

Japanese lacquer bottles from the Schönbrunn Palace Examination – Preservation – Presentation

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Abstract | The Japanese lacquer bottles presented in the “Chinese Oval Cabinet” are a valuable example of Japanese art in Europe. This paper focuses on the conservation of these ten vessels, dating back to the 17th century. It was written as part of a research project about the “East Asian Cabinets” of the Schönbrunn Palace in Vienna. A study of East Asian lacquer techniques in general as well as a detailed investigation of the objects’ construction and decoration techniques preceded the evaluation of the damage. The bottles have been partially stained with an adhesive. Furthermore, they have been damaged by UV-light, which results in increased vulnerability of the lacquer layers. Therefore, the choice of suitable methods for cleaning the bottles and removing the staining was limited. A series of tests helped in choosing an adhesive for the consolidation of the flaking lacquer and metal sheets. Lastly, a guideline for presenting and handling the bottles was established to ensure their long-lasting preservation.

Japonské lakované láhve z paláce Schönbrunn Průzkum – Záchrana – Prezentace

Abstrakt | Japonské lakované láhve vystavené v „Čínském oválném kabinetu“ patří k cenným příkladům japonského umění v Evropě. Tento článek, který se zaměřuje na restaurování deseti takových nádob pocházejících ze 17. století, byl napsán v rámci výzkumného projektu, věnujícího se „východoasijským kabinetům“ Schönbrunnského paláce ve Vídni. Dříve než byl vyhodnocen stav dochování a míra poškození láhví, byly prostudovány východoasijské techniky laku a byl proveden podrobný průzkum konstrukce a výzdoby objektů. Láhve byly znečištěny skvrnami od adhesiv a nesly poškození způsobená UV zářením, které zvýšilo křehkost lakových vrstev. Z tohoto důvodu byl omezen výběr vhodných způsobů čištění a odstranění skvrn. Konsolidant vhodný ke zpevnění laku a kovových plátek byl vybrán na základě rozsáhlých zkoušek. Na konci zásahu byly sestaveny pokyny pro bezpečné zacházení s láhvemi a podmínky pro jejich vystavování.

Introduction

The ten lacquer bottles date back to the early 17th century and were produced in the so-called “Edo-period” between 1615 and 1868 AD.¹ Japanese lacquer or urushi has a long history and has been used in Japan from 7000 BC up to this day.²

The bottles have a square shape and round shoulders, with a round nozzle on top. The objects are similarly decorated, depicting landscapes and plants alternating on their four faces. One can find geometrical designs bordering these scenes and on the bottle’s top. Their shape follows the tradition of a schnapps bottle.³ Nevertheless, it is believed that they have never been used in that way, due to being regarded as an art object.

There are two Asian cabinets in Schloss Schönbrunn, the so-called “Chinesische Kabinette”. The research project about the “East Asian Cabinets” of the Schönbrunn Palace focuses on the conservation and historical investigation of the rooms and its interior. They host numerous pieces of Chinese, Japanese and European porcelain. The cabinets have wooden wall panelling. The Japanese lacquer bottles as well as the porcelain objects are placed on wooden consoles. These are fixed to the wall at a height of several meters. Next to them, visitors can see Chinese, Japanese and European lacquer panels, incorporated in gilded framing on different levels (figure 1).

The bottles depict landscapes on two faces and ensembles of bushes, flowers and grasses on the other two faces (figure 2). These pictures, just as the repetitive patterns surrounding them, are created by applying metal powders through different techniques. The landscapes are generally composed of a scenic view of hills, pavilions and trees on a waterfront. Some of the bottles show distant mountains, or waterfalls in the background. The other two faces carry plants on them representing different seasons of the year.

As mentioned earlier, the bottles are shaped as hard-liquor bottles. This type of vessel has been designed specifically for export and was also realised in porcelain.⁴ Supply and demand between western countries and Japan led to a mutual influence. The bottles reached Europe presumably along maritime routes. After initially welcoming strangers, Japan soon closed its borders. For a long time the Netherlands was the only European country allowed to trade goods with the insular state. Lacquer became a highly valued and expensive item of goods. It came into fashion to establish lacquer cabinets in grand residences. Schönbrunn hosts three cabinets demonstrating lacquer objects. Due to limited trading and its elaborate production, lacquerware became more and more expensive.⁵ This led to attempts to imitate lacquerware in Europe with local materials and techniques, known as “Japanning”.



Figure 1 The bottle's position in the “Oval Chinese Cabinet”. © Schloß Schönbrunn Kultur- und Betriebsges.m.b.H. / Bildarchiv des Bundesdenkmalamtes, BDA; Sammlung Bundesmobilienvverwaltung.



Figure 2 Side view of one of the ten bottles. © Schloß Schönbrunn Kultur- und Betriebsges.m.b.H. / Stefan Olah, Institut für Konservierung und Restaurierung; Sammlung Bundesmobilienvverwaltung.

Material and investigation

Urushi

There are three different kinds of oriental lacquer, which all have different properties. Urushi, previously termed lacquer, is the sap of the urushi tree "Toxicodendron vernicifluum", which is cultivated mainly in Japan, China and Korea.⁶ The raw sap is collected and filtered before it is ready for use. It can also be further refined for example by driving off excess water through heat and by adding pigments.⁷ Raw lacquer is toxic and can lead to severe allergic reactions. Once dried, it becomes harmless and is even extensively used on tableware. The lacquer can be applied on various substrates like wood, textile, porcelain, metal and many others.

The hardening of Urushi follows a two-step process. The sap cures through oxidation and auto-oxidation of its components (mainly urushiol monomers, glycoproteins, polysaccharides, laccase and water), which leads to polymerisation and cross-linking of these monomers.⁸ It is therefore different from lacquer varnishes in Europe that dry through the evaporation of solvents. To fully enable the process of curing, the material needs thermal settings of 20 °C and approximately 80 % relative humidity for a period of 10 to 24 hours.⁹ The lacquer forms a strong and hard polishable surface and is initially resistant to humidity, acids and alkalis.¹⁰

General construction

The bottles consist of a wooden substrate, covered with oriental lacquer. Figure 3 shows the construction of the bottle. Four side panels (yellow, transparent, orange and green), one at the bottom (grey) and another one to close the top of the vessel (blue) form the body.

Urushi is typically applied in many layers and follows a traditional scheme that starts by isolating the substrate. It is not possible to determine, if it was carried out on the bottles. To investigate the composition of the layers, three samples have been taken and prepared as cross-sections (figure 4).

The wooden body carries two foundation layers. Analysis performed by scanning electron microscopy showed a composition of feldspar, quartz and iron oxide particles, bound with a mixture of urushi, animal glue and, possibly, drying oils. Lacquerware traditionally carries a foundation made of burnt and raw earthen particles in varying degrees of fineness bound with raw lacquer. Being an expensive substance, it is sometimes substituted with animal glues and other binding media.¹¹

Two layers of lacquer follow the foundation. Pyro-Gc-MS analysis showed the presence of urushi, camphor, cedar oil, benzoin resin and soot.¹² To

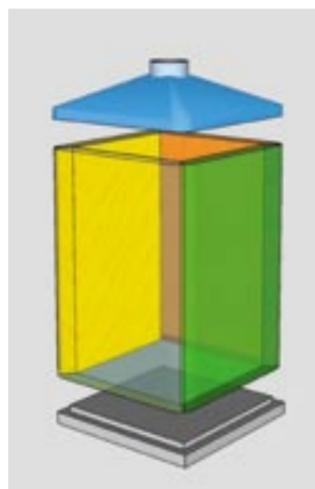


Figure 3 Model of the bottles' construction with four side panels (yellow, transparent, green and orange), a top panel (blue) and a bottom panel (grey).



Figure 4 Cross-section of the lacquer layer with two foundation layers (red and violet) and two lacquer layers (green and blue). © Schloß Schönbrunn Kultur- und Betriebsges.m.b.H. / Tanja Bayerová, Institut für Konservierung und Restaurierung; Sammlung Bundesmobilenverwaltung.



Figure 5 X-ray image of the bottle with outlet reaching into the vessel. © Schloß Schönbrunn Kultur- und Betriebsges.m.b.H. / Agnes Szökrön-Michl, Institut für Konservierung und Restaurierung; Sammlung Bundesmobilenverwaltung.



Figure 6 Example of the Hira-makie technique on leaves and flowers. © Schloß Schönbrunn Kultur- und Betriebsges.m.b.H. / Stefan Olah, Institut für Konservierung und Restaurierung; Sammlung Bundesmobilenverwaltung.



Figure 7 Example of the Taka-makie (rock formation), Kirikane (framed red) and Togidashi (framed blue). © Schloß Schönbrunn Kultur- und Betriebsges.m.b.H. / Stefan Olah, Institut für Konservierung und Restaurierung; Sammlung Bundesmobilenverwaltung.

obtain a smooth and reflective surface, artisans grind and polish each layer, starting from the foundation layers to the lacquer layers. This is a very elaborate process, which takes a lot of patience and time. The Japanese tradition for manufacturing lacquerware has provided a labour division for different tasks, such as the preparation of the substrate, the application and grinding of the foundation layers, and the application of the finishing lacquer layers. Finally, artists carry out the final decoration with metal powders and sheets, eggshells and pearl inlays and other techniques.¹³

The vessel's nozzle and its top consist mainly of copper, partially covered with silver. X-ray images show that the copper nozzle reaches inside the bottle (figure 5). Seven of the tops have been lost. The rest depicts a chrysanthemum, an ornamental flower, with multiple rows of petals.

Decoration techniques

There are multiple possibilities to decorate lacquerware amongst which one can find different inlays, carvings, or the application of metal sheets. Most decoration techniques are carried out on the already polished surface. "Makie" or "Maki-e" is the Japanese term for the decoration with sprinkled metal powders. These powders can be differentiated through coarseness, shape of their particles, and alloys. Considering its long-term stability, gold is the most commonly applied metal for this purpose. Other metals and alloys can create a contrast to the gold and are used for their colour-changing characteristics. Therefore, oxidised decoration should not always be categorised as damage.

One can find a number of decorating techniques on the ten lacquer bottles of the Chinese Cabinet in Schloss Schönbrunn. Three of them are different realizations of Makie, the most common one is "Hira-makie".

Hira-makie

Hira-makie is the Japanese term for "flat sprinkled picture". In this technique, the artist traces the outlines of a pattern with urushi. While it is still wet and tacky, he sprinkles metal powder on top, which adheres to the freshly painted lacquer. For this step, silver particles are used on the bottles. After curing, the area in between the outlines is filled with urushi and gold powder is applied. The gold particles of these Hira-makie designs are very fine and have a round shape. After finishing and drying the motif, multiple layers of lacquer are applied on top to protect the underlying gold decoration. It can be found on the ornaments on the top and on the edges of the bottles, as well as in the pictorial motifs (figure 6).

Taka-makie

This decoration is similar to Hira-makie, but forms a noticeable relief. There are several ways to build a raised surface, the easiest being a mixture of fine earthen powder and Urushi. More elaborate and more stable are the ones built up of multiple lacquer layers. This sort of decoration exists in the form of rock formations (see figure 7).

Tsukegaki

Tsukegaki describes fine lines often applied on top of Hira-makie or Taka-makie design to enable further explicitness of the motives. The process is the same as in Hira-makie. On the bottles, this technique is used in detailing flowers and bushes as well as for shingles on buildings and butterflies (figure 8).

Kirikane

Kirikane can be found on top of the Taka-makie rock formations. The term refers to the square pieces of metal foil – gold and tin in this case – applied onto the relief (figure 7).



Figure 8 Example of Tsukegaki as lines on the butterfly's wings. © Schloß Schönbrunn Kultur- und Betriebsges.m.b.H. / Stefan Olah, Institut für Konservierung und Restaurierung; Sammlung Bundesmobilenverwaltung.

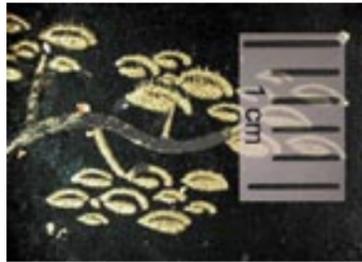


Figure 9 Close-up of dense gold distribution of a Hira-makie design. © Schloß Schönbrunn Kultur- und Betriebsges.m.b.H. / Silvia Miklin-Kniefacz, Institut für Konservierung und Restaurierung; Sammlung Bundesmobilenverwaltung.

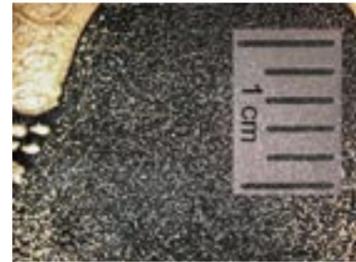


Figure 10 Close-up of loose gold distribution of a Togidashi design. © Schloß Schönbrunn Kultur- und Betriebsges.m.b.H. / Silvia Miklin-Kniefacz, Institut für Konservierung und Restaurierung; Sammlung Bundesmobilenverwaltung.

Togidashi

Similar to other Makie techniques, in case of Togidashi metal powders are applied onto wet urushi. The difference is that the particles are embedded in multiple layers of lacquer and are polished afterwards. It therefore resembles an inlay technique. The metal particles in use are slightly coarser so they do not get lost in the process of polishing. Their distribution is not as dense as in the Hira-makie and Taka-makie technique which often achieves a smooth blending (compare figure 9 with figure 10). It is applied mostly on distant mountain peaks and on the riverside depictions.

Damage protocol

Considering their age and long journey to Schönbrunn Palace, the bottles' condition seem to be rather good. Nevertheless, they carry a significant amount of minor and more serious damage, which should be taken care of to ensure a long-term preservation. Furthermore, we encounter typical damage that is due to the specific aging and deteriorating of lacquerware.

Photodegradation

Centuries and decades of exposure to sunlight have led to photo-oxidation of the lacquer surface. The short wave ultraviolet radiation causes the greatest harm. Newly fabricated and well-kept lacquerware has a deep gloss. It shows great stability against climatic changes, acids, alkalis and humidity. After aging and exposure to light, lacquer loses its favourable characteristics and becomes more and more sensitive to impacts such as handling and manipulation. Lacquerware also becomes vulnerable to polar substances. This is an important fact in choosing the right methods for conservation.

Light-damaged objects are easily recognizable by their dull surface (compare figure 11 and 12). This effect of matting is due to the formation of micro-cracks in the top layers (figure 13). Ultraviolet radiation attacks the chemical bonds that lacquer forms during curing. The cohesion of the layer diminishes and it can lead to a loss of lacquer particles. Radiation splits these bonds which results in splitting of the chains and the forming of fission products. These products are largely polar and include ketones and carboxylic acids. They lead to the formation of an acidic lacquer surface.¹⁴ Due to these circumstances, the surface attracts water and dirt. It reacts hygroscopically and displays an affinity to integrate polar solvents and water molecules in its structure. This leads to swelling and furthermore, to cracking and flaking of lacquer layers.¹⁵

Adhesive staining

Besides dirt and dust accumulation on the objects' surface, they also display widespread adhesive staining. Those spots are clearly visible in ultraviolet light (figure 14 and 15). They occur incoherently and mostly in the form of fingerprints and do not fulfil any purpose. Therefore, it is assumed, that someone working with adhesive touched the objects without intending to stain them (figure 16). Analysis by FTIR (Fourier transform infrared spectroscopy) revealed a composition of resin and wax, which could be interpreted as beeswax or Japan wax.¹⁶

Not only do these stains tarnish the bottles' optical appearance, they prevent an even aging of the surface. They may also damage the underlying lacquer as they might develop inner tension and become less soluble over the time. Therefore, it was decided to remove the staining. In this process, stickers with inventory numbers on the bottom of the bottles were removed as well.



Figure 11 Highly reflecting lacquer surface that is not photodegraded. © Schloß Schönbrunn Kultur- und Betriebsges.m.b.H. / Stefan Olah, Institut für Konservierung und Restaurierung; Sammlung Bundesmobilenverwaltung.



Figure 12 Dull photodegraded lacquer surface. © Schloß Schönbrunn Kultur- und Betriebsges.m.b.H. / Stefan Olah, Institut für Konservierung und Restaurierung; Sammlung Bundesmobilenverwaltung.



Figure 13 Close-up of micro-cracks on the lacquer surface. © Schloß Schönbrunn Kultur- und Betriebsges.m.b.H. / Silvia Miklin-Kniefacz, Institut für Konservierung und Restaurierung; Sammlung Bundesmobilenverwaltung.



Figure 16 Detail of adhesive staining on the bottles' surface. © Schloß Schönbrunn Kultur- und Betriebsges.m.b.H. / Amélie Bézard, Institut für Konservierung und Restaurierung; Sammlung Bundesmobilenverwaltung.



Figure 14 Side-view in normal light. © Schloß Schönbrunn Kultur- und Betriebsges.m.b.H. / Stefan Olah, Institut für Konservierung und Restaurierung; Sammlung Bundesmobilenverwaltung.



Figure 15 Side-view in ultraviolet light that clearly shows the adhesive staining. © Schloß Schönbrunn Kultur- und Betriebsges.m.b.H. / Stefan Olah, Institut für Konservierung und Restaurierung; Sammlung Bundesmobilenverwaltung.

Flaking of lacquer layers

More profound damage includes scratches, dents and deformation of the lacquer layer, such as flaking, the formation of bubbles and even losses. When encountering marked changes in relative humidity and climate, wood has the affinity to expand and contract more than lacquer, which is more rigid. This may lead to the formation of cracks and disengagement of the layers through flaking and the formation of bubbles.

Decoration damage

The weakening of the lacquer layers and the resulting loss of lacquer particles endangers the bottles' decoration. As their cohesion is diminished, golden particles can be easily abraded.

Aged lacquer layers also permit oxygen to penetrate through to underlying layers and to metal designs. Therefore, decoration with non-precious metals starts oxidising. The formation of grey and green corrosion products starts and leads to a different appearance. This effect is desired in some cases, but can be considered damage in other cases (see figure 17 for a close-up).

As mentioned earlier, silver was used for the underdrawings on the bottles' scenes. On many motifs, silver corrosion products made their way to the surface and cover the overlying golden layer (figure 18).

In addition, the metal parts of the bottle, the nozzle and the bottle top, show green corrosion products. Furthermore, only three of the tops still exist.

Historical interventions

Additionally, two kinds of historical interventions should be mentioned. The first one concerns large historical inventory numbers applied to the faces of the bottles. But as they represent a part of the bottles and the Cabinet's history – the whole inventory carries these markings – they will not be removed from the surfaces.

The second historical intervention affects the bottles' bottoms. A large hole (\varnothing 1 cm) had been drilled into each bottle (figure 19). It was intended to ensure the objects' stability on the wooden consoles, which carry a long metal pin on their platform. The bottles are put over this pin, which extends into the vessels.

Goal of the conservation

The goal of the conservation was the preservation of the ten bottles in their current state. It aimed to attain a clean appearance and to prevent further damage. Therefore, these precious objects needed a concept for further presentation and handling.

The main topic was the cleaning of the bottles. The objects should be freed from dust and dirt accumulations, as well as from the adhesive staining. To prevent dust falling into the bottles through the nozzles without bottle tops, seven replicas needed to be fabricated.

The second issue concerned the damage of the lacquer surface, its flaking and the fragile gold decorations that were at risk of getting lost. Mainly some Kirikane sheets, whose borders started detaching from the lacquer layer, are endangered.

Another point was the presentation of the bottles. The overall concept aims to show all the historical objects in the Schönbrunn palace in their initial position, that is to say, on wooden consoles mounted on the wall of the cabinets. These presentation elements have a platform that is more or less inclined. To ensure that the objects are stable once mounted, a solution for the compensation of this incline was required.

Lastly, a guideline for the care and handling of the bottles needed to be worked out.

Concept of the conservation

The approach to the conservation and restoration of lacquerware in Japan and in western countries is different to some extent. The claim for reversibility is often secondary for Japanese restorers. It is important to them to use original lacquer techniques, which mostly include the use of urushi. This is both an irreversible process and a very delicate procedure that requires the necessary expertise and experience of working with lacquer. This report therefore tries to find a reversible approach without the use of Urushi.

Cleaning

Lacquer surfaces alter their properties during aging as has already been described above. One of the most crucial alterations is the heightened sensitivity to polar substances. It can vary from object to object and depends on the degree of photo-oxidation. It is imperative to carry out spot tests to define the specific reactions. Rash use of solvents can lead to discolouring, bleaching, swelling or even dissolution of lacquer.

Due to this fact, conservators start cleaning approaches by using non-polar solvents and slowly move to more polar ones.¹⁷ Hence, white spirit was chosen to start the experiments. Additionally, ten mixtures of a non-polar and polar solvent (isooctane and ethanol 10:1 to 1:1) in descending proportions have been tested. In this way, the smallest amount of polar solvent (ethanol) needed to solve dirt, could be determined. In addition, it allowed the dissolution of various kinds of dirt, whose solubility range is unknown.



Figure 17 Corrosion products silver underdrawings overgrowing the golden decoration. © Schloß Schönbrunn Kultur- und Betriebsges.m.b.H. / Silvia Miklin-Kniefacz, Institut für Konservierung und Restaurierung; Sammlung Bundesmobilienvverwaltung.



Figure 18 Detail of corroding silver underdrawings. © Schloß Schönbrunn Kultur- und Betriebsges.m.b.H. / Stefan Olah, Institut für Konservierung und Restaurierung; Sammlung Bundesmobilienvverwaltung.



Figure 19 Bottom side of a bottle with drilling hole, bubbles in the lacquer layer and sticker with inventory numbers. © Schloß Schönbrunn Kultur- und Betriebsges.m.b.H. / Stefan Olah, Institut für Konservierung und Restaurierung; Sammlung Bundesmobilienvverwaltung.

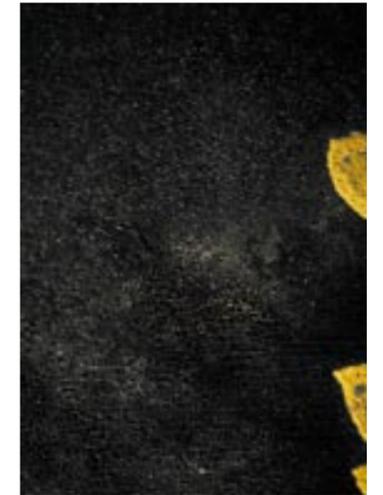


Figure 20 Bleaching of the lacquer surface caused by solvents. © Schloß Schönbrunn Kultur- und Betriebsges.m.b.H. / Amélie Bé-zard, Institut für Konservierung und Restaurierung; Sammlung Bundesmobilienvverwaltung.

Water has a long tradition as a cleaning agent for lacquer. As with other polar solvents, it should be used with caution. Because it often achieves outstanding results,¹⁸ it is included in the series of tests, as is ethanol and acetone, which has the advantage of evaporating quickly and thereby limiting the time of exposure.¹⁹

The mentioned solvents and mixtures have been tested and investigated on inconspicuous spots on one of the bottles' edges. Through optical inspection, photo-documentation and examination of the used cotton swabs, the author attained the following results. White spirit, as well as most of the mixtures (isooctane: ethanol, 10:1 to 2:1) lead to bleaching of the lacquer and had negligible cleaning effects. The mixture of 1:1 isooctane to ethanol however, produced good results. So did water, acetone and ethanol, even though a slight dissolution of lacquer was the consequence.

According to the test results, 1:1 isooctane and ethanol were chosen for cleaning the bottles, but ultimately, mostly ethanol was used, as the mixture lead to bleaching (Figure 20).

The adhesive staining disrupts the optical appearance and prohibits even aging. It may create tensions on the surface and emit harming substances. Due to these facts, it was decided, not to retain it on the objects. The adhesive consists of resin (soluble in polar solvents) and wax (soluble in non-polar solvents).²⁰ For removing the staining,

the same procedure of testing solvents and solvent mixtures was applied. The different solvents were tested on the bottles edges contaminated with adhesive. Through optical inspection, photo-documentation and comparison under ultraviolet-light, the following results were achieved. Most of the mixtures (isooctane: ethanol, 10:1 to 2:1) lead to smearing of the adhesive and had a rather low impact on removing it. The concentration of 1:1 isooctane to ethanol, and ethanol alone however, lead to good results. Relatively good results were attained with white spirit and acetone. Therefore, 1:1 isooctane to ethanol and mere ethanol were chosen for removing the adhesive. As with the cleaning, the mixture lead to undesired results and mostly ethanol was used. Images with ultraviolet light, (figure 21 and 22, before and after adhesive removal) show that it was possible to fully remove all of the staining.

Consolidation

Flaking lacquer layers as well as loose metal leafs (Kirikane) could be noticed. There are different types of separation, one in the zone between the lacquer layer and the foundation layer, another one between the foundation layer and the wooden structure and the last one between the Kirikane and lacquer. Hence, these three different types of flaking should be kept in mind when choosing a consolidation medium. To find a medium that can be applied for the different situations, desirable properties



Figure 21 A bottle before removing the adhesive staining under ultraviolet light. © Schloß Schönbrunn Kultur- und Betriebsges.m.b.H. / Stefan Olah, Institut für Konservierung und Restaurierung; Sammlung Bundesmobilienvverwaltung.



Figure 22 A bottle after removing the adhesive staining under ultraviolet light. © Schloß Schönbrunn Kultur- und Betriebsges.m.b.H. / Stefan Olah, Institut für Konservierung und Restaurierung; Sammlung Bundesmobilienvverwaltung.

were formulated. They include good penetration, adhesion strength and, as lacquer layers are quite rigid, elasticity for being able to move with eventual expansions and contractions of the body, and good aging properties, as well as reversibility.

As lacquer might react sensitively to polar substances, adhesives dissolved in non-polar solvents were included in the choice. Paraloid B 67 was chosen, as it dissolves in white spirit and has good aging characteristics.²¹ Other consolidation media that are in use for lacquer conservation are animal glues, Paraloid B72 and Lascaux Medium for Consolidation. They were also included in the series of experiments.

A traditionally used Japanese adhesive is a mixture of urushi with wheat starch or wheat flour, called Mugi-urushi.²² It has excellent bonding performance and the conservator uses the same materials as in the object. For comparative reasons, it was tested as well.

A series of experiments should detect the most suitable consolidation medium amongst this selection. As the detachment of lacquer and Kirikane occurred in three different zones, three test boards have been produced: at first an isolation layer with urushi was applied on wood, followed by two foundation layers with Tonoko (powdered clay) and urushi. Two boards were then again isolated with urushi, and on one of them, a black lacquer layer was applied on top. In addition, lacquer films were fabricated to imitate flaking lacquer and tin and gold sheets were cut to imitate Kirikane (figure 23).

The selection of seven different consolidation media in different concentrations have been tested on each test board. After several days of weighting down, some of them did not adhere well, wrinkled and formed bubbles. Amongst the best results were sturgeon glue for the consolidation of lacquer and Paraloid B72 in acetone and ethanol (1:1) for the consolidation of Kirikane.

Two other topics will be mentioned only briefly. The first one refers to the reduction of corrosion products on the bottles' metal elements, which were

removed with glass fibre pens and a scalpel. The second topic is the replication of the missing bottle tops. They were copied in brass, using the centrifugal casting technique.

Exhibition parameters

As previously mentioned, the bottles will be placed on the consoles in the Oval Chinese Cabinet after conservation. They stand free, held only by the metal pin sticking out of the consoles' platform. To compensate the platforms' inclination, a wedge could fit in between the console and the objects (figure 24, green wedge). Plexiglas would be a discreet material for this purpose.

Turning towards climate conditions, one has to define the storage and exhibition parameters. Unfavourable settings of relative humidity and temperature can accelerate the lacquer decay and lead to the formation of cracks, micro-cracks and flaking of the lacquer layers.²³ Optimal conditions for keeping lacquerware are set at 55–60 % relative humidity and 20 °Celsius.²⁴

However, these demands are hard to implement in historical buildings. Therefore, experts working on lacquer have defined a relative humidity range of 45–60 % and a temperature of 18–25 °Celsius as acceptable for historical exhibition buildings.²⁵ The Schönbrunn Palace has taken measures to achieve similar results. The cabinet is oriented towards the southwest. The window shutters are permanently closed, which prevents sunlight from shining onto the objects and increasing the room's temperature. Moreover, a glass barrier has been built at the cabinet's entry to prevent tourists from entering and to stabilize the climate. Additionally the palace revived already existing ventilation systems that regulate air exchange.²⁶

Schönbrunn has a cleaning initiative once a year, where restorers and custodial staff clean the palace's inventory. It was determined, that the bottles should be carefully cleaned by brushing the dust off their surface with a soft brush.



Figure 23 Test boards for defining a suitable consolidation medium, with lacquer on foundation (right), lacquer on foundation with isolation of the foundation (middle) and Kirikane on a finished lacquer surface (left). © Schloß Schönbrunn Kultur- und Betriebsges.m.b.H. / Silvia Miklin-Kniefacz, Institut für Konservierung und Restaurierung; Sammlung Bundesmobilienvverwaltung.

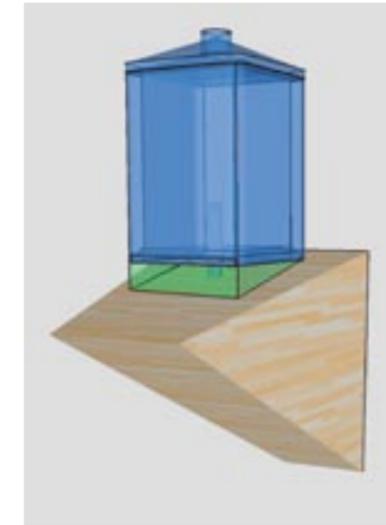


Figure 24 Model of a wedge (green) compensating the platform's inclination.

FOOTNOTES

- 1 | Hibi, S., Niwa, M., Snow, Wave, Pine. Traditional Patterns in Japanese Design, Tokyo – New York – London 2001, p. 186.
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