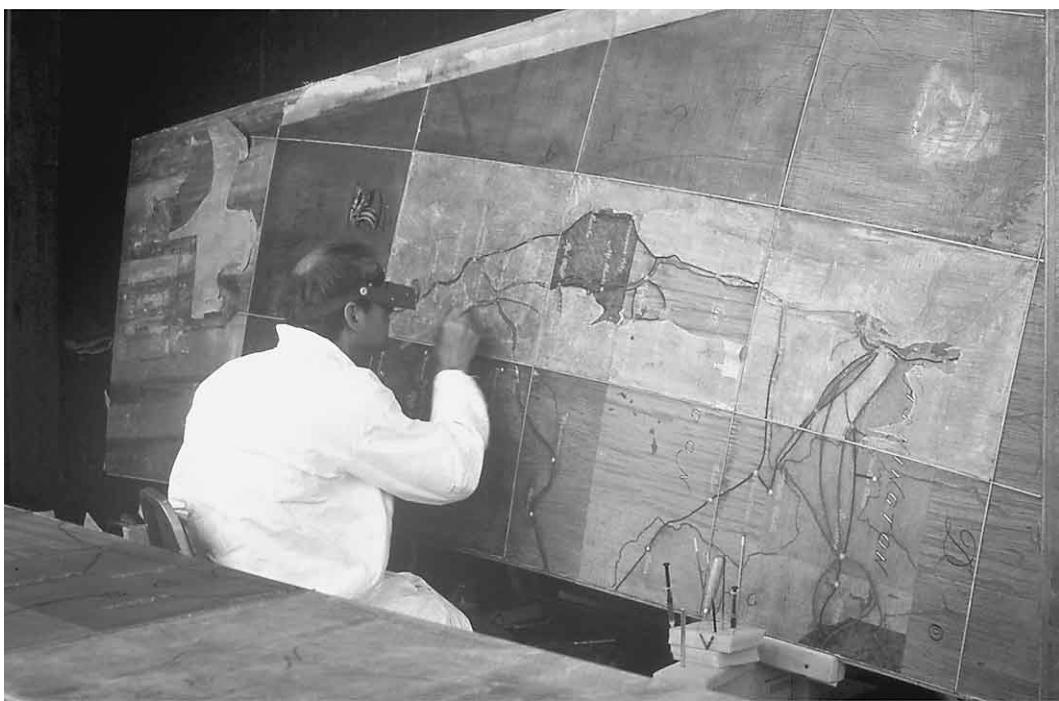


*Figure 1: Post treatment 1989.*



*Figure 2: John Kjelland, conservator, at work.*

# Adhesive Transfer of 24,520 Square Inches of Marquetry

*John R. Kjelland, Conservator in Private Practice, Missoula, Montana*

**ABSTRACT:** The inlaid map of the United States, centerpiece of the “Map Room” at Yellowstone National Park’s Mammoth Hot Springs Hotel, has enthralled visitors since its creation in 1937. Designed by Old Faithful Inn architect Robert Reamer, along with W. H. Fey, the map measures over 10' by 17' and is composed of 2,544 pieces of 15 different kinds of wood.

Due to faulty steam pipes inside the support wall, the “Flexwood,” a cloth-backed veneer, buckled and became detached in many areas. After consultation with other conservators and scientists, it was decided to replace the failed adhesive and the veneer cloth backing. There was no intent to remove the map’s surface coatings or to return the buckled veneer to a flat plane. To do so would necessitate the retooling and loss of historic fabric.

After weeks of study and in full view of park visitors, the treatment began with the arduous task of lifting the veneer from its substrate, then removing the failed adhesive and cloth backing. Once removed, high-grade cheese cloth and hide glue was used to return the veneer to its position in the map. During the process, some small losses were incurred to the veneer, lettering and surface coating. Compensation materials included: barrier coats, fillers, pigments, and clear varnishes. After completion, the map was reinstalled onto the wall.

The park visitors observed first hand the exhibited treatment process which added a dimension to the project that I shall always remember. Aided by volunteer interpreters the many visitors gained insight into how a major conservation effort proceeded. “When was the map made?” was a most often asked question. Others came to pinpoint a location while others came to see the impressive craftsmanship or maybe to embellish upon a certain memory that time has diminished. A few geographic discrepancies were often humorously noted, perhaps present as the mark of man and not the artisan... I hope the visitors returned home with a renewed interest in supporting museums.

---

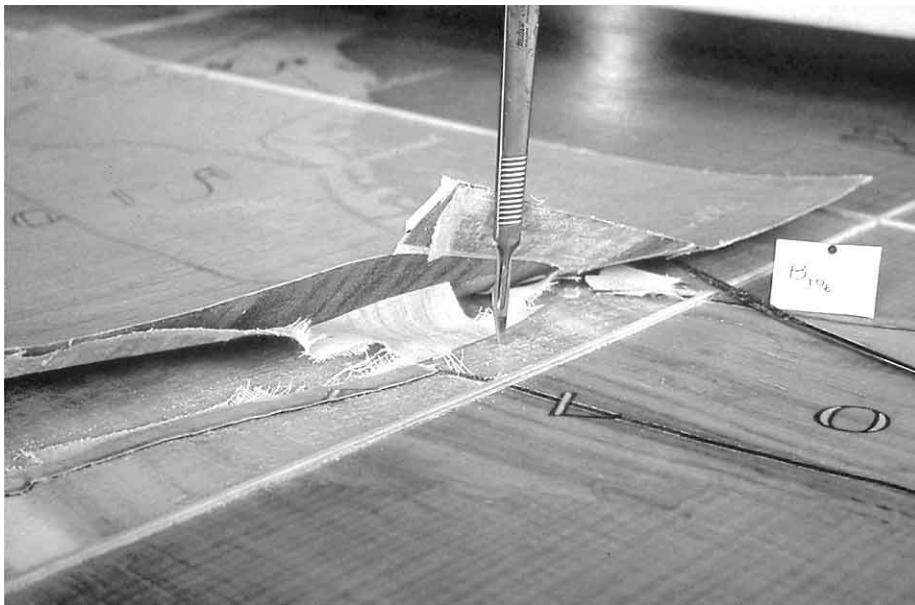
## Treatment Overview

### Inlaid Map Treatment

**T**HE METHODOLOGY BY WHICH THIS treatment was undertaken is more elaborate than is described herein. Approximately 100 steps have been identified, to mention all of them is out side the scope of this paper. Therefore, to minimize any possible confusion, the following overview is offered.

## Introduction

Nestled within mountains and a number of geo-thermal features is the site of the once Fort Yellowstone. Now called Mammoth Hot Springs, Wyoming, it is the administrative center for the entire Yellowstone National Park, our first National Park. Year-round residents here include park staff and abundant wildlife. In the summer, this community becomes an intermediate home to many national



**Figure 3:** Beva/Reemay applied to the face of the veneer; removed veneer from substrate using spatula and cutting wedged cloth backing from roadway.

and international visitors. At the Mammoth Hot Springs Hotel these visitors find a welcome rest. The Hotel's map room is a spacious room with abundant sunlight, a hardwood floor, a grand piano, and a large map of the United States of America on its wall. It was within this room the conservation treatment was performed. The map is a splendid example of marquetry and its original makers must have been proud of their accomplishment.



**Figure 4:** Removing the cloth backing, scraping and washing away the failed adhesive.

In 1987, The National Park Service Division of Conservation<sup>1</sup> began the initial steps for treatment by performing a Condition Survey. The survey noted that the "special paste" used to adhere the Flex-wood to the substrate had failed and some veneer was missing. Thereafter in 1989, I entered into contract with the Park concessionaire, TW Recreational Services, to stabilize the map by re-adhering all loose veneer and replacing some missing veneer. Once stabilized (fig. 1) the recommendation to replace the adhesive at

some future date was proposed. Further repeated repairs were undertaken in 1994. Then, in June of 1996, I began the adhesive transfer and "relining" of the Inlaid Map completing the treatment in January of 1997. (fig. 2) Corporate donations in part from Conoco and Minwax made this treatment possible.

#### Reason for treatment

The adhesive and veneer problems are attributed to faulty steam pipes (subsequently corrected) inside the support wall. The adhesives failed and the veneer expanded, leaving the veneer poorly adhered and very buckled.

#### Scope of treatment

The veneer needed its adhesive and cloth backing replaced. No change to its general aesthetic appearance by removing surface coatings or flattening the buckled/expanded veneer was intended.

#### Pre-treatment considerations:

A number of adhesive chemists were contacted. I then decided to send samples to Forest Products Laboratory<sup>2</sup> and Williamstown Art Conservation Center Inc.<sup>3</sup> for analysis in identifying

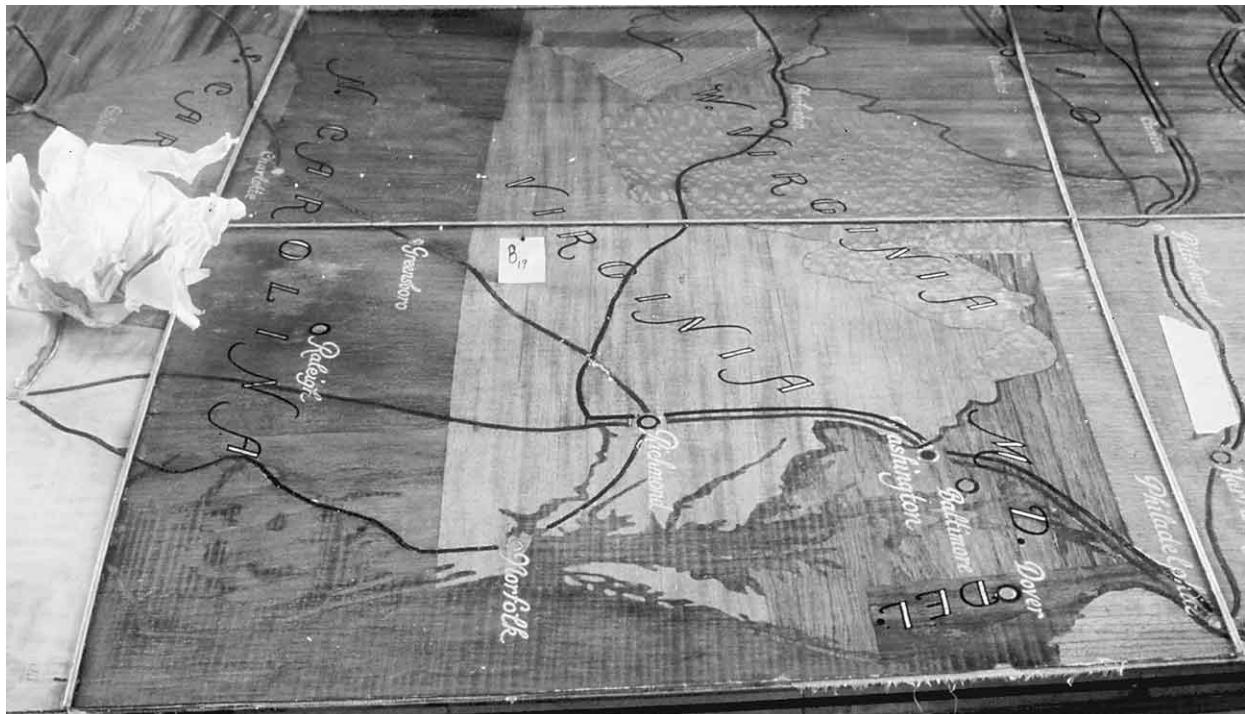


Figure 5: After Beva/Reemay membrane was removed from re-adhered veneer.

adhesives and coating materials. Once the results of their investigation were understood, I developed a cleaning system and selected a replacement adhesive. All materials and procedures needed to take into account that the treatment was performed in the Hotel's Map Room/Lobby. The constant presence of people was an influence in a variety of ways. The materials selected needed to be people-friendly and perform the conservation task.

## Treatment

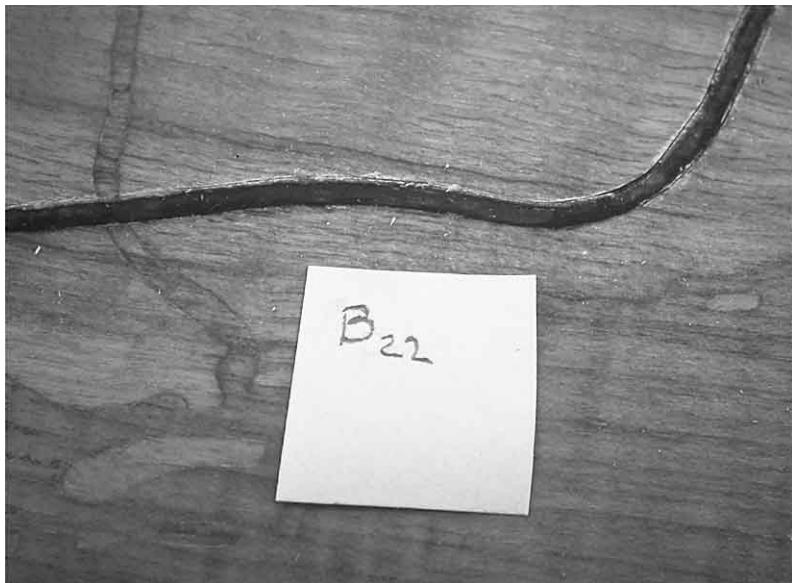
The map is divided into six sections. Within each section the meridian lines define a grid. During the treatment process each grid was treated as a single unit. Sections of the map were removed from the wall and returned to the wall as needed to complete various stages of treatment.

To begin, the surface of each grid was dewaxed, cleaned, allowed to dry, and barrier coated with shellac. Using Beva Gel to adhere 2 mil Reemay over the surface, a membrane was created that held all the veneers together. Prior to applying the Beva Gel, the rubber roadways and cites were waxed to allow release of the Beva/Reemay. This sandwich was lifted using a small hand-made spatula and distilled water to soften the hide glue used in the

1989 treatment. The cloth backing was cut away from the rubber roadways/cities as the cloth was wedged between the dado wall and the rubber (fig. 3). The removal and cleaning of the failed adhesives (protein/starch, protein/kaolin, casein and latex rubber or British gum) entailed removal of the Flexwood's cloth backing, scraping (using a 3/8" wide scraper), abrading, and brushing with a 3% solution of ammonium hydroxide in distilled water. Removal of the failed adhesives from the veneer was a delicate process as the veneer was 1/32" thick. (fig. 4) In contrast, the substrate was aggressively scraped using a cabinet scraper and acetone that was applied to precipitate the removal of any remaining adhesive. The distilled water was removed from the veneer in a drying press composed of silicon release paper, Tyvek, and particleboard.

## Re-adhering the veneer

Within the grid, liquid hide glue was brushed onto the substrate, then the replacement cloth (a high-grade cheesecloth) was overlaid and a second coat of hide glue was applied. After the glue was allowed to get tacky, the cloth lying over the roadways, cities and meridian lines was incised and removed. The hide glue was then applied to the backside of the veneer, and using distilled water I softened



*Figure 6: The veneer over laying the rubber roadways and cities incised for removal and guided by the underlying rubber, a “blind cut”.*

the tacky hide glue on the cheese cloth/substrate. Now ready for re-adhering, the sandwiched veneer was placed into its “keyed” position within the meridian lines and roadways/cities. A hand roller then squeezed out any excess glue.

After which, I placed a press (a clamp) within the grid and over the veneer. The press consisted of silicone release paper, Plexiglas, 1/2" Ethafoam, particleboard, and weighted bags. This press assemblage was left for a minimum of four hours to overnight so that the glue had time to congeal. Once congealed, the press was removed. During the pressing step, the alignment of the veneer occasionally slipped. To correct the slippage, a hair dryer with and without a heat tent and thermometer was used to warm and reactivate the first layer of hide glue (the hide glue under the cheesecloth did not soften due to the thick substrate acting as a heat sink). This heat allowed the veneer to be re-positioned and the press was then reinstalled.

After final inspection for veneer alignment, the Beva/Reemay was removed (fig. 5) using a warm damp cloth of distilled water.

Now that the veneer was re-adhered and exposed, a very delicate process was next. Due to some flattening of some of the expanded and buckled veneer by the press, the veneer slightly overran the rub-

ber roadways and cities. This excess material was removed by incising with a scalpel (fig. 6). To do this, the hide glue was locally heated to a desirable temperature to allow me to feel the rubber under the veneer with my scalpel. If the glue was cool, I could not feel the rubber and if the glue was overly warm, the veneer slipped away from the rubber. Once trimmed, the press was reinstalled. The next morning the press was removed. After an additional 48 hours of drying, the surface coating was ready for treatment.

#### **Surface Treatment**

First the surface was cleared using warm water and mineral spirits to remove any residual Beva, hide glue or releasing wax. Once dry, I

brushed on a few coats of 2 lb. shellac to saturate the surface and remove any bloom, help make the accumulative ultraviolet damage to the aged finish more transparent and to enhance the over all wood tones. Also, the shellac acted as a final barrier coat for isolating the historic fabric from the inpainted coatings/fillers necessary for loss compensation. These materials include bulked and toned hide glue and lacquer sealer as fillers for small losses to veneer or original finish; dry pigment bound in shellac and Maimeri pigments for wood tones; and sign painters' enamel for letter touchup. After two weeks of drying, Soluvar varnish was sprayed onto the map as a protective coating.

The Inlaid Map was then reinstalled onto the wall. (fig. 7) (Note: Throughout the process, I was on the phone to Mr. Ronald Sheetz, a conservator at the National Park Service for his assistance in guiding me through the “trenches,” and I thank him.)

Many people will continue to return to the map and some will remember Yellowstone National Park’s “1996 Special Project”—a successful effort to preserve a portion of this region’s cultural heritage.

#### **Notes**

- 1.Ron Sheetz, Conservator, Department of Conservation, National Park Service.



*Figure 7: Post treatment 1997, close-up.*

2. Charles B. Vick, Research Scientist, Wood Adhesives Science and Technology, Forest Products Laboratory, Madison, Wisconsin.
3. James Martin, Director of Analytical Services and Research, Williamstown Art Conservation Center, Williamstown, Massachusetts.
4. Craig Deller, The Deller Conservation Group, Ltd. Geneva, Illinois, as editor.

#### **About the Author**

JOHN R. KJELLAND, wooden objects conservator, established himself in 1972. He has a long list of study and experience that enable him to successfully complete the many and varied tasks asked of him. Using scientific and artistic means,

his life's work has been to care for the decorative and utilitarian wooden objects/coatings produced by fellow artisans from bygone days.

#### **Address:**

P.O. Box 9401  
Missoula, MT, 59807  
e-mail: [woodobj@aol.com](mailto:woodobj@aol.com)  
Phone: (406)-728-4534