THE DEVELOPMENT OF A MOLD AND CAST TECHNIQUE FOR INFILLING LOSSES ON VARNISHED CHINESE EXPORT LACQUERWARE

by

Julianna Marie Ly

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ABSTRACT

While China continues to capture newspaper headlines during discussions of economic growth and competition with the United States, much has been forgotten about early 18th century trade between China and the United States. The results of luxury export trade can still be seen through current patterns of consumption, the growth of the United States economy, and revived interest in Chinese designs still evident in European and American homes. During research conducted during the summer of 2014, the conservation treatment of a Chinese export lacquerware shawl box, 1964.0084D, from the Winterthur Museum and Country Estate collection was performed. The shawl box was chosen as it exemplified the monumental impact Chinese export had on developing trading ports across America, specifically focusing on Salem, Massachusetts. The shawl box was analyzed through the techniques of pyrolysis gas chromatography/mass spectrometry (py-GC/MS), ultraviolet light (UV) auto-fluorescence, and chemical staining in order to accurately assess the current condition of the object and develop an appropriate conservation treatment plan. After learning one lacquerware conservation technique through the shawl box treatment, I aimed to develop an alternative methodology that would eliminate some material issue concerns that arose during the shawl box treatment and facilitate the treatment of larger losses. This thesis aims to develop a mold and cast system which completely eliminates the use of water while reducing the amount of time an object is handled during the conservation treatment of varnished Chinese export lacquerware pieces. A varnished Chinese export lacquerware screen, 2004.0030.002, in the Winterthur
Museum and Country Estate collection was used to carry out testing for the purposes of this study. This study has informed further treatment of the varnished Chinese export lacquerware screen, 2004.0030.002, and presents a new method of treating large losses on varnished Chinese export lacquerware.
Chapter 1

INTRODUCTION

Beginning in the 16th century and continuing into the mid 1800s, Chinese export lacquerware spurred extreme interest in both Europe and the United States. As Chinese export goods continued to flood into ports along the East Coast, revived interests in Chinese designs, as well as Chinese philosophy, permeated Western homes and minds. The China trade’s positive impact on the economy increased its desirability to Europeans and Americans. By analyzing the root of Chinese lacquerware circulation, the intense impact of Sino-Western relations on Asia and the West becomes more evident.

During infilling conservation treatment of a Chinese export lacquerware shawl box in the Winterthur Museum and Country Estate collection, 1964.0084D, performed throughout the summer of 2014, conservation material questions arose. This thesis aims to investigate a new technique specifically focused on filling large losses on varnished Chinese export lacquerware objects in order to eliminate the material concerns that arose during the treatment of 1964.0084D. An ideal mold and cast technique would not only eliminate the use of water during treatment, but also significantly reduce the amount of work and handling time for the object.

In an effort to develop a new technique for larger losses in varnished Chinese export lacquerware surfaces, several questions guided my research. The first series of questions that needed to be addressed included—What stable materials can be used in order to create an ethical and effective fill using a mold and cast system to conserve
large losses in Chinese export lacquerware? When testing different materials, will the fill created shrink over time? Depending on the materials used, will it be possible to successfully remove the fill out of the mold without breaking? Will a separating agent or another material be needed in aiding the mold/fill removal? If a separating agent was needed, another material would be introduced that would need to be compatible with both the molding and fill material, as well as aid, rather than hinder the process.

The next series of questions concentrated on the execution of the technique once the appropriate casting and fill materials were selected—How will the fill match the surface of the piece? Will additional inpainting or polishing achieve the look of the smooth lacquer surface I am aiming to replicate?

Each of these questions forced a comprehensive assessment of my material testing strategies, a new technique and/or application method, and several consultations with conservators in other specialties in order to understand more about the variety and applicability of materials available. Through a year and a half of research and testing, I believe that I have developed a technique that is appropriate, ethical, and effective at filling large losses on varnished Chinese export lacquerware surfaces. It is my hope that this research can be implemented when appropriate and further investigated in order to significantly reduce the amount of time the object is physically handled and eliminate the use of water during treatment while providing an effective fill to prevent future deterioration.
Chapter 2

DEVELOPMENT OF CHINESE LACQUERWARE AND TRADE

With any object, it is imperative to understand if the provenance can reveal a history of trade relations and show a larger impact of the arts on a revolving global economic and commercial network. During the summer of 2014, while beginning treatment and research on object 1964.0084D (Figure 1), a Chinese export lacquerware shawl box, it was crucial to delve into the history behind Chinese export lacquerware within Asia, and the impacts of its assimilation into Western decorative arts.

Figure 1  Shawl Box, Winterthur Museum and Country Estate Collection, 1964.0084D Pre-treatment.
Although the lacquerware pieces discussed in this thesis originated from China, lacquer was also produced in surrounding Asian countries. The dynamics and competition between these countries surrounding the production of lacquerware played a major role in the creation and distribution of luxury goods. During the 16th century, Japan established itself as one of the most globally connected countries. Through four maritime links, Nagaskai, Tsushima, Satsuma, and Matsumae, the Japanese were able to conduct effortless trade with China, the Netherlands, Korea, the Ryukyu Islands, and the Ainu people respectively. As the dominating trading power in Asia, Japan was able to create the most luxurious lacquer which became much more desirable within the trading sphere than other Asian lacquerwares. Although Japan was producing the most sought after lacquer, Japanese artisans borrowed much from their Chinese counterparts. Both carved lacquerware and lacquerware containing mother of pearl decorations were imported into Japan from China, “encourage[ing] Japan to emulate, copy, and master Chinese technique or push Japanese artists to create something entirely different.”

Thus, lacquer and maritime trade within East Asia became linked making it harder for art historians to determine the origin of many techniques. Kaori Hidaka, an expert in Japanese export lacquer, divided East Asian maritime trade into four different categories outlining the development of lacquerware trade amongst these countries. The first category begins around the end of the 18th century with Japanese envoys arriving in China. The second category spans from the 9th to the 14th century where lacquer trade exponentially increased. However, from the 15th century on, in Hidaka’s third category, “injunctions against maritime trade imposed by China’s Ming Dynasty rulers disrupted previous patterns of exchange.” China’s Song and Yuan
dynasty periods, lasting from 960-1386, comprise the last category, where lacquer trade resumed at an alarming rate.

However, during the first half of the 17th century, during a period known as *sakoku*, the Japanese Tokugawa government ceased all foreign trade with foreign countries,\(^4\) thus allowing lacquer to become an overwhelming commodity in China, as foreigners could no longer import Japanese lacquer. China, however, was not the only country competing with Japan in order to create the highest quality lacquer. Lacquer was additionally made and circulated in Korea and Vietnam. Yet it was this exchange of goods, this movement of designs, which encouraged countries to create “something different and distinctive…[hence] a balance was maintained between the making of objects inspired by the new and exotic, and that of artifacts that continued to reflect native cultural traditions.”\(^5\) It was China’s amalgamation of mimicked Japanese “maki-e” and traditional Chinese carved lacquer that pushed China to the top of lacquer production and trade. China’s Ming Dynasty furthered China’s status in lacquer production expanding the sphere of Asian trade.

As lacquer served as a catalyst of intra-Asian trade, its lustrous sheen soon caught the eyes of Western and European traders as well. Yet just as lacquer spurred intra-Asian trade, it also prompted European competition. The Portuguese became the first European power in China, permanently settling in Macau in 1557.\(^6\) After Spain took over Portugal in 1580, Portugal was annexed and all Portuguese territories were turned over to the Spanish. The English, Dutch, and French were also competing alongside Portugal in order to establish direct trade with China. As lacquerware started entering European markets, exportware began to reflect the tastes and desires of the West.
Lacquer, first entering organized trade in 1543 between the Portuguese and Japan, soon became increasingly popular and desirable within Europe. As China began to create lacquer solely for export purposes, the most obvious change was the production of non-Asian shapes (Figures 2 and 3). As countries began to transform traditional Asian styles to appeal to a Western market, by the mid 1800s, three cities became major trading centers which linked Asia to Western and European powers: Macau, Canton (modern day Guangzhou), and Hong Kong.

Figure 2  
*Davenport Desk, Peabody Essex Museum. ca. 1850-1860. Chinese export lacquered version of the popular 18th c. English desk form from the firm of Waring and Gillow.*
Foreign merchants soon began to commission Chinese artists to provide a “visual record of their own involvement in the China Trade,” as a means to create a romanticized document of their trade with Asia. As Westerners viewed Canton trade in particular as, “romantic, sometimes exotic, [and] often heroic,” Chinese artists’ most popular lacquerware designs began to include Chinese landscapes, geometric designs, and grape leaf patterns.

Figure 3 Table. Peabody Essex Museum, Salem Massachusetts. Chinese export lacquerware table geared towards the American market featuring dragon legs.

While lacquer designs began to conform to Western tastes for the export market, during the late 16th and early 17th century, there was an increase in the number of illustrated books being published in China which increased, “the willingness of Chinese artisans to work from indigenous printed sources [laying] the groundwork for the 18th century manufacture of goods with European motifs and decorative
schemes.” Additionally, export lacquerware was used as gifts in diplomatic exchanges and was often offered to powerful officials in order to gain advantage in political disputes.

The United States did not begin trading with China until the 18th century. Previously excluded from European/China trading, American trade was rather a result of “private enterprise.” The first American ship that went to China, *Empress of China*, sailed in 1784 carrying furs and ginseng. “Before long the speed of the American ships became a threat to the slow-sailing vessels of the English company,” and by the 19th century, Chinese export goods were available from Boston to California. One of the most significant trading ports, Salem Massachusetts, became “the wealthiest city per capita in the United States,” as a direct result of engaging in the China trade. The impact of this trade relationship is represented in the Peabody Essex Museum and adjoining Phillips Library, which houses ten thousand objects specifically made for the American market from the 16th-20th c. originating from varying parts of Asia.

This trade relationship surpassed a mere exchange of goods by truly impacting both European and American culture and their economies. The most significant European result was the development of Chinoiserie in Italy. As “an expression of what Europe thought the East to be,” beginning roughly around 1600, Chinoiserie affected the style of books, walls, patterns, fabrics, furniture, and even stimulated a movement in Anglo-Chinese gardens. Truly permeating into European culture, “it was the unreal, the fantastic and novel quality of the Orient,” which excited Europeans. Easily described as a Chinese craze, Sino-Western trade had lasting economic influences as well. However, although the Europeans continued to conduct trade with
China in exchange for lacquerware, the art of Japanning\textsuperscript{20} soon grew in Europe where European artists began to mimic Chinese and Japanese lacquerware with European materials (Figure 4). As Japanning aimed to copy the look and luster of Chinese lacquerware, the materials used significantly varied. Therefore, only through chemical testing can one distinguish between a lacquered object or a Japanned one.

![Lacquered table from the Peabody Essex Museum. Top of table is lacquered. Sides and legs of the table were previously thought to be japanned, but presently are under research and investigation.](image)

By studying a Chinese lacquerware stratigraphy for the grounds, substrates, finishing layers, and decorative techniques, one can decipher whether an object is of European or Asian origin.
Chapter 3

CHINESE LACQUER

Asian lacquer is produced from the sap of tree species including *Rhus verniciflua* (China, Japan, and Korea), *Rhus succedanea* (Vietnam and Taiwan), and *Melanorrhoea usitata* (Myanmar and Thailand). *Rhus verniciflua* grows in twenty-three provinces in the mountainous regions of China.\(^{21}\) There are one hundred and sixty-one recorded districts within China that harvest lacquer, allowing China to be the world leader in production and export. Due to the high water content in raw lacquer (25-65\%), excess water must be driven from the material through processing at 40°C in order to “disperse polysaccharides and glycoproteins [to make] a more homogenous mixture [while] promoting dimerization of the urushiol molecule (Figure 5).”\(^{22}\)

![Urushiol Molecule](image)

*Figure 5 Urushiol Molecule.*
Yet it is lacquer’s composition that must be fully understood as the 2% glycoprotein component, laccase, results in the material’s durable quality and sheen. As “laccase acts as a catalyst in the presence of oxygen and moisture [which] causes polymerization,” it must be applied in numerous thin coats with ample drying time in between. Lacquer is poisonous in its liquid state; however, following polymerization, the substance is no longer toxic.

As lacquer is a coating material, before approaching a conservation treatment, one must understand the material of the substrate, or what gives body to the lacquerware itself. Wood, bamboo, paper, and ceramics have all been used, however, wood remained most popular and versatile. Ranging from high to low quality, elm, mulberry, quince, pine, and cedar were all used.

A ground layer often followed in order to smooth out the substrate before lacquer application. Although lacquerware included a ground in order to provide a stronger surface, due to cost constraints materials in exportware would vary. For lacquerware created solely for the domestic market, a ground was made out of clay bound with lacquer. However, for exportware, the ground would consist of clay bound with animal glue in order to make the production more cost effective.

Finishing layers were then added and consisted of thinly applied lacquer layers. These layers were applied with brushes and dried in a humid, dust-free environment, which accelerated the hardening process. Each layer is then ground and polished prior to any additional lacquer application. For the domestic market, more than one hundred finishing layers would be applied, whereas lacquerware made for the export market would only receive two to three finishing layers, making export pieces much more susceptible to damage and fading.
Aside from chemical analysis of the different layers of the stratigraphy (Figure 6), the decorative techniques used can help us understand the materials and technology used at that time. The five most common techniques used were: painting with lacquer, inlaid lacquer, carved lacquer, surface relief work, and the use of metallic leaf and powders. For purposes of this thesis, only lacquer painting and metallic leaf/powders will be addressed since those two techniques were used on object 1963.0084D and 2004.0030.002. Although by the Han Dynasty in China, it became common to see elaborate and sophisticated designs, only a limited number of pigments were available as many were incompatible with the lacquer. Therefore the following pigments could be used and would be ground into the lacquer prior to application: cinnabar, iron oxide black, and orpiment. Following the creation of synthetic pigments, vermillion, chrome green, and ultramarine blue, would also be used. Conversely, when working with
metallic powders, wet lacquer would be brushed on first while the powder would be sprinkled on or brushed on in order to adhere to the surface.

Table 1  Summary of Differences Between Domestic and Export Lacquerware. The most significant differences are highlighted in green.

<table>
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<tr>
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<th>For Export</th>
<th>For Domestic Use</th>
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<tr>
<td><strong>Object/Substrate</strong></td>
<td>Wood predominates; however, bamboo, paper, and ceramics are possible</td>
<td>Wood, bamboo, paper, ceramics</td>
</tr>
<tr>
<td><strong>Ground</strong></td>
<td>Clay with layers of fibrous material for stability and strength</td>
<td>Clay with layers of fibrous material for stability and strength</td>
</tr>
<tr>
<td><strong>Binder</strong></td>
<td>Bound with animal skin glue</td>
<td>Bound with lacquer</td>
</tr>
<tr>
<td><strong>Finishing</strong></td>
<td>2-3 lacquer layers present in numerous pieces at Winterthur, however export lacquer layers can range from 2-15.</td>
<td>100 + lacquer layers</td>
</tr>
<tr>
<td><strong>Decorative Techniques</strong></td>
<td>Metallic leaf and powders predominate; however, painting with lacquer, inlaid lacquer, carved lacquer, and surface relief work also possible</td>
<td>Metallic leaf and powders, painting with lacquer, inlaid lacquer, carved lacquer, and surface relief work</td>
</tr>
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</table>

As is evident in Table 1, lacquerware made for export and lacquerware made for the domestic market differ in their stratigraphy specifically in the number of finishing layers and binder composition.
Chapter 4

LACQUER DETERIORATION

Although lacquerware made for the domestic and export market differ in composition and stratigraphy, both are susceptible to similar deterioration factors. Within each layer: substrate, ground, finishing layers, and decorative techniques, each poses its own deterioration issues. As versatile as wood is, it poses many difficulties as a substrate. As wood expands and contracts with changes in relative humidity, lacquer remains inflexible and rigid. Overtime, the movement of the wood will result in cracks, tents, and flaking of the lacquer (Figure 7).

Figure 7  Severe tenting of lacquer present on 1964.0084D. Lower left corner of lid.
Wooden objects will begin to show cracking parallel to the grain of the wood; however, with continued movement, stress will occur at the interface between the lacquered layers and wood resulting in complete detachment. Lacquer can then, with repeated movement and stress form a pattern of lifting and tenting lacquer if the substrate shrinks permanently due to extreme low humidity. Additionally, one must take into account the biotic (microorganisms) and abiotic (chemical/environmental) agents that will affect a wood substrate; “since water, oxygen, temperature and nitrogen can increase microbial growth it is important to understand the cell wall structure of the wood…and look for fungi and/or bacterial decay.” Clay and/or animal glue used as the primary binder of a ground material is also problematic. While clay is water-soluble and easily degrades overtime, glue can also dry out and shrink, “lift[ing] easily from the substrate forming large blisters of raised lacquer that may be lost (Table 1, Chapter 3).”

Depending on the metal inlay or powder used, metal deterioration can occur as well. A relative humidity of 50-60% will result in immediate silver tarnishing. Copper will form a red-brown cuprite and discolored carbonates, and lead can either form lead carbonate or lead formate (eventually formaldehyde), the latter of which is toxic. It is important to note that these forms of deterioration all represent inherent vice. A wealth of abiotic agents can present serious deterioration as well.

In the presence of light, permanent and irreversible damage can occur. As, “the energy contained in light is enough to break the molecular bonds of the lacquer polymer,” lacquerware should not be exposed to more than 32,000 lux hours in its lifetime. Depending on the pigment used, different fading can occur. For example, cinnabar darkens in light “due to red mercuric sulfide transitioning into a darker
form.” After the surface is weakened by light degradation, it is immediately susceptible to water damage as well. Condensation can result in watermarks left on the surface. After an object is exposed to light, the object can become discolored from heat. Often becoming lighter in color, heat changes can occur at as low as 50°C. Therefore performing any conservation treatments with heat-activated adhesives can pose long-term issues.

When handling any lacquered object, one must use gloves to avoid fingerprints becoming permanent on the surface as “residue from the finger causes a microscopic cracking pattern in the shape of the fingerprint.” Additional mechanical damage can occur as a result of improper handling resulting in dents and/or scratches. However, damage can also occur when improper materials are used for conservation treatments. Over-cleaning can result in faded and abraded surfaces. Additionally, when conservators are working to imitate lacquer by applying either lacquer (sometimes practiced in Asia) or western coatings or consolidants (practiced in the United States, Australia and Europe), more issues can arise. Since newly applied lacquer ages at a significantly different rate than the older lacquer on the object, fills would overtime become increasingly visible. Any Western coatings applied to the surface, for example, shellac or rosin, will crack overtime. Additionally, since strong solvents must be used to remove them, these are not advisable materials due to their potential irreversibility. However, before considering any conservation treatment, one must understand the current state of the object, identify problem areas, and understand what materials an object is composed of in order to select the most appropriate treatment option. Keeping in mind both the stratigraphy of lacquerware objects, and their agents
of deterioration, one can devise an appropriate, ethical, treatment plan in order to conserve export lacquerware pieces.
Chapter 5

CASE STUDY: 1964.0084D

The shawl box used as a case study for this thesis, 1964.0084D (Figure 1, Chapter 2), is one of a pair of boxes within the Winterthur Museum and Country Estate collection, brought to Delaware by William Hemphill for his daughter Mary Hemphill. William Hemphill was an Irish immigrant who grew to become a successful Wilmington merchant and who also worked with Robert Flaston of Philadelphia to finance international trade. Following Hemphill’s death in 1823, the box was then given to Mrs. Lalor Burdick, who gifted the box to the collection in 1964.

1964.0084D no longer holds its original shawl as its pair, 1964.0083D, does. The 1964.0083D shawl box still contains its shawl and will not be removed on the request of the curator in order to help provide more art historical context to both boxes. The shawl box, 1964.0084D, is dated between 1820-1840. The description from Winterthur’s KE-EMu database reads:

“Shawl; white silk embroidered with flowers, leaves, and scrolls in white silk with white net fringe; (b) paper pattern with red and white silk material with access to case by two hinged lids which extend halfway across top of case; (d) black lacquer case; two hinged lids, one at each side of interior which extend halfway across case; one hinged lid at top of case which covers the two smaller lids; spray of flowers in gilt on exterior of each inner lid, one the reverse of the other; a scene of four figures in a garden enclosed in a border with a floral spray at each corner on the outer lid; one bail handle centered at each side; lock centered on side opposite the hinged side (key missing).”37
As both 1964.0084D and 1964.0083D are identical visually and in materials, the 1964.0083D records were helpful in identifying more about the materials used in production. In a conservation report conducted by Country Von Stein on February 12, 2012, the wrapping paper enclosing the shawl on 1964.0083D was tested. Stein took small samples and treated them with Graff “C” stain. The samples were also looked at under transmitted light. The results indicated that the wrapping paper is an Asian rice straw mixed paper. Additionally, Stein proposed a three-tier system of repair. Beginning with a HEPA filtered vacuum and soft brush cleaning method; Stein then suggested consolidation via a mixture with a syringe. Stein then listed five different fill materials that could be used: pigmented waxes, polyester resins, B72 with microballons, gesso, and an acrylic emulsion.

In order to identify the appropriate conservation treatment, two samples were taken from 1964.0084D. Samples taken included: one from the top lid, located towards the bottom right, and one taken from the bottom left inner leaf. As lacquer was historically chosen as a durable lustrous material, taking samples was extremely difficult as cuts into the surface could cause a ripple effect of cracking along that cut. Additionally, each sample had to be deep enough to include all ground layers for analysis to be accurate and effective. Samples were then labeled and taken to the lab in order to be mounted and casted for analysis. Samples were placed in a mixture of 5 ml polyester resin and eight drops of polyester hardening catalyst, and were left to dry for four days before polishing. Samples were then looked at under the microscope both in visible and in ultraviolet light (UV) (Figures 8 and 9). Pyrolysis gas chromatography/mass spectrometry (py-GC/MS) was also conducted by Catherine Matsen39 and Maria João Petisca40, on the samples, as well as sample staining with
iodine potassium iodide to test for the presence of starch. Additionally, UV light was used to test for the presence of a varnish on the surface of the object.

Figure 8  1964.0084D Sample 1B examined under ultraviolet light, 10x.

Figure 9  1964.0084D Sample 1B examined under visible light, 10x.

Looking at the samples under the microscope using visible light helped provide insight on the production and stratigraphy of the box. The coarse clay/earth ground
layer was visible—possibly bound in animal glue with the paper fiber layer separating the two. Two lacquer layers were visible—the top darker layer as a result of added carbon or iron for a desired final effect. A thick layer of gold and red bole was also apparent.

When examining the samples under UV light, the fluorescing white layer indicated the layer of fibrous material as the proteins present fluoresced once being exposed to UV light. Additionally, the UV light enhanced the differentiation between the two lacquer layers. The number of layers within the sample also helped solidify that this particular piece was of exportware. As the cost of lacquer was extremely expensive, pieces for export had a significantly lower number of layers than that of a domestic piece, which would have a considerably higher number of lacquer layers applied (see Table 1, Chapter 3).

Winterthur staff members completed a thorough examination and condition report before treatment options were proposed. The exterior of the box was examined with a hand-held UV light in order to test for any varnish. No obvious autofluorescence suggested that the presence of a varnish was not detected. This made it imperative to wear gloves during the entirety of handling and treatment. Additionally, the bamboo dowels that were used to hold the boards together were swollen as evidenced by the raised edges of the lid. Due to the middle vertical plank construction of the box, severe tenting resulted following the path of these planks (Figure 7, Chapter 4). Additionally, on the bottom inside of the box, there was a large horizontal crack in the wooden structure that required immediate attention.

Following the condition report, Maria João Petisca devised the following treatment proposal comprised of the following four steps: 1) dust cleaning with
brushes, 2) consolidation via warm hide glue injected with a syringe, 3) infilling gaps with black Modostuc\textsuperscript{42}, and finally 4) inpainting with Gamblin paints and light cloth polishing. However, before any treatment occurred, tests were conducted to ensure that the hide glue would not stain the lacquer surface.

The first step, the injection of warm hide glue (Figure 10), was done in conjunction with small amounts of a 50:50 water, ethanol mixture. If the lacquerware was not soft enough to be consolidated, small amounts of the water-ethanol mixture were injected into the object. After the lacquer was appropriately and safely softened, warm hide glue was injected underneath the tented area. The box was then clamped using a system of 1) Mylar\textsuperscript{®}, protecting the surface, 2) rubber, for added flexibility, and 3) Plexiglas\textsuperscript{®}, for pressure (Figure 11). A clamp was then placed and checked after twenty minutes to determine if more pressure would be needed. Lastly, the clamps were put back on and left for two days to ensure complete consolidation.

\textit{Figure 10}  \textit{Injecting warm hide glue via a syringe under lifting lacquer.}
Figure 11  Clamp system using Mylar®, rubber, and Plexiglas® for final consolidation.

The second stage of conservation was infilling with commercially available black Modostuc (Figure 12). A small spatula was used to apply the Modostuc to the loss. Small controlled amounts of water were used to pick up any Modostuc that was left on the surface of the object or surrounding area in addition to smoothing the fill. A damp swab was used to level the fill out prior to inpainting.

Figure 12  Infilling gaps with black Modostuc and controlled amounts of water.
After the fills were complete, Gamblin paints were used to finish the conservation treatment followed by light cloth polishing. After around fifty total hours of hands-on conservation treatment, the shawl box is now on exhibit as part of the 2015 Brittle Beauty: Understanding and Conserving Chinese Export Lacquer exhibition at Winterthur Museum and Country Estate.
Chapter 6

NEW PROPOSED QUESTION

Following the treatment of 1964.0084D, I identified several areas I thought could be improved specifically with the infilling process. My first concern was the amount of time spent infilling on the physical object. The number of hours the object was handled totaled nearly fifty hours. The second concern, which truly prompted this thesis, was that although the use of the water and damp cloths were extremely controlled and monitored, the use of water in any lacquer treatment is a risk. Since water is an agent of deterioration for a lacquered object even when closely monitored, I aimed to find a new technique that would significantly reduce the amount of time physically spent on an object while eliminating the use of water (which causes further deterioration) entirely. This led me to develop my lacquer research and treatment further and form the hypothesis that a better fill material or filling technique existed. This hypothesis prompted a full analysis of past infilling practices, techniques, and case studies to find the most suitable technique and materials. During a painting loss compensation workshop held by one of my advisors and professors, Brian Baade, at the University of Delaware, I learned how to take casts of painting frames in order to reconstruct areas of loss. Extrapolating this technique, I worked to create a mold and cast technique that could be applied to large losses in varnished export lacquerware pieces.
In order to test my hypothesis, a varnished lacquer object with large enough losses was needed. A Chinese lacquer screen in the Winterthur Museum and Country Estate collection was selected, 2004.0030.002 (Figure 13), and is dated between 1810-1825. Measuring 83.375 inches in height and 21.5 inches in width per panel (with a total of six panels), a full description taken from the Winterthur KE-EMu database file reads,

“Six panel, black-lacquered screen with two-toned gold designs; each panel with elaborate, wide, foliate border and central branch with exotic birds and butterflies; all screens edges with thin wooden band with mitered corners; three brass barrel hinges attach screens at either side; each panel with two brass-cuffed block feet; cuffs painted black and secured with brass escutcheon pins; border with birds, butterflies, spiders, paper scrolls, fans, and foliage with gold-stripes; branches with vines, leaves and berries, atop patches of moss surrounded by water; reverse of screens decorated with bamboo plants, birds, and butterflies.”44
The database file also provided insight on the provenance of the piece explaining that the family of Mrs. Violet Thoron originally owned the screen; however, it was previously owned by Thomas Wren Ward (1786-1856), son of merchant William Ward of Salem, Massachusetts. Thomas then married William Gray’s daughter, Lydia, in 1810. It is believed that this screen was a wedding gift to the couple. The screen was later sold to the Winterthur Museum and Country Estate collection in 2004 for $35,000.

The panel is constructed from three central vertical pieces of wood, each bordered with a two-inch band of wood around the edges. The wood species itself was identified on August 17, 2014 by Alden Identification Service, as Chinese Swamp
Cypress, or *Glyptostrobus pensilis*, which is native to southeastern China and northern Vietnam.

Mark Bockrath’s February 28, 2005 conservation report noted that, the brass cuffs which hold the three large panels together were bending, and the lacquer was suffering from extreme cracking and cupping. Bockrath proposed a treatment with no specific materials, but called for a combination of cleaning, consolidation, infilling, and the use of a varnish in order to match the glossy sheen of the lacquer surface. The condition that Bockrath described in 2005 is similar to its current condition.

As described in the condition report, the screen exhibits lacquer cupping, flaking, and significant loss towards the edges of the work. However, much like the lacquer shawl box previously discussed, it is imperative to understand the stratigraphy of the object in order to determine an appropriate conservation plan.

Cross-sectional analysis under visible and blue light (Figure 14) revealed paper fibers directly adhered to the wooden substrate. Two ground layers are also visible with a second layer of fibers separating each layer. Following the use of py-GC/MS (tests performed by Catherine Matsen and Maria João Petisca), it was concluded that the lacquer source was from the *Rhus succedanea* tree species.
The next step was selecting a loss large enough for testing an effective and efficient mold/casting system. A loss on the left edge of the work was selected (Figure 15). However, before testing on the surface, the surrounding lifting lacquer was first treated using the same method of softening the surface, injecting warm hide glue, and using a clamp system of Mylar®, rubber, and Plexiglas®.
Once the surrounding lifting lacquer was secured and lying flat, the fill was ready to be tested.

It is important to note that this particular piece was intentionally selected due to the presence of a varnish. As this mold and cast system has not been previously tested on export lacquerware, the use of a piece with a varnish would ideally ensure additional protection.
Before choosing potential mold making and casting materials, it was imperative to know the specific criteria of what constitutes a safe mold and an appropriate cast. The mold material I was looking for had to be malleable enough to form to the loss, have a fast enough curing time, and could be used to create both positive and negative casts—that is that the material can cast on top of a previously cured mold.

The first material that I chose to test was the material I used during the painting loss compensation workshop: PoYo Putty Series Part A\textsuperscript{47}. However, I immediately ruled this material out, as it requires a thirty-minute curing time directly on the surface. Through research of additional putty materials, it was evident that much faster curing times were available with different products. Following the general conservation practice of trying to reduce the amount of time an object is handled or treated, it was important to find another material with a faster curing time.

As I desired the characteristics of the PoYo Putty Series Part A—its malleability, softness, and accurate impression, I shifted my focus to ESPE Express STD, STD Firmer Set, Vinyl Polysiloxane Impression Material Putty Catalyst & Base (VPI)\textsuperscript{48} (Figure 16), which is used in the Winterthur Paintings Conservation Lab for painting frame conservation.
Outside of the conservation field, VPI is primarily used for dental impressions. The VPI provided an extreme advantage as its curing time is only five minutes compared to the thirty-minute curing time of Po Yo Putty, which significantly reduced the amount of time the object was handled and directly worked on.

VPI is extensively used in the conservation field. In an article published by The International Council of Museums (ICOM), author Alexandra O’Donnell discusses the use of vinyl polysiloxane rubber molds as a trial material for creating textured leather fills. O’Donnell used the material to create a mold of a leather loss and filled the mold with a BEVA gel. Golden Artist’s Colors were then used to finish and tone the fill before it was adhered to the loss.49

VPI requires a 1:1 ratio of putty with the catalyst. After one minute of mixing time, the putty is ready to use in order to create a mold. The results of VPI testing are outlined in Table 2, Chapter 9.
# Chapter 9

## RESULTS: CASTING & MOLD

Table 2  Three Different Mold and Cast Tests Performed on 4/10/15.

<table>
<thead>
<tr>
<th>Casting Material:</th>
<th>Method:</th>
<th>Other Materials Needed:</th>
<th>Test Results:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Po Yo Putty Series Part A</td>
<td>N/A</td>
<td>N/A</td>
<td>RULED OUT- needs a thirty minute curing time on the surface</td>
</tr>
<tr>
<td>ESPE Express STD, STD Firmer Set, Vinyl Polysiloxane Impression Material Putty Catalyst &amp; Base (VPI)</td>
<td>First consolidation was performed in the surrounding area addressing lifting lacquer with warm injected hide glue. The lacquered surface was soft enough and using water to soften the surface was not needed. Consolidated areas were clamped down for three days. The surface was protected with Mylar®. VPI was then used to make a cast of the surface. Both the base and catalyst were mixed for thirty seconds and the cast of the surface was created.</td>
<td>Mylar®, Plexiglas®, Silicone Release</td>
<td>4/10/15: TEST 1 The gap was traced with a sheet of Mylar® and then cut out, making an appropriate Mylar® protective covering for the surrounding lacquer. The VPI was mixed in a 1:1 ratio with the catalyst. After a minute of mixing time, the putty was pressed into the gap in order to make a positive of the gap. After it was firmly pressed down into the gap and on the surrounding Mylar®, a piece of Plexiglas® was used to apply pressure and smooth out the backside of the gap. The cast was set for one minute and was then pulled up revealing a successful cast. No residual VPI was left on the surface and no new damage was recorded. Once the positive was made, the VPI was then used to create the negative of the gap (for future infilling). Using the same method, the VPI was mixed in a 1:1 ratio with the</td>
</tr>
</tbody>
</table>
catalyst. Before making a mold of the positive cast, a small amount of silicone release (Vaseline) was used to coat the positive in order to help the two layers of VPI separate after the second mold was cast. After the silicone release and VPI were applied, an additional Plexiglas® layer was used creating a layered mold system of: Plexiglas®, positive, silicone release & Mylar® (which remained after the first test and helped with release) new VPI and Plexiglas®. The VPI was allowed to set for a minute and revealed a successful negative impression to use.

4/10/15: TEST 2
In order to create additional negatives to test with so that the initial lacquer object was only touched once, an additional cast was made of the positive, again using the silicone release and the presence of Mylar®. After the VPI set and was peeled off, the Mylar® no longer sat firmly against the VPI and ended up being more detrimental creating a less-clean result.

4/10/15: TEST 3
In order to ensure a successful cast of the positive, to create a good negative, the test was repeated without the Mylar®. The test proved extremely successful and provided an excellent mold.
Chapter 10

DISCUSSION: CASTING & MOLD

The ESPE Express, STD Firmer Set, Vinyl Polysiloxane Impression Material Putty Catalyst and Base (VPI) created a successful material to create both a positive and negative of the desired fill. Only requiring a one minute mixing time and range of one to five minute curing time, this material provides an efficient method significantly reducing the amount of time work is physically performed on the object without compromising the integrity of detail captured in the cast. Each of the three tests showed that Mylar® was not needed and its use ended up being more detrimental to the accuracy of the cast. Tests also suggested that the mold material did not appear to pose a threat to the varnished lacquer surface. When using this material, however, the “sandwich” system consisting of: Plexiglas®, the positive cast, VPI (aimed to create the negative cast), and Plexiglas®, allowed the creation of the negative cast to be accurate while creating a smooth backing (Figures 17 and 18). This would prove extremely helpful when testing fill materials as the mold can flatly lay on a surface in order to be used for testing.
Figure 17  Creation of the positive cast using the previous negative cast created. Plexiglas® is surrounding both the positive and negative cast in order to ensure an accurate fill and achieve a smooth back surface.

Figure 18  On left, positive created from TEST 1 on 4/10/15, and on right, the negative created from the positive. This negative was later used for fill material testing.
After a successful cast and mold material was identified, the next task was finding a suitable filling material that would effectively interact with both the mold material, VPI, and the lacquered surface. Before beginning my search for the best filling material it was imperative to establish criteria to match when looking at different materials: only using a nonpolar solvent (if necessary), eliminating the need for heat (lacquer can undergo thermochromatic change), ensuring the fills reversibility, having enough flexibility to account for fluctuations and movement in the wood, and achieving adequate hardness so that the fill will not break when popped out of the mold. I investigated prior literature about filling materials and procedures in order to find suitable filling candidates.

In Asia, lacquer is often conserved with the same material—therefore newly applied lacquer would be used to fill a loss. However, this practice conflicts with the Western ethical standards set by the American Institute of Conservation (AIC) Code of Ethics. Namely, being able to discern between the original material and that of the restoration. However, there are additional concerns with using the same medium to fill a loss—the first being that lacquer is an irreversible medium, and the second being that lacquer changes color over time, therefore a fill would not optically age at the same rate as the original.50

Wax restorations, a previously common fill material used by conservators, can also be problematic. In an article by Marianne Webb on “Methods and Materials for Filling Losses on Lacquered Objects,” she writes, “Once wax has been introduced to
the porous ground layers, the choice of subsequent treatments is severely limited. Any fill area where wax is used should be isolated with Paraloid B-72 before filling to ensure that the wax does not enter the ground layers.”

However, even with the use of an isolation layer or Paraloid B-72, wax fills themselves might not interact well with a lacquered surface containing any metal components. A case study conducted at the Royal Ontario Museum in 1984, examined infilling losses on a namban lacquer chest with a “combination of beeswax and carnauba with vine black pigment used.”

“The wax was first heated, pigment added, and then allowed to cool into colored wax blocks. A hot stylus for batik wax was used to melt the wax and guide the flow into the loss. [However,] beeswax corrodes copper therefore this formula could not be used near any metal fixtures, [additionally,] wax fills can bloom over time.”

In order to prevent blooming, polyvinyl alcohol (PVOH) was used to coat the surface. The case study concluded that the use of wax as a filling material should be eliminated as its causes difficulty inpainting, could initiate thermochromatic changes, and is not reversible.

Polyester resins, often used in glass conservation, have also been tested as an infilling material for lacquer; however, in a series of tests conducted in 1990, “pure polyester was too brittle for cutting to shape, and bulking materials that softened the final product made it opaque and pale in color so that it no longer matched the lacquer. It [was] also difficult to blend the fill with the surrounding lacquer without putting the lacquer in direct contact with the resin.”

Epoxy resins also represent a class of fill materials often used for lacquer conservation. A case study conducted by Melissa H. Carr and John M. Driggers in 1997, investigated the use of epoxy resins in lacquer loss compensation in which silicone molds were used and filled with tinted epoxy. Although irreversible, epoxy
resins could hypothetically be applied with a reversible adhesive. However, the epoxy fails in that it is not flexible enough to account for changes in wood fluctuations of the substrate.

The last common method that surfaced within prior filling literature was the use of polyvinyl alcohol and calcium carbonate in which “polyvinyl alcohol is dissolved in water to make a solution between 6% and 8%. Calcium carbonate is added to the mixture until it reaches a desired consistency and is applied with a spatula.”

After reviewing the literature on common lacquerware filling materials, I tested a variety of materials available in the Winterthur furniture conservation lab. Although as previously discussed, Modostuc was problematic as water was needed to remove excess Modostuc from the surrounding areas, with the mold and cast technique, Modostuc would no longer need to be applied directly to the surface. Additionally, if water was needed, it could be applied to any excess Modostuc left on the mold itself. As a result, I conducted several tests with Modostuc within the mold. Testing results for Modostuc tests, as well as all other filling material tests can be found in Table 3, Chapter 12. The next material I tested was Golden Black Gesso (Figure 19), which is part of a larger conglomerate of commercially available acrylic fillers.
Meg Loew Craft and Julie A. Solz conducted a study on commercial vinyl and acrylic fill materials. The purpose behind the study was to provide conservators with the same amount of information on these newly developed materials as is available for more traditional materials like varnishes and traditional fillers. Craft and Solz mention Golden Black Gesso stating:

“The Golden Acrylic Black Gesso has low viscosity, but not as low as Liquitex Black Gesso. It still will not hold sharp peaks or forms without additional support or additives. The filler dries faster than Liquitex Black Gesso. The fill is also rubbery and difficult to finish by sanding. A smooth surface can be obtained by wiping with acetone. Ghosting tends to be a problem, as the pigment size is very fine.”

Although Craft and Solz state that this material cannot hold its own form without additional support, with using this material in a mold, I would hopefully negate that observation allowing Golden Acrylic Black Gesso to be a viable material to test.

Following the use of Golden Acrylic Black Gesso, I tested bone black pigment in Lascaux medium for consolidation. Used in the Winterthur’s Furniture
Conservation Lab for wood consolidation, it was recommended by Mark Anderson after his successful use at bulking the medium with pigment (Figure 20).

I then experimented with a mixture of calcium carbonate, rabbit skin glue and ivory black pigment. The rabbit skin glue was a 1:8 ratio of glue to water mixture. I additionally created a gesso mixture with a significantly decreased water volume in order to bulk up the material more (Figure 21).

The last two materials I used to test were Kölner Insta-Clay and dental plaster. The dental plaster used was Kerr Lab Snow White #1, 31001 Natural, Plaster/Natural Set- Type II, White. I tested the Kölner Insta-Clay with no added water, a mixture of dental plaster with the Kölner Insta-Clay, calcium carbonate with the Kölner Insta-Clay, dental plaster alone, dental plaster with Golden Black Gesso, and dental plaster with bone black pigment (Figure 22). All filling materials were evaluated after being left for seven days to dry. Results from filling material tests can be found in Table 3, Table 4, and Table 5 in Chapter 12.
Figure 21  Applying a mixture of calcium carbonate, ivory black pigment, and rabbit skin glue.
Figure 22  Mixing dental plaster and bone black pigment.
Table 3  Filling Material Tests Conducted on 4/24/15.

<table>
<thead>
<tr>
<th>Filling Material:</th>
<th>Method:</th>
<th>Other Materials Used:</th>
<th>Test Results:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Epoxy</td>
<td>N/A</td>
<td>N/A</td>
<td><strong>RULED OUT</strong>. Epoxy is too stiff to account for wood fluctuations. Additionally it is difficult to level and inpaint.</td>
</tr>
<tr>
<td>Modostuc</td>
<td>Modostuc application in the same method used on the original conservation treatment of the shawl box. Modostuc was applied using a microspatula and a damp cotton swab in order to smooth out the surface. Layers were applied thinly in order to ensure adequate drying time in between.</td>
<td>DI water and cotton swabs</td>
<td><strong>TEST 1- 4/24/15</strong> Thinly applied layers did not work, as the Modostuc had nothing to adhere to resulting in cracking and considerable shrinking. <strong>TEST 2- 4/24/15</strong> When it was applied in a thicker layer, the results proved better, although large cracks were still present as it was unable to fully dry properly (Figure 23). <strong>TEST 3- 4/24/15</strong> Vaseline was used in the final Modostuc test to see if it would help the Modostuc adhere to the mold. Results proved that it did help but not enough. The fill still showed cracking.</td>
</tr>
<tr>
<td>Material Description</td>
<td>Details</td>
<td>Vessel/materials</td>
<td>Notes</td>
</tr>
<tr>
<td>----------------------</td>
<td>---------</td>
<td>-----------------</td>
<td>-------</td>
</tr>
<tr>
<td>Golden Black Gesso</td>
<td>Since Golden Black Gesso is a liquid, it needs to be shaken before opening. The gesso is then applied with a brush.</td>
<td>Brushes</td>
<td>TEST 4-4/24/15 The Golden Black Gesso produced a successful fill to use, but exhibited some shrinkage. This fill was later compared to other successful filling materials (Figure 23).</td>
</tr>
<tr>
<td>Bone black pigment in Lascaux medium for consolidation</td>
<td>A small amount, approx. 5 mL, of Lascaux medium for consolidation was pipetted onto a glass dish. A spatula was used to add bone black pigment to the medium for consolidation in order to create the desired consistency to create a thick black paste.</td>
<td>Glass dish, spatula, pipet</td>
<td>TEST 5-4/24/15 Test was conducted with Vaseline. Because the Golden Black Gesso is water based it was not able to adhere to the surface. This test resulted in a thick layer, but it shrank a considerable amount over time (Figure 29).</td>
</tr>
<tr>
<td>Mixture of calcium carbonate, rabbit skin glue, and ivory black pigment</td>
<td>Calcium carbonate was added until it was completely absorbed in the rabbit skin glue. Black pigment was then slowly added as well, alternating adding pigment and calcium carbonate to darken the material.</td>
<td>N/A</td>
<td>TEST 6-4/24/15 Ruled out- Lascaux medium had to be added slowly and several issues arose: the ratio of pigment to Lascaux was too large requiring an immense amount of pigment resulting in a granular paste that dried too quickly.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>TEST 7-4/24/15 Test proved extremely successful during application. The fill created a material that you can easily pour into the mold. It was extremely fast in production and did not need to be built up in slow, thin drying layers. One problem was identified: once dried, there were some bubbles-possibly due to the</td>
</tr>
</tbody>
</table>
pigment used and size of pigment particles. However, over a week period, the fill completely curled up.

**TEST 8- 4/24/15**
Calcium carbonate was applied with no rabbit skin glue component. Results showed that the fill completely cracked. However, after a week period, the fill completely curled up (Figure 24).

**TEST 9- 4/24/15**
Calcium carbonate was applied with no rabbit skin glue component, but applied in a thinner layer. Results showed that there were significantly less cracks, but the fill still lacked strength. However, after seven days, the fill completely curled up (Figure 24).

**TEST 10- 4/24/15**
Calcium carbonate was applied with two drops of rabbit skin glue. Results showed that cracking still persisted. However, after seven days, the fill completely curled up (Figure 24).
Table 4  Filling Material Tests Conducted on 5/8/15.

<table>
<thead>
<tr>
<th>Filling Material:</th>
<th>Method:</th>
<th>Other Materials Used:</th>
<th>Test Results:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kölner Insta-Clay</td>
<td>Used straight from the can, no added water needed. A spatula was used to help guide the liquid into the fill.</td>
<td>N/A</td>
<td>TEST 11- 5/8/15 Results proved that Kölner Insta-Clay provided a successful fill material; however, it was applied in too thin a layer and shrank considerably (Figure 23).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>TEST 12- 5/8/15 The Kölner Insta-Clay was applied in a thicker layer. Results proved that a thicker layer significantly reduced the amount of shrinkage (Figure 31).</td>
</tr>
<tr>
<td>Mixture of dental plaster and Kölner Insta-Clay</td>
<td>Dental plaster was added with a spatula in a 1:1 ratio to the liquid Kölner Insta-Clay.</td>
<td>N/A</td>
<td>TEST 13- 5/8/15 Dental plaster was mixed with Kölner Insta-Clay in order to see if this mixture would provide a more bulked up fill material and prevent shrinking. This mixture cracked considerably after drying (Figure 23).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>TEST 14- 5/8/15 Test was conducted with a higher ratio of Kölner Insta-Clay to dental plaster; however, the same outcome resulted (Figure 25).</td>
</tr>
<tr>
<td>Mixture of calcium carbonate with Kölner Insta-Clay</td>
<td>Calcium carbonate was was added with a spatula in a 1:1 ratio to the liquid Kölner Insta-Clay.</td>
<td>N/A</td>
<td>TEST 15- 5/8/15 Calcium carbonate was added to the Kölner Insta-Clay in an attempt to try and bulk up the fill and prevent shrinking. The results proved that this mixture was a successful viable option to use for a filling material (Figure 30).</td>
</tr>
</tbody>
</table>
TEST 16-19- 5/8/15
More tests were conducted in order to see the results of how successful multiple attempts at creating this mixture would be.

TEST 20 & 21- 5/8/15
A greater ratio of calcium carbonate to clay was used. Results showed a small increase in hardness, but no significant visible change.

| Dental plaster | Dental plaster was mixed with water and bone black pigment to reach a thick consistency. The mixture was then applied to the mold with a brush. | Water, bone black pigment, brush | TEST 22- 5/8/15
The result was a light gray fill- the material lightened upon drying. |
|----------------|----------------------------------------------------------------------------------------------------------------------------------|----------------------------------|---------------------------------------------------------------------|
| Mixture of dental plaster with Golden Black Gesso | Dental plaster was added to the Golden Black Gesso with a spatula in a 1:1 ratio. | N/A                             | TEST 23- 5/8/15
Charcoal pigment was used to see if changing the pigment would produce a darker color. The same result occurred (Figure 26). |
| Mixture of calcium carbonate with Golden Black Gesso | Calcium carbonate was added to the Golden Black Gesso with a spatula in a 1:1 ratio. | N/A                             | TEST 24- 5/8/15
Dental plaster was added to see if that could help bulk up the Golden Black Gesso. The fill resulted in significant cracking towards the middle (Figure 27). |
| Mixture of calcium carbonate with Golden Black Gesso | Calcium carbonate was added to the Golden Black Gesso with a spatula in a 1:1 ratio. | N/A                             | TEST 25- 5/8/15
Calcium carbonate was added to see if that could help bulk up the Golden Black Gesso. The fill resulted in significant cracking (Figure 28). |
Table 5  Filling Material Tests Conducted on 5/15/15.

<table>
<thead>
<tr>
<th>Filling Material:</th>
<th>Method:</th>
<th>Other Materials Used:</th>
<th>Test Results:</th>
</tr>
</thead>
</table>
| Kölner Insta-Clay | Used straight from the can, no added water needed, applied with a spatula. | N/A | TESTS 26-32-5/15/15  
Six additional tests solely using the Kölner-Insta clay were performed to provide ample fills to test finishing techniques on (burnishing, inpainting, etc.) (Figure 32). |

Figure 23  Test Result Images. From right to left: Dental plaster with Kölner Insta-Clay (TEST 13), Golden Black Gesso (TEST 4), Modostuc (TEST 2), and Kölner Insta-Clay (TEST 11).
Figure 24  Results from Filling Tests #8-10. Upper left: TEST 8, Upper right: TEST 9, Lower Right: TEST 10.

Figure 25  Results from TEST 14. Kölner Insta-Clay mixture with dental plaster.
Figure 26  Results from TEST 23. Mixture of dental plaster, water, and charcoal pigment.

Figure 27  Results from TEST 24. Mixture of dental plaster and Golden Black Gesso.
Figure 28  Results from TEST 25. Calcium carbonate mixed with Golden Black Gesso.

Figure 29  Results from TEST 5. Curled up Golden Black Gesso fill with Vaseline.
Figure 30  Results from TEST 15. Mixture of calcium carbonate and Kölner Insta-Clay.

Figure 31  Results from TEST 12. Thick layer of Kölner Insta-Clay.
Figure 32  Results from Tests 26-32. Kölner Insta-Clay.
Chapter 13

DISCUSSION: FILLING MATERIAL

After testing, the following filling materials were identified as the best given the selection criteria: Kölner Insta-Clay and a 1:1 ratio of the Kölner Insta-Clay with calcium carbonate (Figure 33). It is important to note that calcium carbonate was added to the latter in order to bulk up the material and prevent shrinkage. However, upon closer examination of the two fills side by side, it was clear that just using the Kölner Insta-Clay as a fill material proved much more suitable as fewer bubbles formed and the small amount of shrinkage that occurred proved to be an advantage when using it as a fill as it could be more easily placed and adhered to the loss. Additionally, having a fill that was not perfectly level with the surface and a little lower allows conservators and a viewer the ability to distinguish between original material and new material in raking light.

Figure 33  On left, mixture of Kölner Insta-Clay and calcium carbonate fill. On right, Kölner Insta-Clay fill.
Although the particular Kölner Insta-Clay fill shown (Figure 33) exhibited two small bubbles, no bubbles were created in the other nine tests performed with Kölner Insta-Clay. Before adhering the fill to the loss, it was first checked to ensure that it properly fit into the lacuna (Figure 34).

![Figure 34 Fill fit into area of loss. Test conducted on 7/3/15.](image)

Once the fill was determined to be successful, the next step was to select an adhesive. Paraloid B-72 in ethanol was selected due to its strength and hardness. Additionally, using Paraloid B-72 also eliminated the use of water in the event that the fill needed to be removed as Paraloid B-72 is soluble in acetone, ethanol, toluene, and xylene. However, during removal no solvent was needed. Mechanical removal with a scalpel would be the appropriate procedure as the adhesive chosen in a lower
concentration does not promote a strong enough bond to need removal via solvents. Paraloid B-72 was applied with a paintbrush to both the loss and back side of the fill (Figure 35). The fill was then clamped with a system of Mylar® (directly on top of the fill), foam (in order to account for the uneven surface and to ensure equal pressure throughout), and Plexiglas®.

Figure 35  *Placing Paraloid B-72 in the loss prior to fill placement.*

The fill was not affected by the amount of pressure placed upon it by the clamp system and exhibited no cracking. Additionally, the fill strongly adhered to the loss.
As the fill extended over the edge of the fill—during the creation of the fill when extra Kölner Insta-Clay was applied, the fill was easily shaped with a scalpel following its adhesion to the loss area (Figures 36 and 37).

Figure 36  Fill shaped with scalpel after adhesion to loss area.

Figure 37  Fill sculpted and adhered to the surface before any finishing techniques applied.
Chapter 14

DISCUSSION: FINISHING FILLS

Additional tests were conducted in order to create a fill that most closely matched the surface of the lacquerware. In order to replicate the sheen of lacquerware, tests were conducted with first burnishing the fill with a damp thick felt followed by inpainting with a mixture of Gamblin transparent earth brown and ivory black with Laropal A81 (Figure 38).

![Figure 38](image)

*Figure 38  Comparison of fill in mold with finishing techniques to dried Kölner Insta-Clay fills with no finishing techniques.*

However, as different finishing techniques produce different results, it was apparent after the fill was examined as part of the screen itself, that the Gamblin paints would not be the most ideal material to use to match the surface. In order to ensure the best visible matching, one could perform finishing of the fill or inpainting once the fill is adhered to the surface in order to get the most accurate visible match. However,
once a technique or certain materials are selected for finishing, all additional fills could have decorative techniques applied before being adhered to the loss. Additionally, in situations where the piece is not stable enough to do so, the fill can be inpainted before it is adhered.

When finishing the fill to match the sheen of the screen, the surface was first polished with thick felt. Then the fill was treated with an acrylic Wunda Gilding Size applied with a brush in areas where the gold decoration continued. The Wunda Gilding Size is commonly used in the Winterthur Furniture Conservation Lab. No other sizing materials were tested for decorative technique application. Once dried, mica powder was brushed on top in order to mimic the gold border. Following the application of mica powders, the entire fill received one thin coat of Larapol in order to intensify the shine without changing the color (Figures 39 and 40).
Figure 39  On the left, before conservation treatment image. On the right, after conservation treatment image.
Figure 40  Finished fill—toned, polished, and adhered to the area of loss.
Four additional fills were brought to completion with finishing techniques to confirm the reproducibility of the method (Figure 41). Three of the fills used the tested method—a thickly applied layer of Kölner Insta-Clay with Wunda Gilding Size, mica powders, and a final layer of Larapol. The fourth fill has a thin layer of Japanese tissue paper in between two thin layers of Kölner Insta-Clay. When making thinner fills, there were more noticeable cracks and often times the fills were too fragile to add finishing techniques to. With the Japanese tissue paper added, a thin fill was created that was strong enough to withstand finishing techniques. The use of Japanese tissue paper, however, would only be used with extremely thin and fragile fills that would need additional support. All of the four fills were experimented on with different colored mica powders in order to see which mica powder would match the color of the gold decoration on the surface best.

![Figure 41](image)

*Figure 41  Four additional fills created and brought to completion with finishing techniques.*
Chapter 15

CONCLUSION

A study of the history of Chinese export lacquerware pieces reveals a rich understanding of trade relations between countries and illustrates the impact of the arts on a revolving global economic and commercial network. Analysis and comparison of pieces from both the collection at the Winterthur Museum and Country Estate and the Peabody Essex Museum illustrates the vast effect of Chinese designs on American decorative arts. Each piece holds the history of the relationship between creator and buyer, making it vital that we conserve and protect these important objects.

Through the conservation treatment performed during the summer of 2014, of 1964.0084D, a Chinese export lacquerware shawl box, infilling materials were smoothed down with the application of small controlled amounts of water. Since in larger quantities, water poses a threat as an agent of deterioration, I aimed to eliminate the use of water through the creation of a mold and cast system focusing on the conservation of 2004.0030.002, a Chinese export lacquerware screen. Additionally, the intent of the mold and cast system was to reduce the amount of time the object was directly worked on.

Amongst extensive testing of materials, two materials proved the most effective and successful. Through the developed mold and cast system for conserving large losses on varnished Chinese export lacquerware, the amount of time an object is handled is significantly decreased, as well as water completely eliminated in the treatment process. Both materials identified: ESPE Express STD, STD Firmer Set, Vinyl Polysiloxane Impression Material Putty Catalyst & Base (VPI) and Kölner
Insta-Clay provide an extreme advantage, as well as an added efficiency. Depending on the stability of the varnished export lacquerware piece being conserved, finishing techniques can either be performed before the fill is adhered into the loss or after in order to ensure that the fill matches the look and luster of the lacquer surface.

Although both materials allowed for the development of a successful technique, further testing is imperative. This technique has not been evaluated for use on unvarnished surfaces and will need to be thoroughly tested before use to ensure that the ESPE Express STD, STD Firmer Set, Vinyl Polysiloxane Impression Material Putty Catalyst & Base will not damage or leave any residue on an unvarnished surface. Additionally, the technique has not been tested on losses that wrap around the surface of an object or fills that cannot lie flatly on a surface. However, due to the delicate nature of an unvarnished object, this mold and cast system should be tested and could prove extremely helpful to conservators who want to significantly reduce the amount of time the object is handled.

Additionally, this technique could not have been developed without the merging and communication between different fields in conservation. Through consultation of paintings, objects, and furniture conservators, these materials emerged out of a plethora of materials previously used in the conservation field. I believe that, if not these materials; the sole concept of using a mold and cast system to fill losses on a wide range of objects should be researched further to reduce the amount of time conservators have to handle a wide variety of delicate objects.

In conclusion, the use of a mold and cast system with ESPE Express STD, STD Firmer Set, Vinyl Polysiloxane Impression Material Putty Catalyst & Base (VPI) and Kölner Insta-Clay can be performed on varnished export Chinese lacquerware
pieces in order to infill larger losses on an object. Additionally, finishing techniques should either be performed once the fill is placed or while the fill is still in the mold. This mold and cast technique eliminates the need for water in conservation treatment, as well as reduces the handling time.
ENDNOTES


2 (Rivers, 5).

3 Ibid.

4 Ibid.

5 Ibid.


10 Ibid.


13 (The Metropolitan Museum of Art, 9).

15 (The Metropolitan Museum of Art, 13).


17 Dawn Jacobson defines Chinoiserie as “a wholly European style whose inspiration in entirely oriental.” As much of the East viewed Asia as exotic and imaginative, European artists desired to imitate Asian arts. Since many Asian materials were not available in Europe, the term “japanners” was coined to describe European artists who produced Asian-like designs and objects. With the dawn of 18th c. Rococo style, Chinoiserie became engrained in fashion, furnishing designs, and landscapes. (Jacobson, Dawn. *Chinoiserie.* London: Phaidon, 1993.)


19 (The Metropolitan Museum of Art, 9).

20 Japanning was achieved by using resin varnishes and oils.


22 Ibid.

23 Ibid.

24 Ibid.

25 (Webb, 38).

26 (Webb, 40).

27 (Webb, 60).


29 (Webb, 30).

30 (Webb, 60).
31 (Webb, 54).

32 Lux is a measurement of light. A lux measures the luminous flux per area.

33 Ibid.

34 (Webb, 57).

35 (Webb, 64).


37 Ibid.

38 WUDPAC alumna.

39 Associate Scientist and Affiliated Assistant Professor at Winterthur Museum and Country Estate.

40 Portuguese lacquer conservator and current PSP Ph.D. candidate at Winterthur Museum and Country Estate.

41 Bole is used to help adhere gold to a surface. As bole is a mixture of clay and animal skin glue, the glue is reactivated with water before the gold is laid onto a surface allowing the gold to be securely fixed down. The bole also provides a warm tone to the gold.

42 Modostuc is a commercially available fill material that is made of a calcium carbonate filler with PVA binder. It is soluble in water, ethyl alcohol, or acetone.

43 Assistant Professor at the University of Delaware.


45 Ibid.

46 Ibid.

47 Amounts given in % weight provided by manufacturer Smooth-On Inc.: Polyorganosiloxanes (65-70), Mineral Oil (5-10), Silica, Amorphous (15-20), Silica, Crystalline (5-10).
(http://www.sculpt.com/technotes/MSDS/MSDS_POYO_PUTTY.pdf)
Amounts given in % by weight provided by manufacturer Patterson Dental: Limestone (20-40), Quartz Silica (30-40), Vinyl polydimethylsiloxane (10-25), white mineral oil (petroleum) (5-15). (https://www.pattersondental.com/Sds?publicItemNumber=075013990&effectiveDate=2008-01-03T00:00:00)


Ibid.

Ibid.

Ibid.

Ibid.


Ibid.
According to its Material Safety Data Sheet (MSDS), Lascaux medium for consolidation is a “finely dispersed aqueous dispersion of acrylic copolymers based on acrylate ester, styrene, and methacrylate ester.”

Head Furniture Conservator and Affiliated Assistant Professor at Winterthur Museum and Country Estate.

Kölner Insta-Clay’s main ingredients are: styrene acrylic polymer, calcium carbonate, carbon black, and water. Not much is published on the use of this material within the field of conservation. However, during discussions with the producer of the material and conservator Olaf Unsoeld, he stated that no aging tests have been conducted and the material is estimated to last under twenty years but shows no sign of visible deterioration. In the application of Kölner Insta-Clay as a filling material, Unsoeld stated that fills with great depth could exhibit cracking; however, more tests need to be conducted.

Amounts given in % by weight by Kerr Dental: calcium sulfate (60-100), limestone (1-5), cement (1-5), calcium dihydroxide (1-5), gypsum (1-5), starch (1-5). (https://www.kerrdental.com/resource-center?search=gypsum)
REFERENCES


