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Article: Loss compensation and surface integration

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## **LOSS COMPENSATION AND SURFACE INTEGRATION**

Maureen Russell

In order to inpaint on a 3-dimensional object, a conservator must think below the surface, to replicate not just the skin of a sculpture but the material that constitutes the substrate below. The thread that runs through this tips topic is not only inpainting but also loss compensation, and the ethical decisions we make as a team for each object or sculpture. Teamwork and collaboration with curators, scientists and colleagues in the field is vital in determining the final solution for a successful treatment. In this paper, a range of reversible treatments will be covered for objects made of wood, glass, wax, enamel, metal and a composite object. There is a different approach for each individual work of art; not only the appearance and aesthetics must be considered but also structural stability, physical integrity and the original and contemporary cultural significance. Each medium represents a different challenge and there is no single solution.

There are many ways to inpaint on the surface of an object. A wash may be used that layers glaze upon glaze to achieve a perfect color match. Another technique used to replicate the exact color of the original adjacent surface is dotting in pigment until the surface of the fill is covered. The media used for inpainting (acrylics, watercolors, clear resins mixed with powdered pigments) offer additional challenges and can contribute to inconsistent results, as can the tools themselves (an airbrush, sable brush or stipple brush). Since the topic of tips for inpainting and loss compensation covers so many variables, this paper will suggest several different treatment approaches applied to a variety of media, but will limit the fill material to either wax or epoxy.

The first few treatments employ wax; specifically Multiwax w-445, a soft microcrystalline wax with a melting point between 76° and 82° C. Approximately a tablespoon of wax is placed in a disposable aluminum weighing dish and is slowly heated with a hot air gun. Powdered pigments are added and blended in. An entire palette of colors, or a tonal range of one color such as flesh, can be created in a single dish. Minarettes (small steel retouching tools used for modeling in a variety of media), dental tools and spatulas are used to apply the wax mixture to the missing areas. This is a versatile fill material, quick to apply, very forgiving, easily reversible and useful for polychrome wood, marble, glass and metals.

The polychrome wood sculpture from the collection of the Los Angeles County Museum of Art, *St. Mark* by Alonso Berruguete, dates to 1560. Figs.1- 2 show the full figure before and after treatment. Figs.3 - 4 and 5 - 6 show some before and after details with pigmented wax fills.



Figure 2. *St. Mark*, after treatment.



Figure 1. *St. Mark* (Los Angeles County Museum of Art, ca. 1560, acc. no. 1995.182.1). Prior to stabilization, cleaning, and filling.



Figure 3. *St. Mark*. Before treatment, detail of proper left hand with insect damage.



Figure 4. *St. Mark*. After treatment, detail of proper left hand with pigmented wax fills.



Figure 6. *St. Mark*. After treatment, with pigmented wax fill.

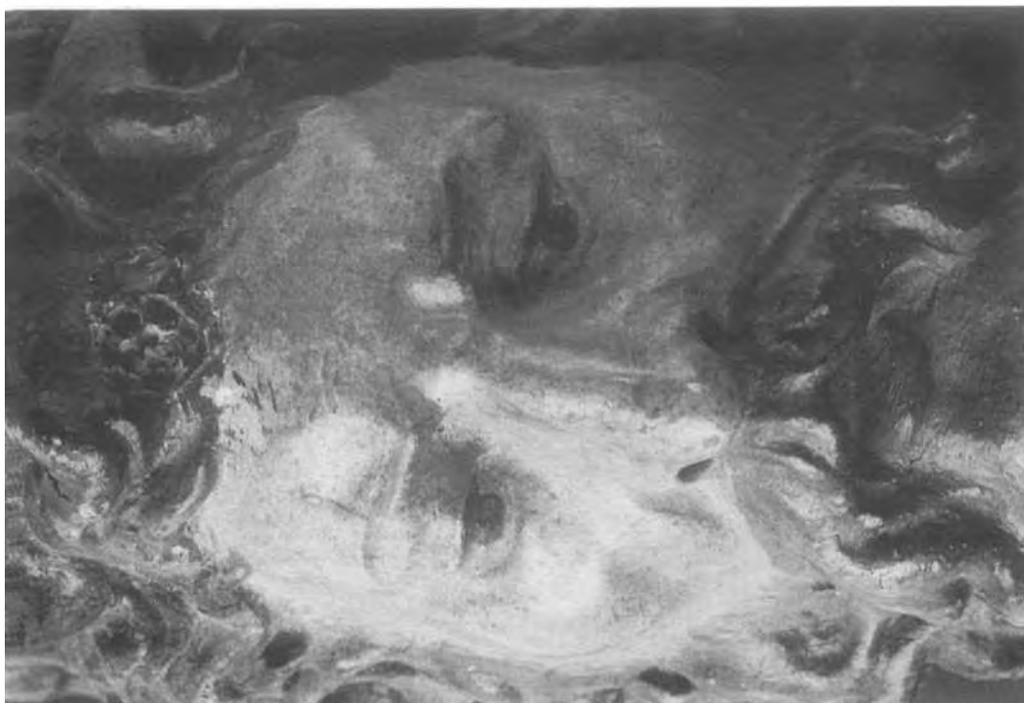


Figure 5. *St. Mark*. Detail of head prior to cleaning, and with insect damage in hair above forehead.

The next treatment, the Spanish *Bust of a Female Saint* by Felipe Ydalgo Buenfiglio circa 1750 (also from the Los Angeles Museum of Art) was discussed in a talk by the author at the Wooden Artifacts Group during the 2000 AIC meeting in Philadelphia (Figs. 7, 8). Disfiguring insect holes marred the beauty of the sculpture. A flexible fill material was needed that could accommodate the expansion and contraction of the wood without being invasive structurally. Microcrystalline wax mixed with powdered pigments was used to replicate flesh tones. The channels left by the insects are not completely filled. A small amount of wax is smoothed just over the top of the exit hole.



Figure 7. *Bust of a Female Saint*. (Los Angeles Museum of Art, ca. 1750-1760, acc. no. 1995.174.1) Before treatment, with insect damage.



Figure 8. *Bust of a Female Saint*. After treatment, with pigmented wax fills.

A beeswax and resin relief by Massmiliano Soldani-Benzi entitled *Apotheosis* (Los Angeles County Museum of Art) was also treated using the wax fills (Figs. 9-10). One of Soldani's most important commissions, it was created as a proposal for the tomb of the Grand Master of the Knights of Malta, Antonio Manoel da Vilhena in 1726. The wax relief depicts Vilhena being elevated to the heavens by two putti and flanked by Father Time and The Virgin Mary. One putto carries the sword and helmet presented to the Grand Master by Pope Benedict XIV. A shield held between two putti at the bottom proper right illustrates Fort Manoel on the island of Malta. Representations of Neptune holding his trident and the lion of Malta are also portrayed.



Figure 9. *Apotheosis*. Before treatment.



Figure 10. *Apotheosis*. After treatment, with surface cleaned and new wax fills added.

First, the visually disturbing restorations were examined under ultraviolet light and were removed with a mini scalpel while working under the microscope. Again a palette of microcrystalline wax, melted with powdered pigments was used. When the wax cooled the fills were laid in with a mini spatula and wax tools (Fig. 11). All the wax fills remain soft, unlike the original beeswax surface that is rigid and brittle. Although the color of the fills is the same, they are easily identified and reversed as they absorb light under UV.



Figure 11. *Apotheosis*. Application of new wax fills



Figure 12. *Apotheosis*. Detail after treatment.



Figure 13. The same area as in Fig. 12, under UV light, showing the location of the fills.

The next treatment was both challenging and problematic, the prominent loss to the proper right glass eye of this early 18<sup>th</sup> century Spanish polychrome, *Virgin Dolorosa* or *Sorrowing Virgin*. The bust belongs to the Huntington Library, Art Collections and Botanical Gardens in San Marino, CA., and is on long-term loan to the Los Angeles County Museum of Art (Figure 14).



Figure 14. *Bust of a Sorrowing Virgin* (The Huntington Library, Art Collections and Botanical Gardens, ca.1725, acc. no. L.2000.7). Before treatment, detail of head.

The missing section of the glass eye required a fill material that was flexible, translucent and easy to apply. Since there is no access to the back of the sculpture, an epoxy resin could not be used. The loss could not be isolated and an epoxy fill would, consequently, wick into the surrounding wood causing irreversible damage. Also, with no access to the glass eye from behind, a cured epoxy fill could not be trimmed from the sides or verso.

Although it is a fragile alternative, wax was selected for the repair because it met the necessary requirements of flexibility, ease of application and translucency. Multiwax W-445 was melted in an aluminum weighing dish and mixed with powdered pigments. The colored wax was slightly gritty and matte but was easily applied to the missing section and bridged the loss without covering any remaining original glass. Gamblin Conservation Colors (premixed in Galdehyde resin) were used to improve the color of the pupil and inpaint the iris and veins. The pigments had sufficient coverage for a good color match. However, the color was still matte and gritty and did not match the appearance of the rest of the eye. In order to achieve the appropriate glassy look, the Gamblin

Galdehyde resin solution was wicked onto the wax fill. Whenever the resin pooled or pulled away from the wax's surface during the seven-hour cure time, a little more was applied on a brush tip until the resin leveled and eventually cured with an even glassy surface. The same resin was used to recreate the missing beaded tears following the remaining original tracks (Figs. 15 -17).



Figure 15. *Bust of a Sorrowing Virgin*. Before treatment, detail of proper right glass eye with missing section.



Figure 16. *Bust of a Sorrowing Virgin*. After treatment, showing proper right glass eye with pigmented wax fill.



Figure 17. *Bust of a Sorrowing Virgin.*  
After treatment, showing the tears.

The next treatment shows the versatility of wax. In this treatment wax is used as a support and to create a flexible mold for a removable fill for a Sassanian Silver Gilded Bowl in the collection of the Los Angeles County Museum of Art (Fig. 18). The bowl has a portrait medallion of a male royal figure in the center and is one of only four known examples in the world. The four bowls were allegedly found together and date between the 3<sup>rd</sup> to 4<sup>th</sup> centuries A.D. with the LACMA bowl placed chronologically at the end of the series.

The first decision was whether aesthetically and ethically the bowl should be treated. The large loss was prominently located and visually disturbing, detracting from the visual integrity of the vessel. And because irreplaceable archaeological evidence had already been removed, there was no reason to leave the bowl in its untreated state. Curators and conservators agreed jointly on three criteria for treatment: the fill should (1) be completely reversible and easily removable without affecting the original material; (2) remain stable; and (3) should be detectable but impart visual harmony. The surface tarnish was reduced using swabs dampened in ethanol and distilled water with a slurry of precipitated chalk. The fire scale and blackened corrosion products adjacent to the loss were reduced by electrolytic reduction. This procedure entailed applying a 10-volt charge to a small cotton square dampened in a mild solution of formic acid and rinsed in distilled water. The corrosion was slowly and painstakingly reduced with wooden tools working under the microscope.



Figure 18. *Bowl with Portrait Medallion of a Royal Figure* (Los Angeles County Museum of Art, Sassanian period, ca. early 4<sup>th</sup> c. AD, acc. no. TR.10020.58). Prior to cleaning, with ragged loss.

The soft wax infill was sculpted to approximate the profile of the bowl and compensate for the ragged and warped loss, Hxtal NYL#1 epoxy resin was flowed over the sculpted wax fill and a barrier dam of plasticene clay (Klean Klay, which does not react with the epoxy) was used to contain the epoxy (Fig. 19). After the wax fill cured the wax was trimmed away from the verso.

A quick drying gold size was applied over the epoxy fill and was then gilded with sheets of silver leaf (Figs. 20 - 21). Since the silver bowl and fill would continue to tarnish at an uneven rate, the bowl was brush coated with a nitrocellulose lacquer, Agateen No. 27. This could not be used on the silver-leafed fill since it would lift off the gilding.



Figure 19. *Bowl with Portrait Medallion*. During treatment, showing wax reconstruction and plasticine dams prior to filling with epoxy.



Figure 20. *Bowl with Portrait Medallion*. During treatment, showing partially silver-gilded epoxy fills.



Figure 21. *Bowl with Portrait Medallion*. During treatment, showing completely silver-gilded fills.

The silver-leafed fill was airbrushed with an acrylic resin, Acryloid B-44 mixed with powdered pigments so the infill would integrate better with the original aged patina. The fill is completely removable if either the bowl or the fill requires further treatment in the future (Figs. 22, 23).



Figure 22. *Bowl with Portrait Medallion*. After treatment detail, showing removable airbrushed fills.

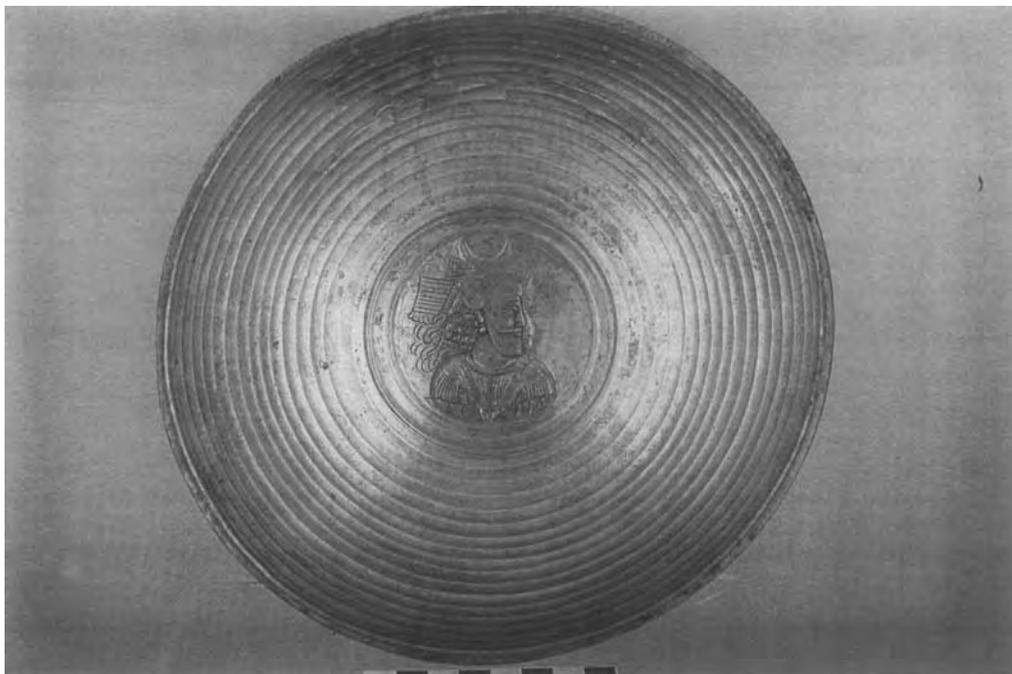


Figure 23. *Bowl with Portrait Medallion*. After treatment.

The next piece is an exceptional composite object treated by the author several years ago. The early 15<sup>th</sup> century Chinese cloisonné ceremonial offering stand was the subject of a thorough analytical investigation published by John Twilley, then Senior Research Scientist at LACMA (Twilley 1994). Works dating to the early 15<sup>th</sup> century are of considerable rarity, especially in American collections. Therefore, when an opportunity presented itself to investigate this unrestored example from Tibet, Twilley carried out as full an investigation as his scientific resources would allow including; thermal analysis, x-ray fluorescence, x-ray diffraction, infrared spectroscopy, wavelength dispersive electron probe microanalysis and optical microscopy. According to Twilley, he investigated three principal activities: “the construction of the metal form; the enamel formulation and application; final finishing and the gilding of the cloisonné edges. Ancient repairs were identified by their residues where fabricators filled defects in the enamels with pigmented beeswax” (Twilley 1994:161).

The offering stand is constructed of a flat-sided, circular, leaded brass casting, 30.8 cm in diameter and 7.8 cm high, enameled only on the exterior (Fig.24) . When in use, this Buddhist ceremonial stand would be surmounted by tiered mounds of rice, each contained within a metal ring resting on the one below and terminating in a finial.

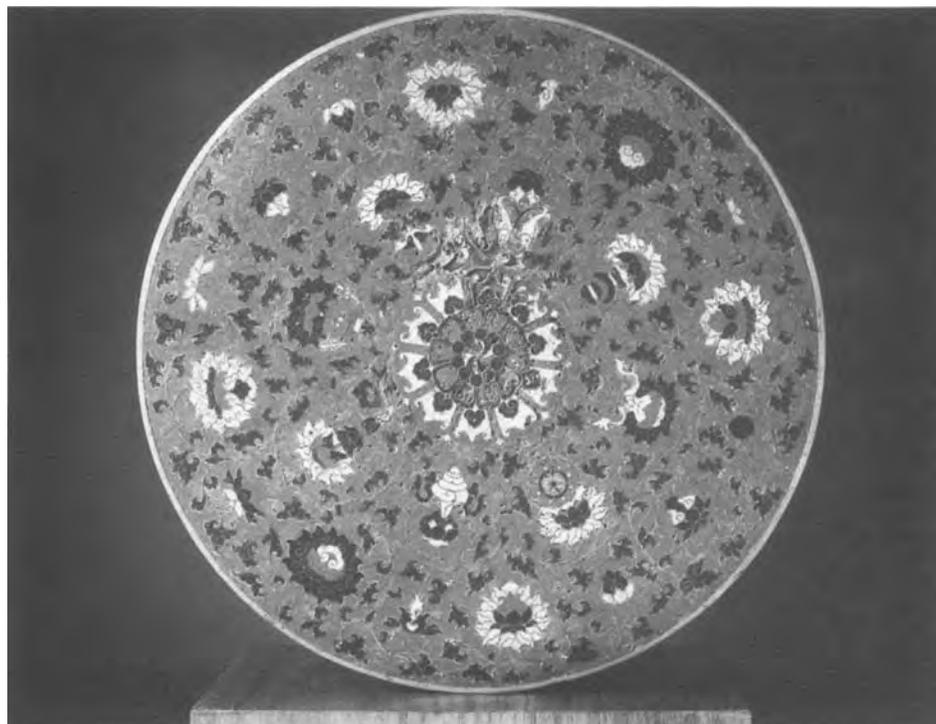


Figure 24. Ceremonial Offering Stand. (Private Collection, early 15<sup>th</sup> c.)  
Before treatment.

Rigid parameters were established in consultation with the owner and Twilley prior to treatment. First, the object had never been treated before and irreplaceable evidence must be preserved

intact. This included ceremonial yak butter on the surface and original pigmented beeswax used to fill the voids or pinholes after fabrication. The object would not be cleaned; treatment would focus locally on the damaged area. Although the brass substrate was deformed, no attempt would be made to mechanically improve the dents since substantial additional damage and loss of enamel would result. The repair would be harmonious aesthetically but should be completely reversible, removable and detectable under ultraviolet light.

The treatment proceeded as follows; a reversible acrylic resin, Acryloid B72 was used to consolidate the lifting and crumbling enamel prior to filling. Using flat stock brass strips located at a model train store, the missing cloisons were replaced. The brass strips were shaped mechanically to replicate the missing cloisons and were tacked in place with a fast curing 5-min. epoxy resin. An additional bead of bulked up adhesive; Acryloid B48N was flowed along the lower edge of the replaced cloisons. This helped seal the compartments created by the brass strips so the fill material would not wick under the cloisons and affect adjacent original enamel. Small pieces of plastic wrap were laid over and inside the areas to be filled so the fills would be completely reversible and removable.



Figure 25. Ceremonial Offering Stand. During treatment, detail with enamel consolidated and cloisons tacked in place.



Figure 26. Ceremonial Offering Stand. After treatment, detail with epoxy fills.

Practice fills (using small polypropylene beakers) were made to replicate the original 15<sup>th</sup> century enamel, blending the deep brilliance of the color with the dense opacity of the enamel.

Additionally, an attempt was made to imitate the way the fired colors bleed together. It quickly became obvious that even a perfectly matched fill would be unacceptable if the surface appearance was not replicated as well. The original surface was fractured and worn looking from repeated ritual abrasion with husks of raw rice. The pinholes from fabrication were black and filled with a mercury gold amalgam residue from the original polishing process. And finally, it was necessary to include all of these characteristics into one fill application.

In an attempt to replicate the intense color and the density of the enamel, the fills were made as follows; powdered pigments were added to a 2-part epoxy resin, Hxtal NYL#1 and bulked with a 1:1:1 mixture of glass microballoons for density, fumed silica for thixotropic properties and alabaster dust for translucency. The bulked epoxy was flowed over the plastic wrap in the cloisons.

Rolled rods of soft microcrystalline wax, W-445, were pigmented with ivory black and burnt umber and were coated with gold leaf. The wax rods were made in various thicknesses to match the pinholes found on the surface, and were placed vertically into the uncured epoxy fills. This technique approximated the look of pinholes created by the fabrication technique; mechanically drilling holes into cured fills would have had a very different look. Just before the epoxy cured, crinkled sheets of clear tape were laid on exposed areas of the fill. This simulated the worn fractured look on the surface.

After the epoxy cured, the tape was removed from the surface of the fill. A hot air gun was used to melt away the wax rods leaving pinhole, pigment and the gold residue behind. The fills were then removed by lifting up the plastic barrier and reattaching them with an acrylic resin.

Figs. 27 and 28 show additional details during treatment.

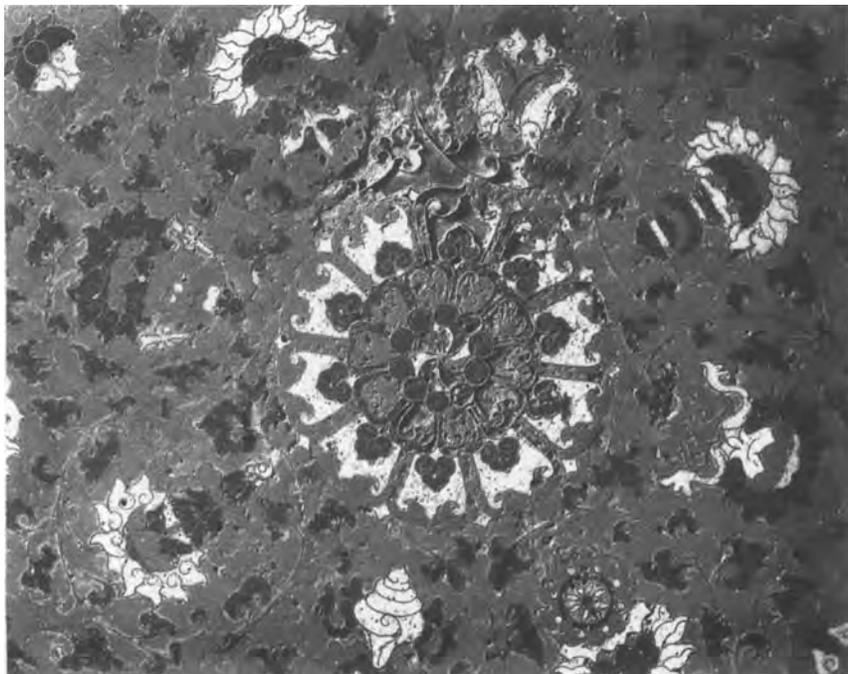


Figure 27. Ceremonial Offering Stand. During treatment, detail with shaped cloisons prior to filling.

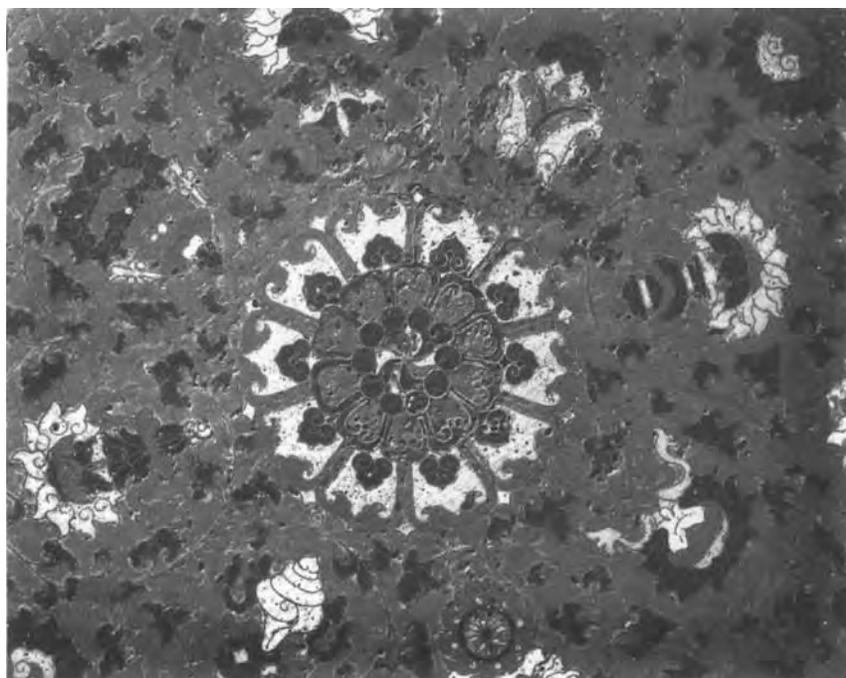


Figure 28. Ceremonial Offering Stand. After treatment detail.

All of the criteria for treatment were achieved. The fills were completely reversible and fluoresced under UV making them easily distinguishable from the original. The irreplaceable archeological evidence was preserved intact and the damaged area was stabilized with the restorations blending harmoniously with original ancient enamel.

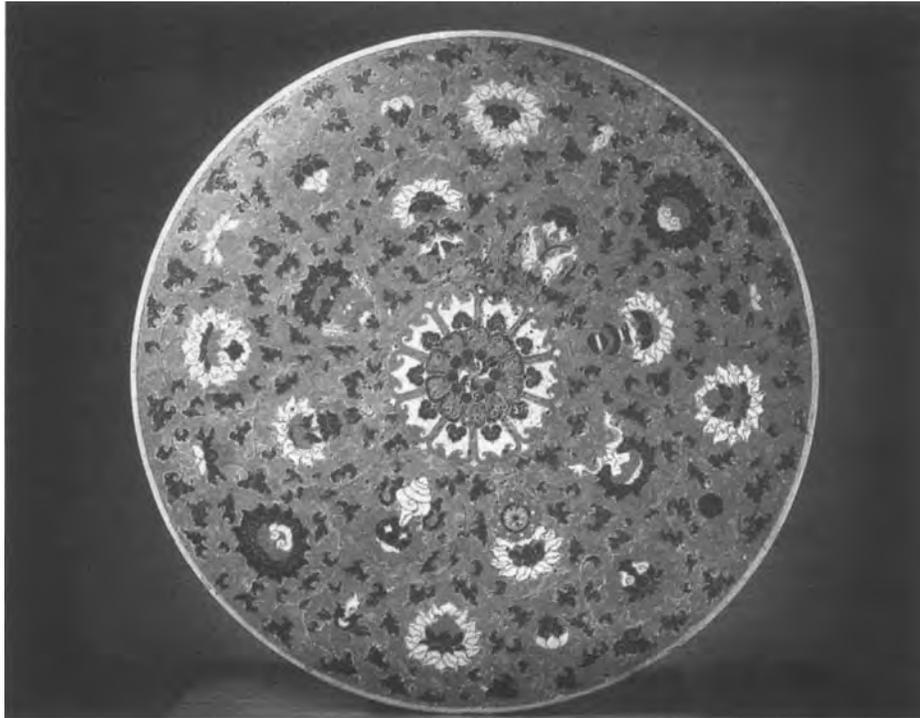


Figure 29. The offering stand after treatment.

Object conservators are frequently called on to treat unique and varied materials. With each treatment and different material, we are presented with a new challenge, and no single solution will cover every case. The materials may change but the criteria for treatment are basically the same: reversibility, documentation and collaboration. This paper covers a few solutions for loss compensation using only wax and epoxy; there are endless possibilities. Hopefully, this will stimulate dialogue on the topic of loss compensation, surface integration and the aesthetic and ethical decisions made for each individual work of art.

### Suppliers

Acryloid (Paraloid) B44: methyl methacrylate copolymer in a 15% solution in xylenes. Distributed by Conservator's Emporium, 100 Standing Rock Circle, Reno, NV 89511. Tel (775) 852-0404. (ConsEmp@comsemp.com)

Acryloid (Paraloid) B48N: methyl methacrylate copolymer in a 15% solution in acetone. Distributed by Conservator's Emporium.

Acryloid (Paraloid) B72: ethyl methacrylate copolymer in a 10% solution in acetone. Distributed by Conservation Support Systems, 924 West Pedregosa Street, Santa Barbara, CA 93101. Tel (800) 482-6299.

Aerosil R 972: hydrophobic fumed silica. Manufactured and sold by Degussa Corporation (Pigments Division), Ridgefield Park, New Jersey.

Agateen No.27: nitrocellulose lacquer. Distributed by Talas, 568 Broadway, New York, NY 10012. Tel (212) 219-0770.

Aluminum weighing dishes. Available from Fisher Scientific Co. Tel (800) 766-7000, ([www.fishersci.com](http://www.fishersci.com))

Beakers: polypropylene graduated measured cups. Available from Fisher Scientific Co. Tel (800) 766-7000, ([www.fishersci.com](http://www.fishersci.com))

Gamblin Conservation Colors: available as dry pigments and in an oil base.  
Gamblin Galdehyde: aldehyde resin commercially produced by BASF. ([rgamblin@telport.com](mailto:rgamblin@telport.com), [www.gamblincolors.com](http://www.gamblincolors.com), also available through suppliers of artist's materials such as Dick Blick, [www.dickblick.com](http://www.dickblick.com)).

Hxtal NYL#1: 2-part epoxy resin. Distributed by Conservator's Emporium, (775) 852-0404. ([ConsEmp@consemp.co](mailto:ConsEmp@consemp.co)).

Klean Klay. Distributed by Conservation Support Systems, Santa Barbara, CA. Tel (800) 482-6299.

409 Microspheres: Glass microballoons. Gougeon Brothers, Inc., Bay City, Michigan 48706.

Multiwax w-445: microcrystalline wax. Distributed by Conservation Support Systems, Santa Barbara, CA. Tel: (800) 482-6299.

## Reference

Twilley, J. 1994. "Technical investigations of an early 15<sup>th</sup>-century Chinese cloisonné offering stand". In: *The Ceramics Cultural Heritage: Proceedings of the international symposium "The Ceramics Heritage" of the 8<sup>th</sup> CIMTEC-World Ceramics Congress and Forum on New Materials*, Florence, Italy, June 28 – July 2, 1994. 161 – 173. Florence: TECHNANA Publishing.

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