Table 1.
Concentrations of Kodak Selenium Toner and
Washing Times of Five Samples

Sample No.	Concentration of Selenium Toner	Washing Time
1 - control sample	1:20	3 mins
2	1:20	6 mins
3	1:20	9 mins
4	1:9	3 mins
5	1:3	3 mins

The result was minimal differences in the tone of the five samples. It was therefore decided, almost arbitrarily, to use a 1:9 concentration of selenium toner with a 3-minute washing time for the reproduction photographs. A number of prints were made using this process. They were air-dried and left unglazed for the next series of tests.

3. Inpainting

While the natural ivory, tin, and ebony areas in the toned black-and-white photographs closely reflected the natural colours, the green ivory and brown wood colours had to be reproduced.

Kodak Retouching Colours did not adhere well to the slightly glossy photograph surface, but Grumbacher watercolour in tube form did. The watercolour was applied directly onto the surface using a small brush. The dull watercolour inpainting also broke up the even gloss of the photograph surface, which helped blend the photographic reproductions with the original veneers.

4. Protective Coating for the Inpainting

The inpainting on the photograph had to be sealed to prevent its accidental removal during a possible routine and well-meaning "surface clean" by a museum staff person.

Although the nitrocellulose spray that Sheetz used for the tinting process in about 1983 shows no signs of having deteriorated,[4] concerns regarding the longer-term stability of nitrocellulose lacquers (Koob 1982) led to a consideration of alternatives. A literature search found no conservation studies on protective coatings that could be applied to a photograph surface separate from the initial printing process.

The coating had to meet three main requirements:

1) to be compatible with the photographic emulsion and its protective supercoat;
2) to protect the inpainting from abrasion and accidental removal;
3) to maintain long-term stability and clarity.

4.1. Protective Coating: Compatibility

Sheetz noted that the photographic emulsion on the reproduction inlay photographs proved insensitive to ethanol, methanol, and lacquer thinner (Sheetz 1986). However, as it was not known how a photographic emulsion would react to other solvents, it was decided to test various coatings for their compatibility with the photographic emulsion. The ubiquitous Acryloid B-72 was an obvious choice. A number of commercial spray varnishes that were on hand were also tested.

The following coatings were selected for testing:

Acryloid B-72 in xylene (5% w/v)
Acryloid B-72 in xylene (10% w/v)
Krylon Crystal Clear Spray[5]
Grumbacher Hyplar Varnish, Gloss[6]
Grumbacher Picture Varnish, Matte[7]
Grumbacher Damar Varnish, Matte[8]
Beaver Clear Lacquer Spray[9]

Sample photographs were inpainted using Grumbacher watercolours, were allowed to dry and were then secured to 6-ply mat board with double-sided tape (to hold the photograph flat). Each coating was sprayed

on a sample photograph. One photograph was left uncoated as a control. Microscopic examination showed no apparent change in the surface of any of the photographs.

4.2 Protective Coating: Abrasion Test

After one spray application, the inpainted areas were rubbed with a swab moistened in distilled water, and the amount of colour loss on each photograph was noted. All samples were then sprayed a second time with the respective coating. The exception was the sample sprayed with 5% Acryloid B-72 in xylene. A concentration of 20% was used for the second coating. Moistened swabs were again rubbed over each surface, and the amount of pressure and
resultant colour loss were noted. The results are listed below.

Table 2
Effectiveness of each coating

Coating	1st Coating: Colour loss after minimal rubbing	2nd coating: Colour loss after vigorous rubbing
Acryloid B-72 (5%)in xylene	major	-
Acryloid B-72 (20%)in xylene	-	none
Acryloid B-72 (10%)in xylene	medium	slight
Krylon Crystal Clear Spray	slight	none
Beaver Clear Lacquer Spray	medium	slight
Hyplar Varnish, Gloss	major	major
Picture Varnish, Matte	major	major
Damar Varnish, Matte	major	medium

Although the test was empirical and the amount of pressure applied to the swab in each case may have varied slightly, the results were clearly defined. It was felt that vigourous rubbing of the swab would exceed the pressure of routine damp dusting by even the most energetic member of the museum cleaning staff.

As shown in the above Table, the 20% solution of Acryloid B-72 in xylene and the Krylon Crystal Clear Spray were the most effective. The others might have been more effective with further applications, however, the coating requiring the fewest applications obviously would be the most suitable.

These results were applied to the immediate protection of the inpainted areas. The coatings were then tested for long-term stability on the photographic emulsion.

4.3 Protective Coating: Accelerated Aging

All of the coated samples were submitted to aging by high-intensity light using a Xenon arc source.[10] A

mat board shield covered half of each photograph as a control. The samples were then placed in an Atlas Weather-Ometer at 50ºC and 40% RH.

Unfortunately, at the time the temperature could not be lowered to more closely represent that expected in a normal museum. However, it was felt that if it had any effect, the higher temperature would accelerate degradation. The testing period of 170 hours at 90,000 lux was equivalent to 17 years at 300 lux, or 7 years at 750 lux.

No visible change was apparent in either tone or surface condition of the samples, with the exception of the Damar Varnish sample, which yellowed as expected. Since none of the coatings affected the photographic elumsion and only the Damar Varnish lost clarity, all except Damar Varnish could be considered for application to the surface of a photograph.

4.4 Protective Coating: Selection

Based on the results of the three tests (compatibility, abrasion and accelerated aging), only the 20% solution of Acryloid B-72 in xylene and the Krylon Crystal Clear Spray were acceptable.

The gloss of the sample sprayed with the Acryloid B-72 solution was markedly higher than that of the original veneer surface. Possibly, the addition of a matting agent to the coating would solve this problem.

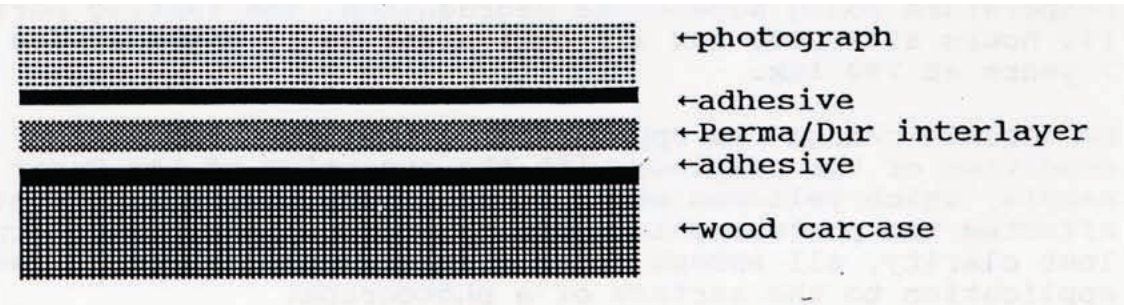
The Krylon Crystal Clear Spray was ultimately chosen because its surface gloss could be manipulated with Krylon Matte Spray.[11] The convenience of a commercial product was not a deciding factor in choosing the Krylon products, but it certainly was an added advantage. Two applications of Krylon Matte Finish Spray and a final application of Krylon Crystal Clear Spray gave the surface of the photograph a gloss close to that of the original veneer.

5. Adhering the Replacement Veneer

The photographic reproductions had to be secured in position on the sewing box with an adhesive. The first step, however, was to increase the reproduction veneer thickness to that of the original veneer with an interlayer. Perma/Dur® light weight bristol board, an acid- and lignin-free buffered board, provided the necessary thickness. Since the inter layer was not in contact with the emulsion side of the photograph, it was felt that the buffered board would cause no negative effects to the photographic emulsion. Although a non-buffered rag board might have been preferable, the choice of a buffered or non-buffered rag or high-quality wood pulp material was considered a moot point because of the acidic wood base.

An adhesive suitable for both the paper-to-paper bond and the paper-to-wood bond was desired. (Diagram 1).

Diagram 1.



5.1 Adhesives: Initial Selection

Although the polyvinyl acetate emulsion reported on by Sheetz in 1986 has not affected the photographic emulsion and the bond has not released,[12] it was decided to test a variety of adhesives currently being used in conservation.

A literature search yielded no other published information on the suitability of modern adhesives for securing photographs to a backing or substrate, and photograph conservation colleagues[13] were not aware at that time (1987) of any relevant studies. Japanese Precipitated Wheat Starch Paste and. carboxymethylcellulose were suggested as possible adhesives.[14] For this project, however, water-soluble adhesives were not suitable because any reversing process would also affect the natural glue that adhered the original veneer.

The properties of an ideal adhesive for this particular application included

- high viscosity to prevent absorption of the adhesive into the paper;
- low toxicity to allow the replacement process to proceed free of encumbering fume exhaust systems;
- bond strength, particularly to resist curling of the photograph;
- compatibility of the adhesive components with the photographic emulsion; and
- reversibility with a non-aqueous solvent.

The immediate and long-term effects of an adhesive on the photographic emulsion were important considerations. Of particular concern were alkalinity or acidity and the emission of degradation products from the adhesive.

A number of adhesives were selected for testing based on the author's familiarity with the working properties of some adhesives and adhesive mixtures, and in consultation with Jane Down, Conservation Scientist, Environment and Deterioration Research Division, who heads the Adhesive Testing Program[15] at CCI.

The following adhesives were selected:

25% Acryloid B-72/10% EHEC in denatured ethanol (w/v)[16]
25% Acryloid B-72/15% EHEC in denatured ethanol (w/v)
Rhoplex AC-33
Rhoplex AC-33/Acrysol ASE-60[17]
Rhoplex N-560, Rhoplex N-580, and Rhoplex N-619[18]
Plextol B-500/Acrysol ASE-60 Beva 371 in toluene R2258[19]
Wheat Starch Paste[20]

Although it was known that the pH of Rhoplex AC-33 was quite variable--alkaline in the wet emulsion state, neutral in the initial dry film state, and acidic after aging[21] (Howells et al. 1984)--it was included for testing. The pH stability of Plextol B-500 is not referred to by Howells et al., and this adhesive had not been studied in the CCI Adhesive Testing Program. The possible effects on the photograph surface of the ammonia in Rhoplex AC-33 and Plextol B-500 was considered, but any such effect was expected to be readily apparent. Despite these concerns, the Rhoplex AC-33 and Plextol B-500 adhesives and mixtures were included. It was felt that should none of the other adhesives be suitable for both bonds (photograph-interlayer-carcase), these two adhesives might be appropriate for at least the inter layer-wood bond.

1.2 Adhesives: Peel Resistance Test

In order to determine the resistance of each adhesive to the possible curling tendency of the photograph, two peel tests were devised. For the first, a photograph strip was adhered to a Perma/Dur panel. For the second, a) a photograph strip was adhered to a Perma/Dur strip, and b) the photograph-Perma/Dur composite strip was adhered to a wood panel (see Diagram 1).

After one week, an attempt was made to pull each strip away from the panels. Although this empirical test obviously is not precise, it did indicate the relative peel resistance of each adhesive. All gave similar resistance, with two exceptions.

The Rhoplex AC-33 sample readily released due presumably to the absorption of this low-viscosity adhesive into the surfaces before adhesion could take place. The Rhoplex AC-33/Acrysol ASE-60 sample displayed good peel resistance, as did the Plextol B-500/Acrysol ASE-60 sample. The Rhoplex pressure sensitive adhesives gave considerable resistance to peeling, but did release leaving no visible residue.

The test results indicated that all of the above adhesives except Rhoplex AC-33 were suitable for paper-to-paper and paper-to-wood bonds. The choice of adhesive for this project was narrowed by a process of elimination, as follows:

Wheat starch paste was not suitable because it is water soluble, but it could be considered where aqueous reversibility is not a problem.

R2258 has performed well in the CCI Adhesive Testing Program but more long-term study is desirable.

Beva 371 was eliminated because of the toxicity of its solvent (toluene). It could be used for a treatment where fume extraction systems would not be an encumbrance. Another concern was that the amount of heat necessary to penetrate both bonds (photograph-interlayer-carcase) might damage the photograph. Solvent reactivation was not practical.

Rhoplex N-560, Rhoplex N-580, and Rhoplex N-619 were eliminated because they have not been tested over a long term. The strong peel resistance of Rhoplex N-580 also precluded its use in this project because the process of removing small areas of reproduction veneer adhered with this adhesive could damage the original veneer. Solvent release was not tested.

Rhoplex AC-33/Acrysol ASE-60 and Plextol B-500/Acrysol ASE-60 were eliminated despite their good peel resistance, because no studies were known of on these specific adhesive/thickener mixtures. It became apparent in studies by Down,[21] Howells et a1. (1984), and De Witte et a1. (1984) that acrylic emulsions cannot be considered as a group--each responds individually to different thickeners and additives, and under different aging conditions.

It is noted, however, that the test strips adhered with these acrylic emulsions still show no sign of image deterioration almost five years later. More recently, Rhoplex AC-234 was used to adhere albumen photographs in a replacement album. In this treatment, an interlayer adhered with wheat starch paste was used to isolate the acrylic emulsion from the photograph as a precaution (Hill 1991).

The mixtures of Acryloid B-72/EHEC in denatured alcohol remained the most suitable adhesive. It was decided to use 95% ethanol as the solvent rather than the more toxic denatured alcohol. Because the

viscosity of the solution increased with 95% ethanol,[22] less EHEC was required. The peel resistance was not expected to differ with this solvent. The viscosity of the mixture of 25% Acryloid B-72 and 10% EHEC in 95% ethanol was ideal for brush application onto all surfaces.

1.3 Adhesives: Bond Strength Test

It was decided to test the adhesive/paper/wood bond over a range of possible museum environmental fluctuations to see if the bond would hold. A mock object was made.

A photograph with pieces cut out, as loss areas, represented the ivory veneer surface. (It was not practical, of course, to use ivory.) It was adhered to a small mahogany block, which represented the carcase. One large and one small piece of replacement veneer (photograph/interlayer) were adhered in cut-outs with 25% Acryloid B-72/10% EHEC in 95% ethanol. A second set
adhered with Beva 371 was included in this test on the assumption that the results might be useful for future reference. A third set was adhered with a 25% solution of Acryloid B-72 in acetone, with Cab-O-Sil added as a thickening agent (Fig. 6).[23]

Before the mock object could be put through RH cycles, it was necessary to establish a cycle length.
To do this, four reproduction pieces (photograph/interlayer) were cut to represent replacement pieces of various sizes that would be required on the sewing box. These were placed in a sealed container and were subjected to alternating low and high humidities until each piece reached an equilibrium weight. Saturated salt solutions were used to achieve the low (28%) and high (78%) relative humidity.24 The largest piece equilibrated at each relative humidity in 24 hours, so a 24-hour cycle was used for this test.
The mock object was subjected to 24-hour cycles of alternating low-high RH over 12 days, except one weekend when the high RH was maintained (for practical reasons). Only the large piece adhered with Beva 371 released--at one corner of the photograph-inter layer bond. This possibly was due to incomplete adhesive application in this area rather than to a weakness in the bond.[25]

1.4 Adhesive: Final Selection

Based on its performance in the peel resistance and bond strength tests, the Acryloid B-72/EHEC adhesive mixture was selected to adhere the photographic replacement veneers in position on the sewing box. Its advantages over other adhesives were

a) good peel resistance and bond strength as shown above;
b) low toxicity;
c) suitable viscosity;
d) solvent reversibility.

Applying the Test Results

The photographic reproduction veneers were prepared as follows, using the results of each of the foregoing tests:

1) Extant sections of the various repeat border and individual designs were photographed and a number of black-and-white prints of each area were made on fibre-based paper.

2) The photographs were inpainted using Grumbacher watercolours, and were protected with two spray applications of Krylon Matte Finish followed by an application of Krylon Crystal Clear Spray Coating.

3) The photographs were adhered to the Perma/Dur interlayer with 25% Acryloid B-72/10% EHEC in 95% ethanol. To ensure full adhesion of the photograph to the interlayer, the adhesive was brushed over the entire back surface of each photograph and its interlayer.

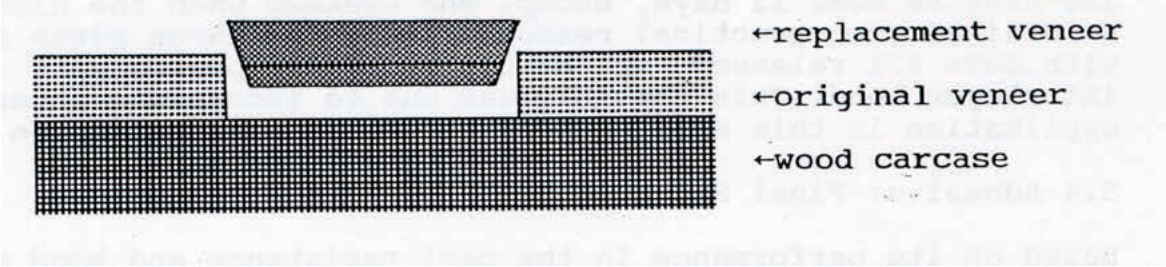
4) The photographs and inter layers were pressed together and weighted overnight.

5) The individual replacement pieces were cut to size from the appropriate area of the backed photographs using a scalpel. To obtain a close fit along the top edge of the original and replacement veneers, each replacement piece was cut on a slight bevel (see Diagram 2).

6) The adhesive was applied to the back surface of the inter layer and to the wood.

7) The piece was placed in position (Fig. 7) and was weighted.

Diagram 2.



The photographic reproduction veneer can be distinguished from the original ivory, wood and tin veneer under normal lighting only on close inspection (Figs. 8a,b, 9, 10). Under raking light, the surface of the replacements is slightly glossier and smoother than that of the original veneer. For documentation purposes, the replacements were outlined on Mylar tracings of all faces of the sewing box.

In addition, the replacement veneer is clearly identifiable using ultraviolet excited visible colour fluorescence. In this process, a single barrier filter (Kodak Wratten 2E) is used on the camera lens, which creates a bluish cast. The replacements are a slightly paler blue than the original surface. The replacements are more clearly identified using a modified barrier filtration.[26] with this system, the replacements are a distinct whitish tone against the yellow of the surrounding area.

Conclusion

On its return to the. Newfoundland Museum, the sewing box was placed in an environmentally controlled storage vault. Therefore, the materials and methods used in the treatment have not yet been exposed to high light levels or to fluctuating environmental conditions. Recent examination revealed no apparent changes to the photographic reproduction veneer and monitoring will continue in order to determine the long-term success of the treatment.

This project involved a great deal of time, particularly for the various tests. However, the results have added considerably to the initial work by Sheetz. A number of adhesives suitable for photographic paper-to-paper bonds and paper-to-wood bonds, and protective coatings for an inpainted photographic emulsion have been identified.

Once the choice of materials has been made for a particular project, the process of photographing extant surfaces, developing the scale photographs, inpainting and sealing the image if necessary, backing if necessary, and adhering the replacements in position on the object is simple and fast. It is clear that this technique can be adapted for many different materials.

Acknowledgements
Many colleagues contributed to this project. The author is particularly indebted to CCI colleagues Jeremy Powell, who participated in the treatment process as well as its documentation, and Jane Down, who shared her extensive knowledge of adhesives and adhesive testing methods. Both also gave valuable suggestions during the preparation of this paper. The assistance of the following people is also gratefully acknowledged: Margo Brunn, now at the provincial Museum of Alberta; Ron Sheetz, National Parks Service, Harpers Ferry Center; Carl Bigras, Charles Costain, Sandra LaFortune, Ian Wainwright, Gregory Young, CCI; Klaus Hendriks, Rick Palmer, National Archives of Canada; Rosemary Smart, Newfoundland Museum. The photographs are used with permission of the Newfoundland Museum.

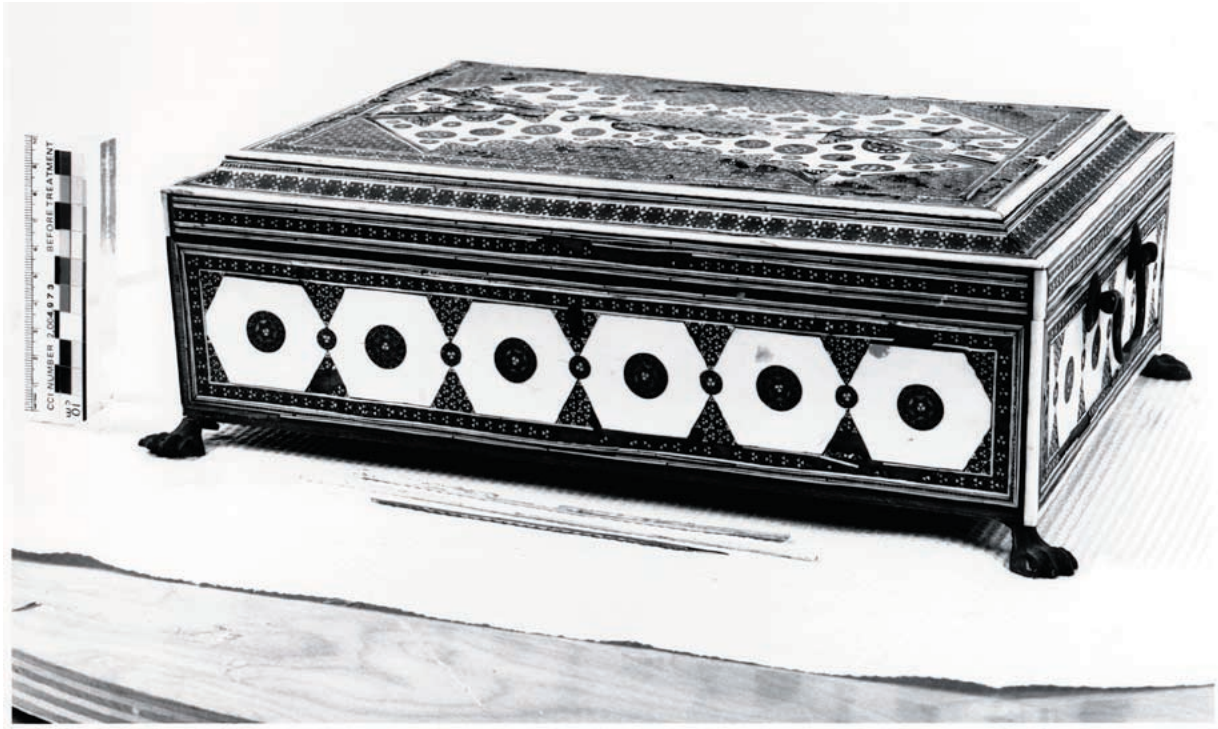


Figure 1. Before treatment

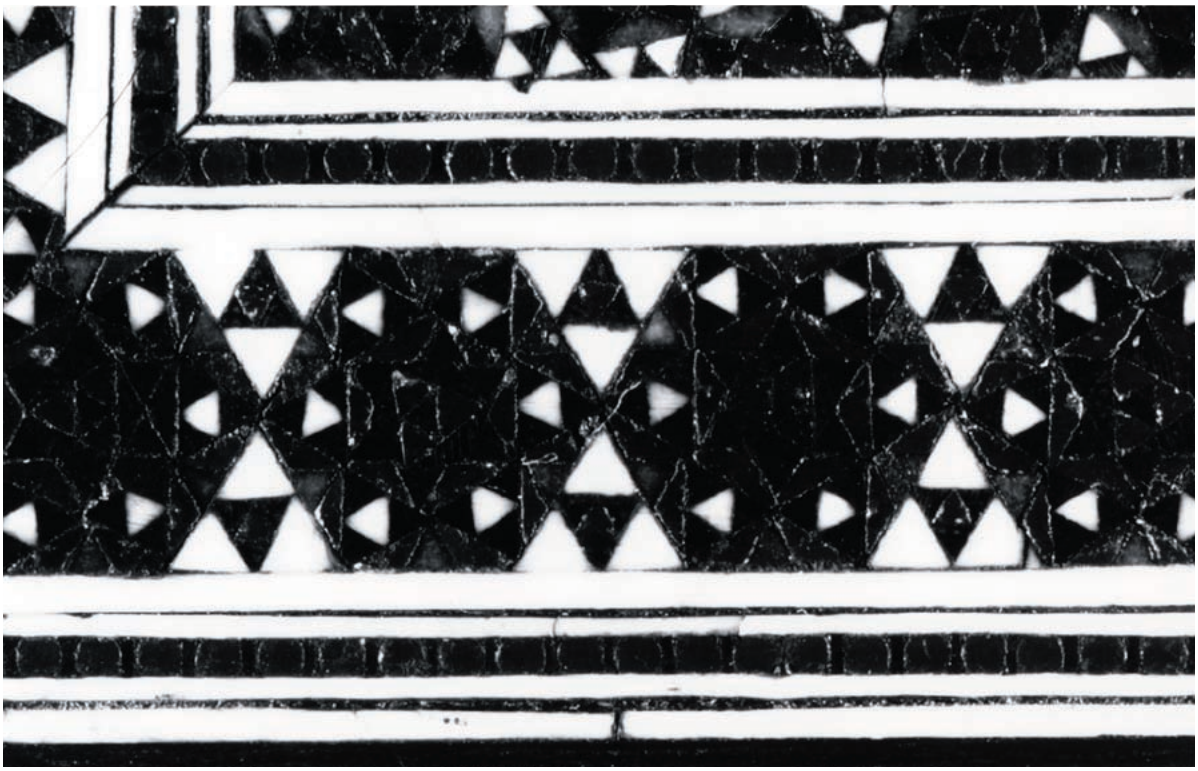


Figure 2. Detail of repeat border designs on the lid. The sides of the smaller diamonds are less than 2 mm each.

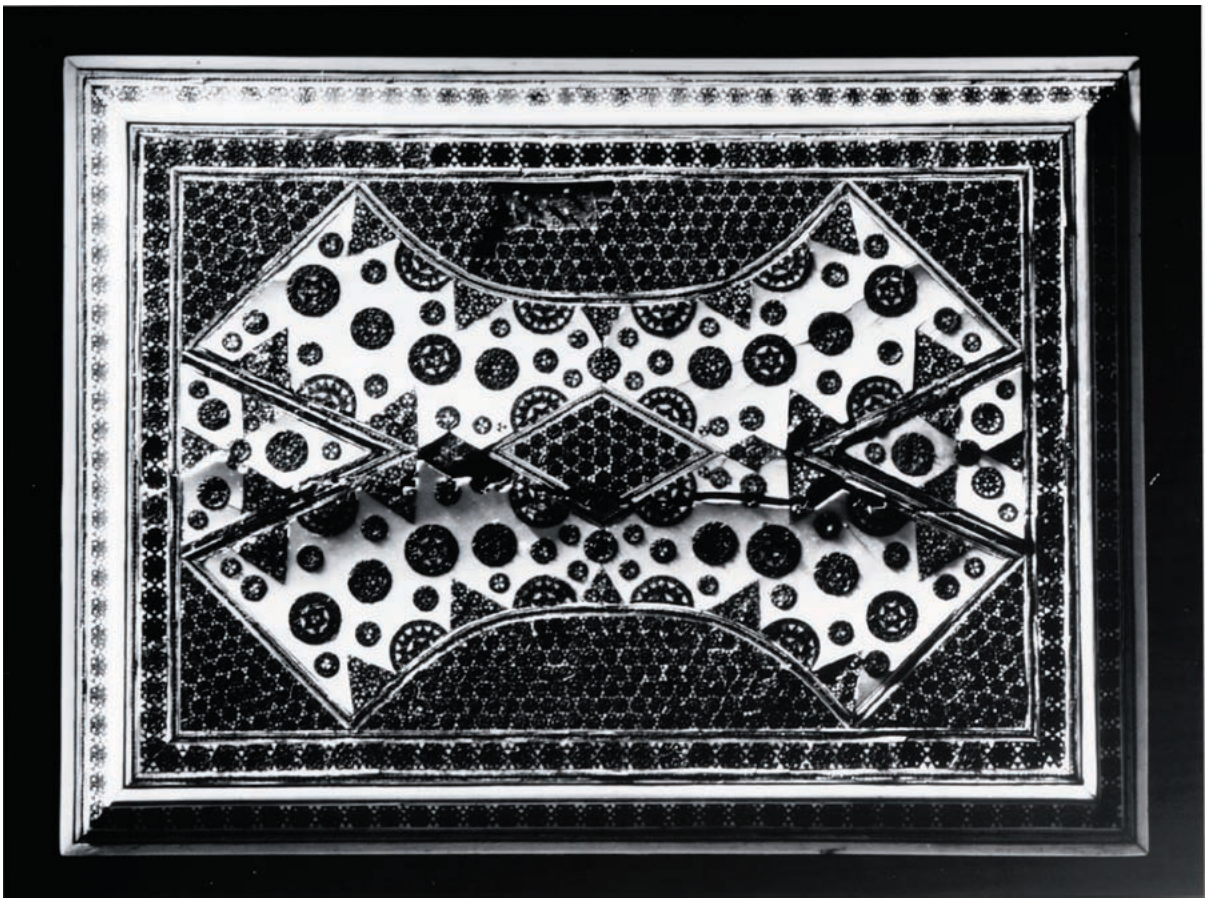


Figure 3. The cupped and separated ivory along the edge of the split on the lid, under raking light.

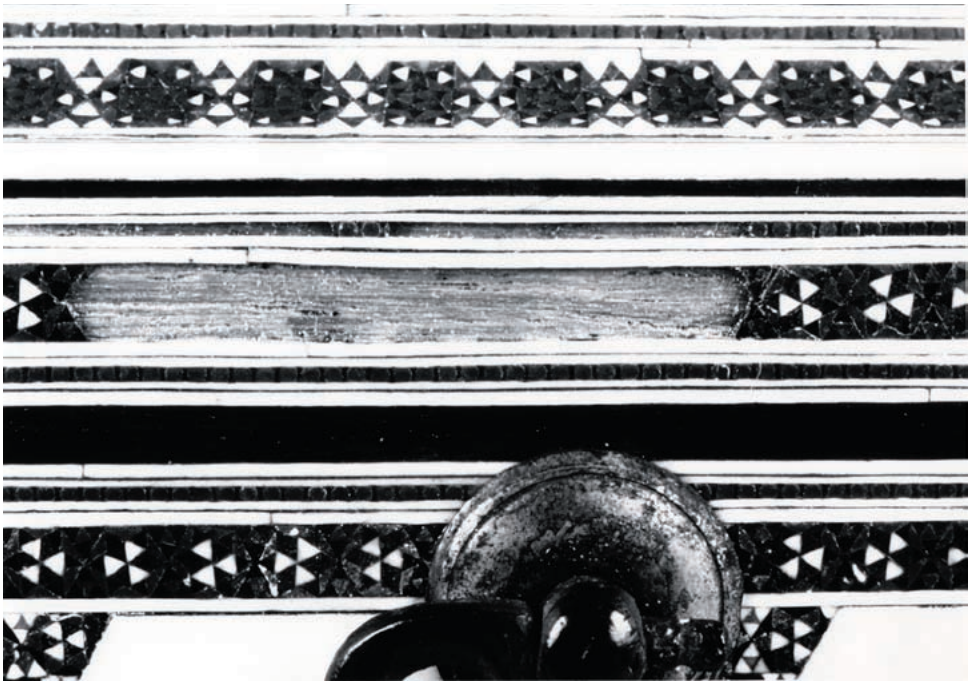


Figure 4. Detail of loss area P.L. end, after removal of pieces to tidy the edges.

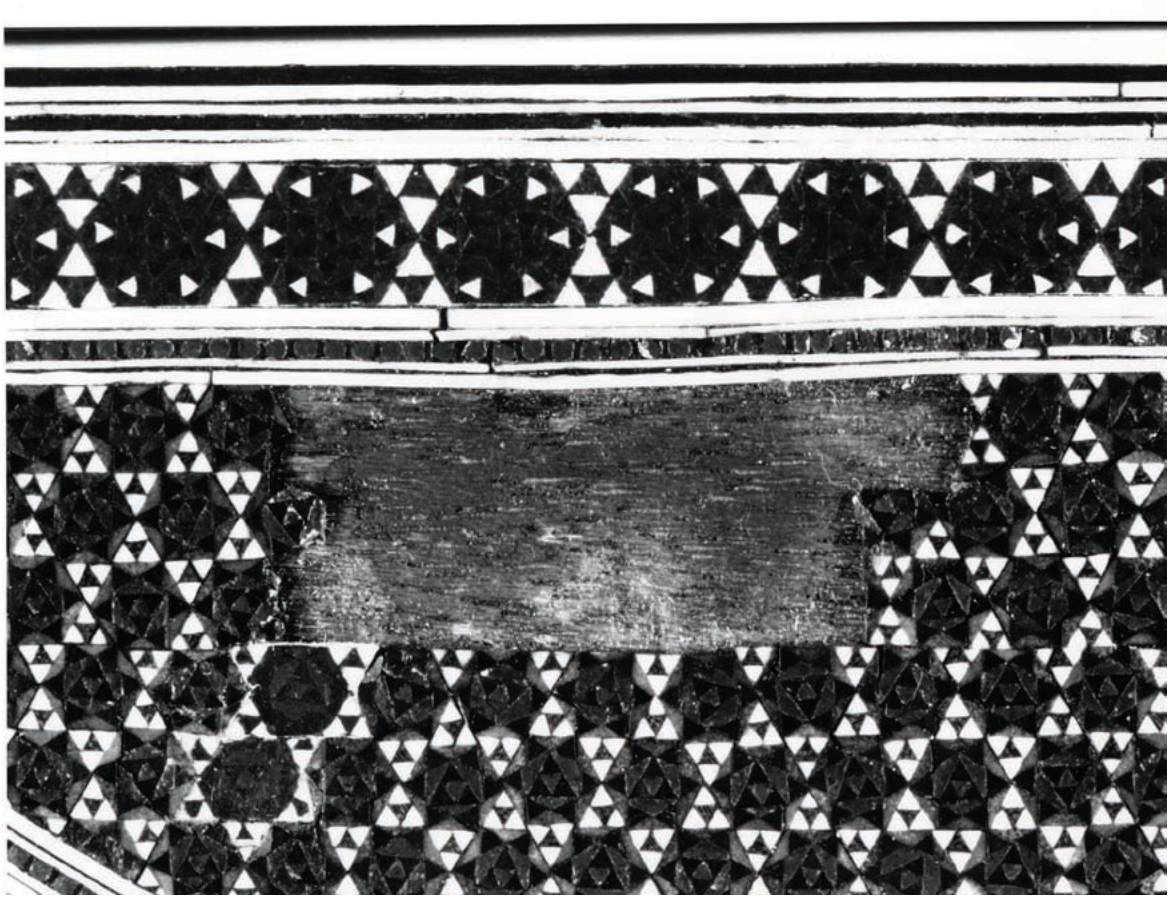


Figure 5. A large loss section on the lid after the edges were tidied.

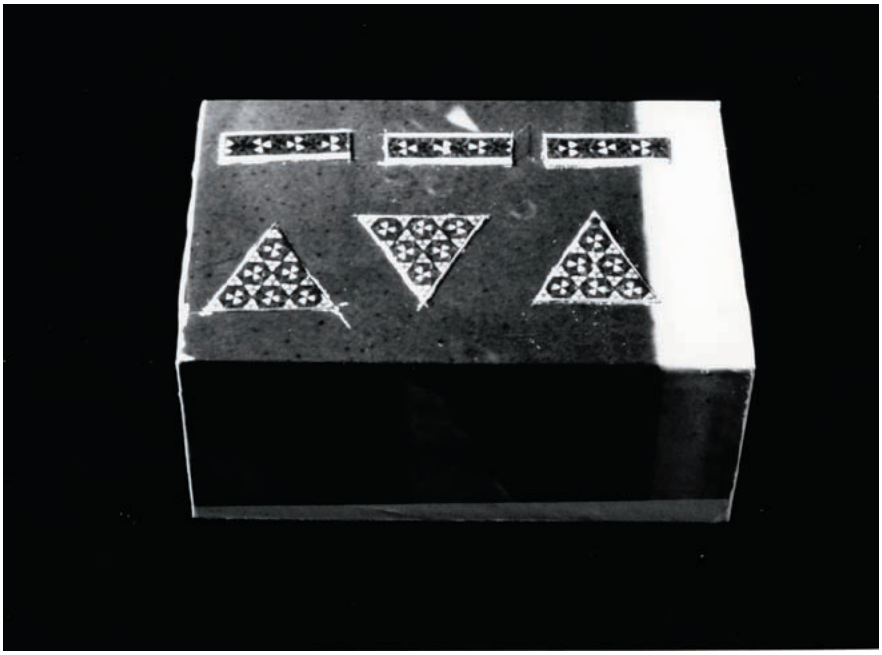


Figure 6. The mock object. Photographic replacements adhered with (1. to r.) 25% Acryloid/10% EHEC in 95% ethanol, 25% Acryloid B-72/Cab-O-Sil, and Beva 371.

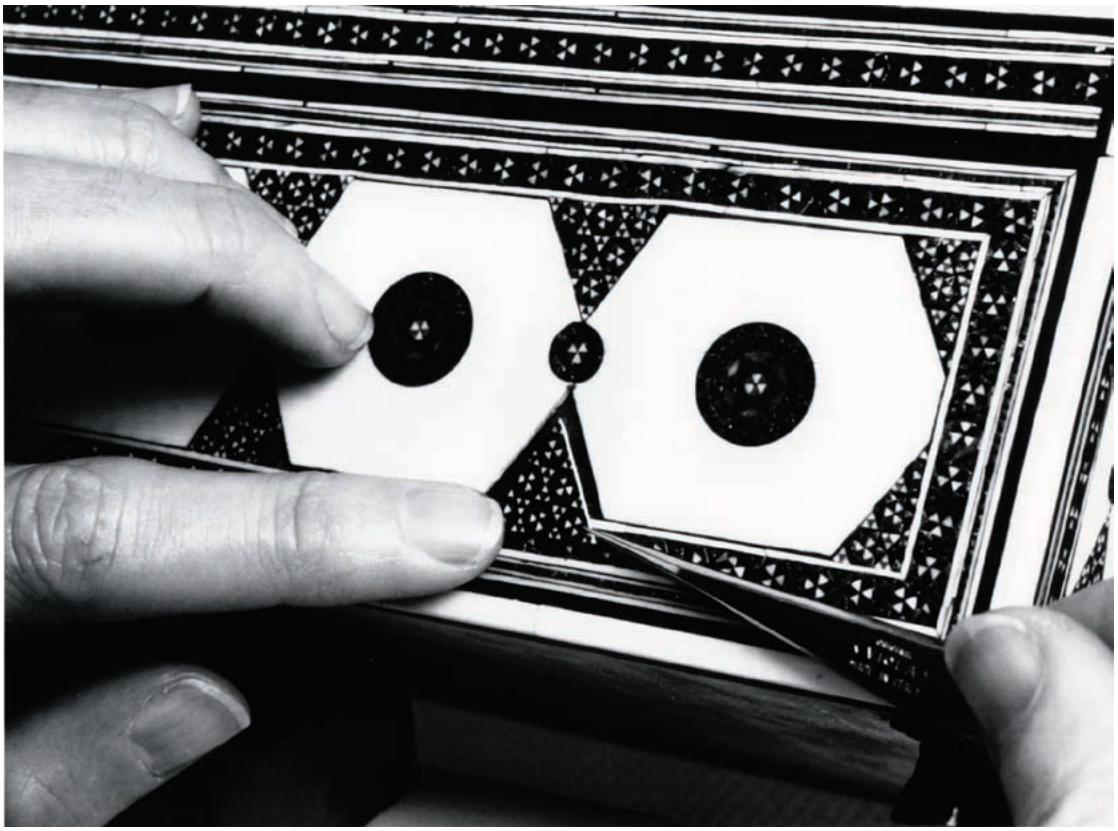


Figure 7. Fitting a photographic replacement piece into position, back, P.R. end.

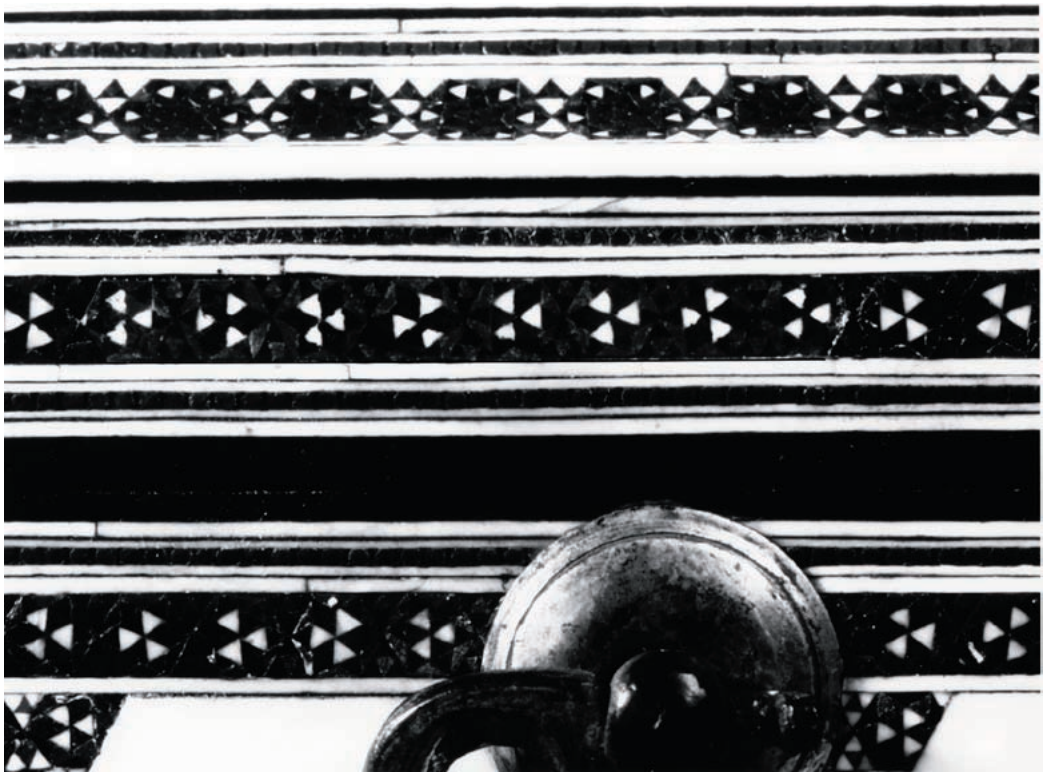


Figure 8a. Detail, P.L. end. Photographic replacement veneer in position. Compare with Fig. 4.

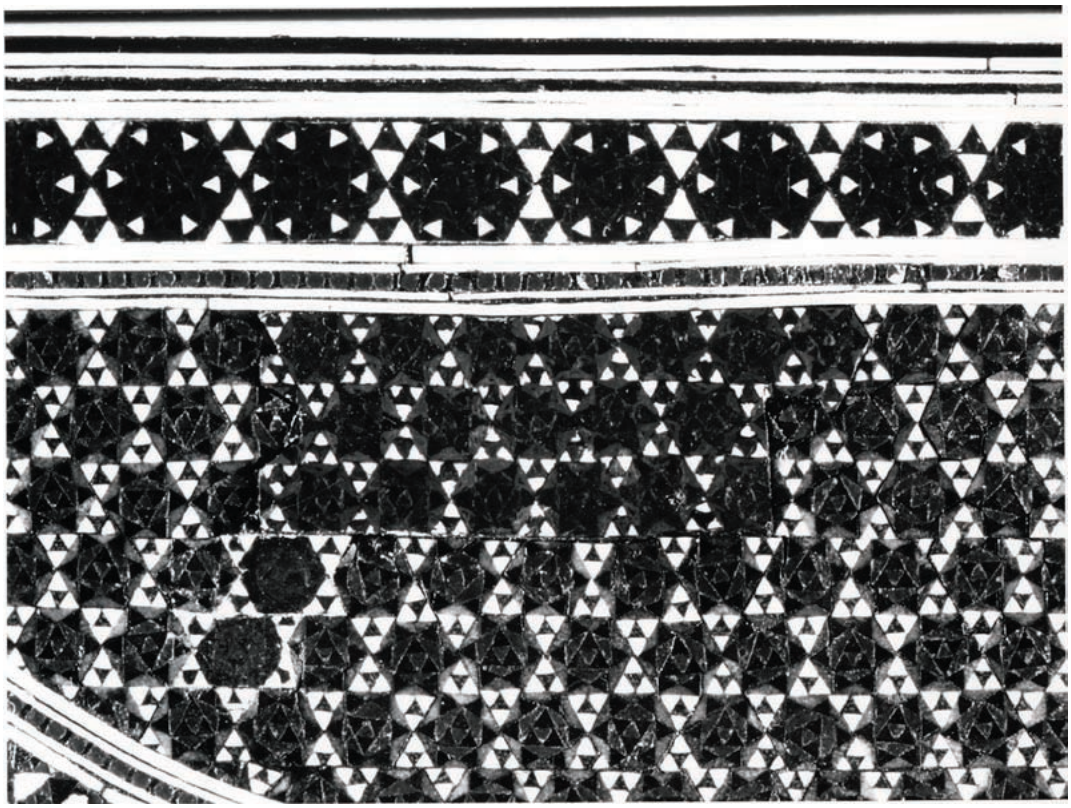


Figure 8b. The photographic replacement in position on the lid. Compare with Fig. 5.

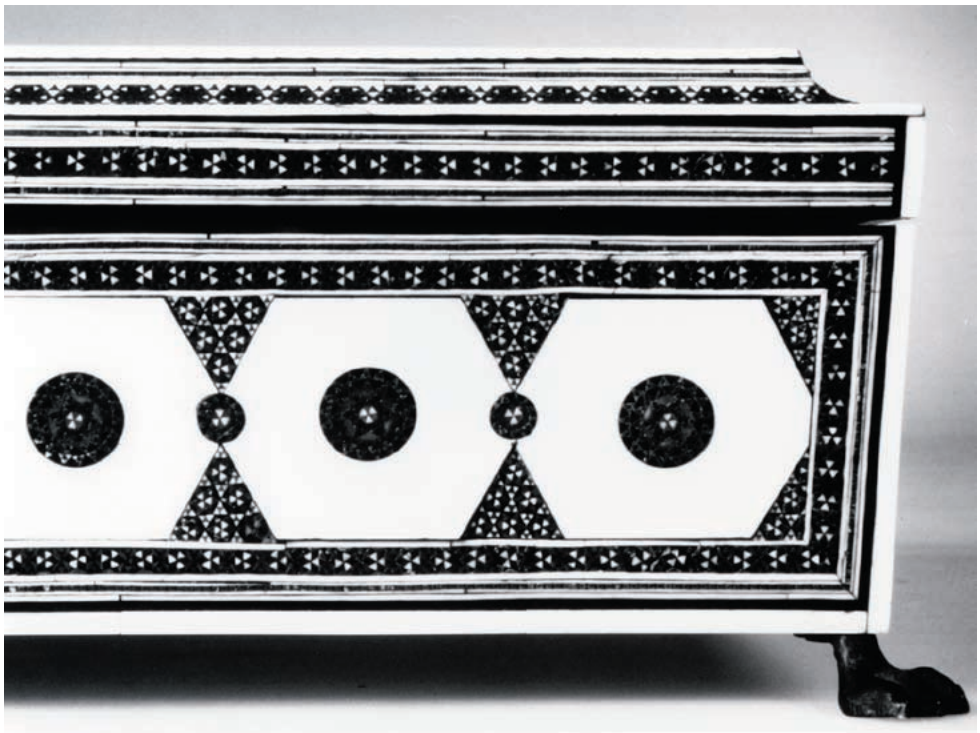


Figure 9.

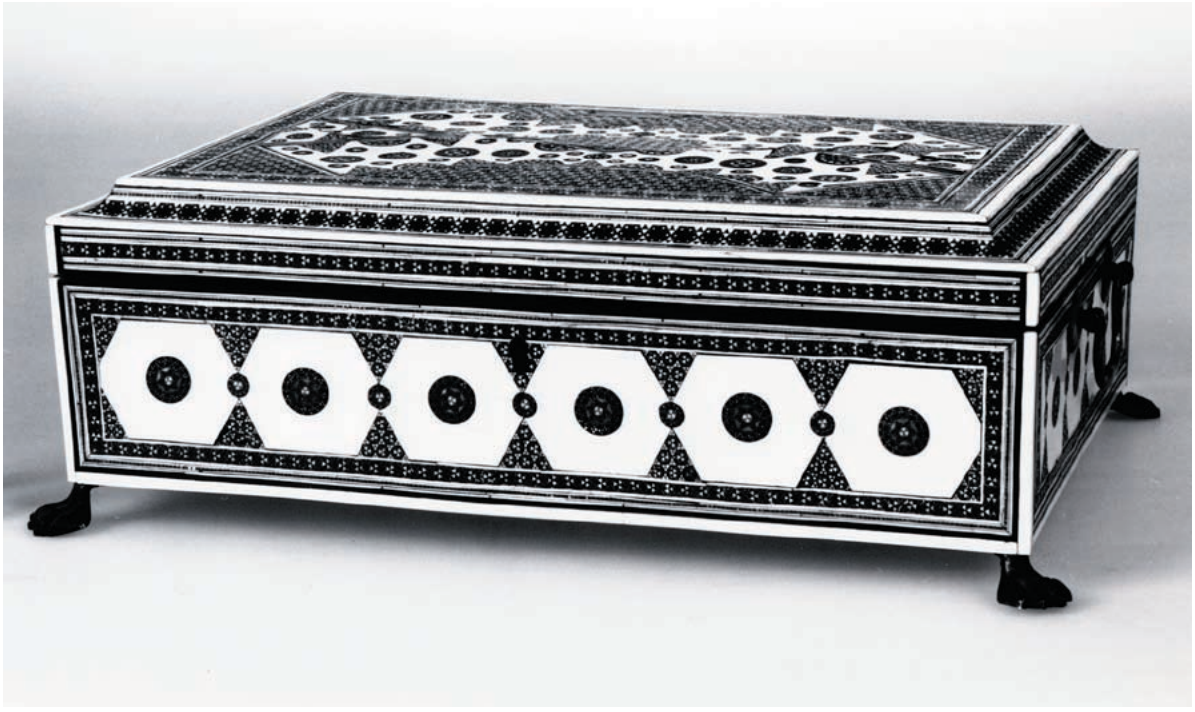


Figure 10. The completed sewing box.

Endnotes

1. No attempt was made to identify the wood, but it was probably sandalwood. Wainwright, I.N.M. and G.S. Young. Analytical Report, ARS no. 2479. Ottawa: Canadian Conservation Institute. June 1986.

2. Stabilization of the original veneer was carried out by Margo Brunn, then Mobile Laboratory Conservator, CCI. The author carried out the research and the resultant treatment process.

3. Hendriks, Dr. K.B., Director, Conservation Research Division, Conservation Branch, National Archives of Canada, Ottawa. Personal communication. 1987.

4. Sheetz, R.E., Senior Furniture Conservator, Division of Conservation, National Parks Service, Harpers Ferry Center, Harpers Ferry. Personal communication. 1987.

5. Krylon Crystal Clear Acrylic Spray Coating, Cat. No. 1303. The manufacturer's label suggests use on photographs. Contents labelled as "petroleum distillates, acetone and toluene." The resin in Krylon Coating Cat. No. 1303 is composed of a methyl methacrylate/n-butyl methacrylate copolymer. (Canadian Conservation Institute. 1989 Update. Commercial Product Analytical Report, no. 1615, L7. Ottawa: Canadian Conservation Institute.*)

6. Grumbacher Hyplar Varnish Spray Gloss, Cat. No. 647. Contents labelled as "acrylic resins, gum spirits of turpentine, methylene chloride, and aliphatic hydrocarbons." Grumbacher Spray, Cat. No. 647 has been identified as a butyl methacrylate polymer. (Canadian Conservation Institute. 1989 Update. Commercial Product Analytical Report no. 2672, L7. Ottawa: Canadian Conservation Institute.)*

7. Grumbacher (New) Picture Varnish Matte, Cat. No. 642. Contents labelled as "acrylic resins, flatting agents, petroleum distillates, toluene, methylene chloride, and aliphatic hydrocarbons." Grumbacher Varnish, Cat. 642 has been identified as a butyl methacrylate polymer with a zinc stearate wax matting agent. (Canadian Conservation Institute. 1989 Update. Commercial Product Analytical Report no. 2672, L7. Ottawa: Canadian Conservation Institute.)*

8. Grumbacher (New) Damar Varnish Matte, Cat. No. 633. Contents labelled as "damar gum, flatting agent, 1,1,1 trichloroethane, gum spirits of turpentine, methylene chloride and aliphatic hydrocarbons." Grumbacher Damar Varnish, Cat. No. 633 contains a matting agent, zinc stearate wax. (Canadian Conservation Institute. 1989 Update. Commercial Product Analytical Report no. 2672, L7. Ottawa: Canadian Conservation Institute.)* Although a dammar varnish could have been prepared in the lab, the commercial product was conveniently available.

9. Beaver Lacquer Spray Paint. Manufacturer's label notes that it "contains petroleum distillate." Although this product has not been tested for conservation use, it was included because there was a can in the lab.

10. A 6,500 watt Xenon arc lamp was used with a borosilicate inner filter and a sodalime outer filter. The radiation emitted by this combination of source and filters would approximate sunlight through window glass.

11. Krylon Matte Finish (Cat. No. 41311) has been identified as a methyl methacrylate/butyl methacrylate copolymer, with a clay or silica matting agent. (Canadian Conservation Institute. 1989 Update.

Commercial Product Analytical Report, no. 2672, L7. Ottawa: Canadian Conservation Institute.)* The manufacturer's label suggests use on photographs.
* Information on these publications is available from Extension Services, Canadian Conservation Institute, Communications Canada, Ottawa, Canada KIA OC8.

12. Sheetz, R.E., National Parks Service. Personal communication. 1991.

13. Hendriks, K.B. and R. Palmer. National Archives of Canada. Personal communication. 1987.

14. Palmer, R., National Archives of Canada. Personal communication. 1987.

15. The Adhesive Testing Program was designed to study the aging properties of various adhesives. It began with the poly (vinyl acetate) and acrylic adhesives. In 1987, when the sewing box was treated, the pH, volatiles, discolouration, strength, and flexibility properties were being studied.

16. Acryloid B-72 with EHEC (ethyl hydroxyethylcellulose), a cellulose ether, has been used successfully by colleagues in the Ethnology Division, CCI, when a viscous adhesive was required. (Vuori, J. 1985. "A Possible Adhesive for Native Tanned Skin." *Leather Conservation News,* 2/1 (Fall):6.) The adhesive mixture is prepared by dissolving the resin in the solvent, then slowly adding the cellulose ether.

17. Acrysol ASE-60, an acrylic emulsion copolymer, was added to Rhoplex AC-33 for one sample to compare the performance of the two. It was expected that the Acrysol thickener would prevent absorption of Rhoplex AC-33 into the paper.

18. Rhoplex N-560, Rhoplex N-580, and Rhoplex N-619, pressure sensitive acrylic emulsions, were included although no long-term testing was known. The possible peel reversibility of Rhoplex N-580 was of particular interest.

19. R2258 is a vinyl acetate/ethylene copolymer. In the CCI Adhesive Testing Program, the pH value of the wet emulsion was 6.58. The pH value for the control dried film was 6.55. The aging tests on dried film were in progress. (Down, J. Personal communication. 1987).

20. Wheat Starch Paste was included to see how it would perform.

21. Down, J. Personal communication. 1987. Current data from the CCI Adhesive Testing Program will be published shortly (Down, Jane L.. and R. Scott Williams. "A Report on the Evaluation of Selected Poly(vinyl acetate) and Acrylic Adhesives for Use in Paper Conservation." In *Conservation of Historic and Artistic Works on Paper,* Ottawa: Canadian Conservation Institute, in press.)

22. Vuori, J., Canadian Conservation Institute. Personal communication. 1987.

23. A sample using Acryloid B-72 with Cab-O-Sil® TS-720 (hydrophobic fumed silica) added as a thickening agent was included in the test. In retrospect, it would have been interesting to have included the adhesive mixture in all of the testing phases.

24. A saturated salt solution of magnesium chloride ($MgC1_2.6H_2O$) was used for the 28% RH, and of lead nitrate ($Pb(NO_3)_2$) for the 78% RH.

25. The environmental testing was carried out with assistance from Jane Down.

26. The filters were placed in the following order (the 2E being closest to the artifact):
1) Kodak Wratten 2E - absorbs UV radiation below 410 nm (approx.)
2) Kodak Wratten 3 - absorbs violet and blue light below 430 nm (approx.), i.e., provides extended blue light cut-off.
3) CC 10 Cyan
4) CC 20 Magenta

The main purpose of the 2E filter was to ensure that the other filters themselves did not fluoresce and "fog" the overall image. The last two were used for minor colour corrections and could be altered in strength to suit the particular job. (Powell, J. Personal communication. 1992.)

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