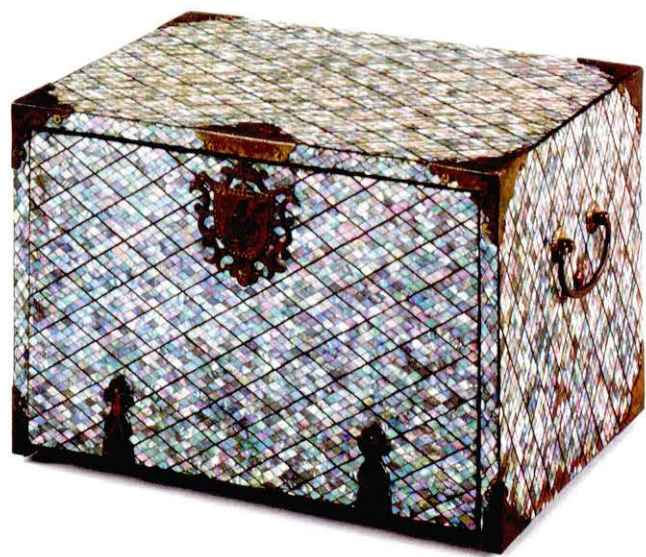




a 修復前  
Before restoration

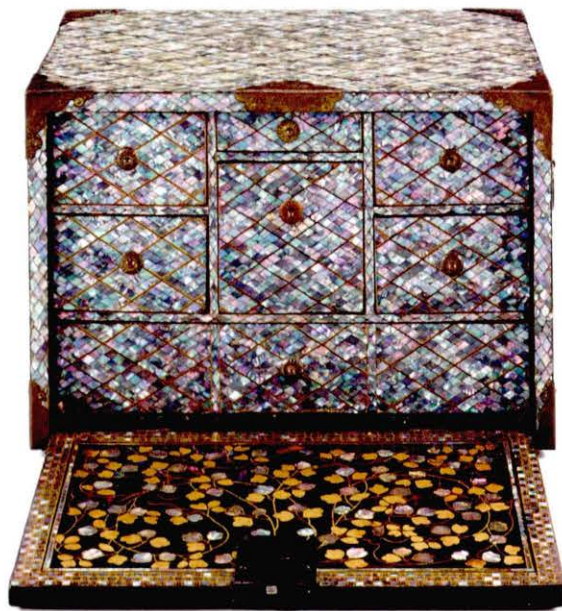


b 修復後  
After restoration

C5.1 菱絜文螺鈿箱筒  
*Cabinet with Lozenge Design*



a 修復前  
Before restoration



b 修復後  
After restoration

C5.2 菱繫文螺鈿單笥 —引出—  
*Cabinet with Lozenge Design, drawer*

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## 5. 菱繫文螺鈿箆笥

### 5. *Cabinet with Lozenge Design*

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国立ナープルステク博物館（チェコ共和国）所蔵  
Náprestek Museum, National Museum, Prague (Czech Republic)

## 5.1. 修復報告

山下 好彦

### 5.1.1. 名称等

名称	菱繫文螺鈿箆筒 一基
制作年代	江戸時代 17世紀
所蔵者	国立ナーブルステク博物館（チェコ共和国）
登録番号	34942

### 5.1.2. 工期及び施工者等

工期	平成 21 年 5 月～平成 23 年 3 月
施工場所	東京文化財研究所修復アトリエ（漆）
修復担当者	山下 好彦

### 5.1.3. 修復前の状態

損傷状態を下記に列記する。

- 箆筒全面に埃や汚れの付着が僅かに見られた。
- 箆筒の上面付近に粘着テープの痕跡が認められた。
- 素地接合部に浅い亀裂があった。特に、蓋内部の左右に亀裂が進行していた。
- 亀裂の周囲では漆塗膜が剥離していた。
- 箆筒の背面を除く外面、扉の内側と引出し表面に黄色塗料が厚く塗られていた。
- 背面、底面と内部の鍵金具および引き出し内外部に黒色塗料が塗布されていた。
- 螺鈿の後世修復が広い面積に認められ、螺鈿が貼りなおされていた。
- 螺鈿の新補が各所にあり、鮑の薄貝や蝶貝の中厚貝が用いられていた。
- 蒔絵や付描き線が一部で剥落し、下付漆が露出していた。
- 後世修復時の西洋塗料による加筆が各所に認められた。螺鈿の欠損部には銀色の塗料、螺鈿際の蒔絵線には金色や黄色塗料で線を書き込んでいた。
- 下段の棧が狂い、下段の引き出し上部が棧下側の後世修復材料に付着してしまっていた。
- 鍵金具、隅金具に施された鍍金がすでになくなっていった。
- 正面の鍵金具が緩み、1本の釘の頭が欠失していた。

### 5.1.4. 修復方針

修復方針は事前に東京文化財研究所から提示を受けた。実際の修復にあたって再度検討を加えた後、変更が生じた部分についてはその都度東京文化財研究所の担当者と修復者が協議して決定した。

次に、作品の修復方針を列記する。

- 文化庁が指導している文化財修復に準じて現状維持修復を基本とした。
- 西洋修復部分の除去は黄色塗料、後世に書き加えられた金色線や白色下地を対象とし、背面、底面、

内部に塗られた黒色塗料は対象外とした。

- 後世修復除去にあたっては、オリジナルの塗膜、蒔絵や金具に損傷を与えないような有機溶剤を慎重に選んだ。
- 欠損した釘は新補し、古色を付けることとした。
- 周囲から目立っていた後補の貝や欠損した貝の一部は、観賞を考慮して色合わせを行うこととした。
- クリーニングをするに際して、提金具と丸足を除く隅金具、鍵金具、蝶番は取り外し、修復後に取り付けることとした。
- 赤外分光分析や蛍光X線分析によって後世修復材料を特定し、後世修復によって施された箇所を特定した。

### 5.1.5. 修復工程

#### (1) 修復前調査

損傷状態と技法に関する目視による調査を行い、現状を記録した。

初めに、紫外線ランプによる調査を行った。その結果、表面に塗布された黄色塗料は濁った黄色に蛍光したが、背面、内部や底面に塗られている黒色塗料や鍵金具は蛍光しなかった。このことから黄色塗料はヨーロッパにおいて修復材料として用いられているシェラックやその他のレジンが塗布されていると考えられた。

黒色に塗られた背面を斜光で観察したところ、菱形の下地の痕跡が認められた。この結果、背面にも菱文の螺鈿が加飾されていたものと判断出来た。制作技法から螺鈿表面は砥石で研いで平滑になるが、天板や各面の周囲には広い面積にわたって螺鈿表面が平滑でなく、色合いが異なる部分が認められた。このことから、背面の螺鈿や剥落した螺鈿を後世修復時に貼りなおしていることが分かった。さらに、十数年前に行われた修復以前の写真と比較して修復箇所を判断した。

素地は檜の板目を使用し、木目は背面と両側面を縦方向、天板と底板は横方向に使用していることが分かった。各引き出しの奥に小さな薄板を接着し、引き出し表面に段差ができないように調整していた。その薄板はその半数がすでに欠失していた。

#### (2) 修復前写真

修復前にカラー写真用デライトランプと自然光を使って作品全体と損傷状態をデジタル写真で記録した。次に紫外線蛍光写真を撮影し、後世修復の状態を記録した。蛍光写真はブラックランプと紫外線カットのゼラチンフィルターを使用し、デジタルで記録した。

#### (3) 溶剤テスト

後世修復の黄色塗料および金線を除去するための溶剤実験を行った。有機溶剤は消毒用エタノール、無水エタノール、アセトン、酢酸エチルを使用した。黄色塗料は消毒用エタノールや無水エタノールでは表面のみ溶解、アセトンおよび酢酸エチルではほとんど変化はなかった。また、金線はアセトンで簡単に除去できることが分かった。

#### (4) 分析

黄色塗料の一部をサンプリングし、赤外分光分析 (FT-IR) を行った。分析は東京文化財研究所保存修復科学センターの早川典子が行った。その結果、黄色塗料はシェラックであると判明した。また、蛍光X線分析を行い、金属粉の材料や金具の材質などを調査した。この調査は東京文化財研究所保存修復科学センターの早川泰弘が行った。その結果、金線の下付漆には朱漆が用いられていた。また、提金具、隅金具や鍵金具 (外面) は銅製金鍍金、鍵金具裏 (内側) と鍵は鉄製であると分かった。鍵金具内側にオリジナルの金属と異なる鉄が用いられていたことから、いつの時代かに鍵金具が取り換えられたと思われる。



## (5) クリーニング

塗膜と蒔絵表面に付着した埃と汚れを僅かに水で湿らせた綿布で取り去った。

## (6) 接着テープ跡の除去

天板と右側面に付着していた接着テープの粘着剤をアセトンで除去した。

## (7) 金具の取り外し

隅金具や鍵金具（外側）を取り外し、元の位置が分かるように発泡ウレタンに仮保管した。

## (8) 西洋塗料の除去

溶剤テストの結果から消毒用エタノールと無水エタノールを併用して黄色塗料を除去した。菱文よりも少し小さめに切った不織布に消毒用エタノールを染み込ませて除去部に置き、塗料が膨潤するのをまって鼈甲箆を用いて除去した。貝上に描かれた付描線に傷みが及ばないようにするため、金線の際は無水エタノールを綿布に付けて慎重に塗料を除去した。扉内側の蒔絵部分も螺鈿と同様に鼈甲箆を用いて文様部分から慎重に除去した。オリジナルの金線の上に2種類の塗料が書き加えられていたことから、無水エタノールを使用した後で酢酸エチルを使用して除去した。

## (9) 螺鈿の剥落止め

西洋塗料除去後に剥離していた螺鈿に膠水溶液を含浸し、木杵とヒゴで圧着した。膠はパールグルー（大王）15%水溶液を使用した。

## (10) 分析

消毒用エタノールの除去時に菱文の線に描き加えられていた黒色塗料が取れ、一部に充填されていた白色下地が露出した。この白色下地は天板と左右側面に見られ、黒く塗りなおされた底の亀裂部分にも観察できることから、後世修復の充填剤と考えた。

螺鈿の間に充填された下地材料と後世修復の螺鈿の接着に用いられた接着材のサンプルを取り、FT-IRによる材料分析を行った。その結果、上部の白色下地は炭酸カルシウム、下部の黒色材料はパラフィン、接着材料は酢酸ビニルであると分かった。

## (11) 後世修復の下地の除去

螺鈿の隙間に充填された下地を物理的に除去した。下地の除去は竹箆を用いた。

後世修復の接着材の除去は螺鈿を全て取り外した状態でないと無理なため、そのままとした。

## (12) 漆固め

劣化した塗膜と蒔絵部分に透漆を用いて強化した。漆固めは、クリーンソルGで希釈した生正味漆と透漆を混合した漆を用い、余分な漆はリグロインで拭き取った。

## (13) 亀裂や割れの補強

素地接合部の亀裂や割れ部分に調整した麦漆を部分的に含浸し、強化した。

## (14) 漆塗膜の剥落止め

剥離した塗膜に麦漆を含浸し、木杵とヒゴを用いて圧着した。

## (15) 下地欠損部の成形

下地が欠損した箇所に刻苧と下地で成形した。天板は3分の2以上が後世修復によって螺鈿が貼りなおされており、菱文様が連続しないところがでるため、一部は螺鈿の上に下地を僅かに被せて文様を調整した。

## (16) 欠損塗膜の復元

下地充填部分に漆塗りと炭研ぎを繰り返し漆塗膜の色合いを合わせた。

## (17) 釘の復元

傷んだ釘を復元した。復元には打たれていた真鍮製の釘に合わせて制作し、タンパン酢と呼ぶ硫酸銅、塩と食用酢を混合した溶液で古色を付けた。釘の制作は東京芸術大学の草野晃氏が担当した。

## (18) 金具の調整と取り付け

金具の歪みを簡易的に矯正し、鍵金具、隅金具や蝶番を元の位置に取り付けた。釘穴にゆるい箇所は刻苧をあらかじめ充填し釘で金具を止めた。右蝶番の歪みが著しく、蓋の開閉に問題が出ることから取り付け位置の下地を除去することで調整して取り付けた。

## (19) 螺鈿の色調整

螺鈿の色合わせにはパール粉（雲母粉）とパラロイド B72 キシレン溶液で貝色を付け、アクリル絵の具で彩度を沈めた。

## (20) 桐箱と外覆の作製

桐箱（横 45.6cm 奥行 34.1cm 高 35.9cm）と絹の覆いを新調した。桐箱は落し蓋造りとし、丸穴の引手を付けたゲス板を作製した。外覆は羽二重を用い、前面左右の上下に紐を付けて取り外し易い形状とした。

## (21) 修復後の記録作製

修復後の写真撮影を行い、修復記録をまとめて報告書を 2 部作成した。

**5.1.6. 修復後の状態**

詳細は Table 5.1 を参照のこと。

## 5.1. Restoration Report

Yoshihiko Yamashita

### 5.1.1. Data

Title	<i>Cabinet with Lozenge Design</i>
Period	17th century, Edo period
Owner	Náprstek Museum, National Museum, Prague (Czech Republic)
Inventory number	34942

### 5.1.2. Restoration Data

Duration	May 2010 – March 2011
Place	Restoration Studio (Urushi), National Research Institute for Cultural Properties, Tokyo
Conservator	Yoshihiko Yamashita

### 5.1.3. Condition before Restoration

The following is a list of the condition of damage.

- Some dust and soiling were observed over the entire surface of the cabinet.
- There were traces of adhesive tape near the top of the cabinet.
- There were shallow cracks on the joints of the substrate. They were progressing especially on the left and right ends inside the lid.
- The urushi coating film around the cracks had become lifted.
- There was a thick coating of yellow material on the outer surface of the cabinet, except at the back, and on the inner side of the fall front and the surface of the drawers.
- Black coating material had been applied to the back surface and bottom of the cabinet, metal lock plate on the inner side of the fall front and the inner and outer sides of the drawers.
- Traces of past restorations could be seen over a large area of the *raden*; the shell pieces had been re-adhered.
- There were new *raden* pieces at various places of the cabinet; thin abalone shell pieces and medium thick pearl oyster had been used.
- Parts of the *makie* and *tsukegaki* lines had been lost, exposing the *shitazuke urushi*.
- Additional touching made during past restorations were evident at many places. Silver coating material was used on parts where *raden* had been lost, and gold or yellow coloring material had been used to redraw the *makie* lines around the edges of the *raden*.
- Crosspiece for the drawers had become distorted. The upper portion of the bottom drawer tended to stick to the past restoration material used on the underside of the crosspiece above, making it difficult to draw out this drawer.



- Gilding executed on the metal lock plates and the corner metal fittings had already been lost.
- The metal lock plate in the front had become loose, and the head of one of the nails was missing.

#### 5.1.4. Restoration Plan

The restoration plan for the object had been presented beforehand by the National Research Institute for Cultural Properties, Tokyo. In beginning the actual work of restoration, details of the plan were discussed once again and changes that were considered necessary were decided upon deliberation between the person in charge at the Institute and the conservator.

The following is a summary of the restoration plan.

- Maintenance of the present condition in the restoration of cultural properties advocated by the Agency for Cultural Affairs would be followed. However, traces of past restorations that might hinder appreciation would be treated simply by matching the colors.
- With regard to the removal of traces of Western restoration, the yellow coating material, the gold lines drawn in the past and the white foundation would be removed, but the black coating material on the back, bottom and inside would not be removed.
- In removing traces of past restorations, organic solvents would be carefully selected so that they would not damage the original coating material, *makie* or the metal fittings.
- The missing nails would be newly made and colored to provide an antique appearance.
- The colors of parts with missing *raden* and of shells added during past restorations that were conspicuously different from their surroundings would be matched partially so as not to hinder appreciation.
- The corner metal fittings, lock, metal plate and hinges would be removed at the time of cleaning and re-attached after restoration.
- Past restorations would be specified by Fourier-transform infrared spectroscopy (FT-IR) and X-ray fluorescence analysis in order to identify places that had been restored in the past.

#### 5.1.5. Restoration Process

##### (1) Investigation before restoration

Condition of damage and techniques employed were investigated visually and the present condition was recorded.

First, investigation using a UV lamp was done. As a result, the yellow coating material applied on the surface fluoresced to unclear yellow, but the black coating material on the back surface the inside and bottom of the cabinet did not fluoresce. From this, it was thought that the yellow coating material is shellac, which is used in Europe as a restoration material, or some other resin.

When the back surface which had been coated black was observed under oblique light, traces of foundation in lozenge sharp were found. As a result, it was determined that the back of the cabinet had also been decorated with lozenge *raden*. When the manufacturing method is considered, it is possible to make the surface of a *raden* flat by grinding it with a whetstone. But there was a large area on the top board and each of the sides where the *raden* surface was not flat and the colors did not match. From this, it was confirmed that the *raden* on the back and the pieces of *raden* that had fallen were re-adhered during past restorations. Places where restoration was executed were confirmed further by studying photographs taken before restoration that was executed ten and somewhat years ago.

Cross-grained cypress was used for the substrate; the grains run vertically on the back and the right and left sides, while they run horizontally on the top and bottom boards. Pieces of small thin board had been attached at the back of each drawer in order to prevent the drawers from going too far into the back. More than half of these thin boards had already been lost.

(2) Photographing before restoration

The entire cabinet and its condition of damage were photographed before restoration with a digital camera under a daylight lamp for color photographs and natural light, and recorded. Then UV fluorescence photographs were taken and the condition of past restorations was recorded. For fluorescence photographs, a black lamp and a gelatin filter that would cut UV ray were used. Digital camera was used in this case also.

(3) Solvent tests

Experiments were done to check solvents that would be used to remove the yellow coating material and the gold lines from past restorations. Ethanol for disinfection, absolute ethanol, acetone and ethyl acetate were the organic solvents tested. Ethanol for disinfection and absolute ethanol dissolved the yellow coating material, but only on the surface. Acetone and ethyl acetate caused almost no change. It was also found that the gold lines could be removed easily with acetone.

(4) Analysis

A sample of the yellow coating material was taken and analyzed by FT-IR. Analysis was done by Noriko Hayakawa of the Center for Conservation Science and Restoration Techniques of the National Research Institute for Cultural Properties, Tokyo. As a result, it was determined that the yellow coating material was shellac. Furthermore, X-ray fluorescence analysis was performed to investigate the materials of the metal powder and the metal fittings. This investigation was done by Yasuhiro Hayakawa, also of the same Center. As a result, it was found that *shu-urushi* had been used for the *shitazuke urushi* of the gold lines. It was also found that copper gilded with gold had been used for the handles, corner metal fittings and the lock metal plate, while iron had been used for the lock itself and the key. Since iron which is different from the original metal was used for the lock, it is thought that the lock had been exchanged at some time.

(5) Cleaning

Cotton cloth slightly moistened with water was used to remove the dust and soiling that had accumulated on the coating film and the *makie* surface.

(6) Removing traces of adhesive tape

Traces of adhesive tape on the top board and the right side of the cabinet were removed with acetone.

(7) Removing the metal fittings

Corner metal fittings, the lock and other metal fittings other than the handles and the legs were taken off. These were temporarily stored on an urethane foam, making sure that their original positions would be kept clear.

(8) Removal of Western coating materials

As a result of the test on solvents, ethanol for disinfection and absolute ethanol were used to remove the yellow coating material. Nonwoven cloth cut to a size slightly smaller than the size of the lozenge and immersed in ethanol for disinfection was put on places where the coating material was to be removed. After having waited for the coating material to become swollen, a tortoise shell spatula was used to remove it. So as not to damage the *tsukegaki* lines on the shell pieces, coating material around

the edges of gold lines were carefully removed with a cotton cloth moistened with absolute ethanol. The coating material on the *makie* on the inner side of the fall front was also carefully removed with a tortoise shell spatula, as was in the case of *raden*. Since two types of drawing material had been used on the original gold lines, ethyl acetate was used after absolute ethanol.

(9) Consolidation of the lifted *raden*

After having removed the Western coating materials, an animal glue solution was impregnated into the lifted *raden*. These were then press-stabilized with a wooden frame and bamboo sticks. For this treatment, a 15 % aqueous solution of Pearl Glue (Daio) was used.

(10) Analysis

The black coating material that had been used to draw missing lines of the lozenge design had come off, exposing the white foundation which had been partially filled in. Since this white foundation could be found on the top and side boards as well as on the cracked parts of the bottom that had been re-coated black, it was thought to be filler used in a past restoration.

Samples were taken from the foundation materials, both white and black, that had been filled into the spaces of the *raden* and from the adhesive agent used to adhere the pieces in past restorations. These were analyzed by FT-IR. As a result, it was found that the white foundation from the upper portion was calcium carbonate, while the black material from the lower portion was paraffin and the adhesive was vinyl acetate.

(11) Removal of the foundation from past restorations

Foundation that had been filled into the spaces of the *raden* were removed physically. A bamboo spatula was used for this. Since removing the adhesive used in past restorations would not be possible unless all the *raden* pieces are removed, this was left untouched.

(12) *Urushigatame*

*Suki-urushi* was applied to the deteriorated coating film and the *makie* portions for consolidation. For *urushigatame*, *kijomi urushi* diluted with Cleansol G and *suki-urushi* were mixed. Excess urushi was wiped off with ligroin.

(13) Reinforcement of cracks

Cracks on the joints of the substrate were reinforced by impregnating *mugi-urushi* that had been adjusted.

(14) Consolidation of the lifted urushi coating film

*Mugi-urushi* was impregnated into the lifted coating film which was then press-stabilized with a wooden frame and bamboo sticks.

(15) Shape-forming the missing portions of the foundation

*Kokuso* and foundation material were used to shape-form places where the foundation had been lost. Since more than two-thirds of the *raden* on the top board had been re-adhered in past restorations and the continuity of the lozenge design would be broken at some places, a very small amount of foundation was placed over some of the *raden* in order to adjust the design.

(16) Reproduction of the lost coating film

The color of the urushi coating film was adjusted by applying urushi to the parts where the foundation had been filled and grinding the surface with charcoal. This was repeated several times.

(17) Reproduction of the nails

The damaged nails were reproduced. They were made to match the original brass nails and given an

old finish by using copper sulfate, vinegar and salt. The nails were reproduced by Akira Kusano of the Tokyo University of the Arts.

(18) Adjusting and attaching the metal fittings

Warping of the metal fittings was simply corrected and the metal lock plate, corner metal fittings and the hinges were returned to their original positions. Nail holes that were loose were filled with *kokuso* and the metal fittings were nailed down. Since the right hinge was warped severely, causing a problem opening and closing the fall front, adjustment was made by removing the foundation under the hinge.

(19) Adjustment of the color of *raden*

To adjust the color of *raden*, Pearl Powder (mica powder) and Paraloid B72 were diluted with xylene and applied to produce the color of the shell; acrylic paint was used to subdue the chroma.

(20) Manufacture of a paulownia box and a cover

A paulownia box (W 45.6 cm, D 34.1 cm and H 35.6 cm) and a silk cover were newly made. The paulownia box was made in such a way that its front board would slide down to serve as the lid (*otoshibuta-style*). It was also equipped with an extra bottom board that can be pulled out by means of two holes at the front. *Habutae* silk was used for the cover. Cords were attached on the front as well as near the top and bottom on the left and right, making it easy to handle the cover.

(21) Compilation of a restoration record

Photographs were taken after restoration and two copies of the restoration report were made.

### 5.1.6. Condition after Restoration

See Table 5.1.

## 5.2. 作品解説

東京国立博物館  
竹内 奈美子

江戸時代初期にヨーロッパなどへの輸出用に作られた漆器の一つ。正面に跳ね上げ式の扉を付け、内に3段7個の引出しを取めた筆筒で、このような筆筒は欧州では通常、机のような背の高い台脚の上に載せて飾り置かれる。また、この形式の筆筒は、当時来日したスペイン人等の記録に「書筆筒 (escritorios)」とあるものに相当するとみられる。開いた扉が水平位置でとまるように吊り、元来はその上で書類を広げ、書きものをするのに用いられたという。

この筆筒は外側と引き出し前面に、螺鈿と平蒔絵により菱繫文を表わす。扉の内側は黒漆塗として、平蒔絵と螺鈿による石畳文で四辺を縁取り、内に平蒔絵・絵梨子地・螺鈿により葛の蔓や葉を描いている。

このように螺鈿による幾何学文様で外側全面を覆う装飾は、インド西部などイスラム圏の工芸品の影響によるものと推測される。桃山から江戸時代初期に来日して漆器を注文したヨーロッパの人々が、東アジアへ至る過程で寄港した土地であり、螺鈿細工が盛んで、同じように螺鈿で表面を覆いつくした工芸品が残されているためである。日本では輸出用漆器の量産体制が確立し、螺鈿や幾何学文様を多用した装飾が採用されるようになったとみられ、この筆筒もその時期の制作と考えられる。

## 5.2. Description of the Artwork

Namiko Takeuchi  
Tokyo National Museum

The object discussed is urushiware made in the early Edo period for export to the West. The cabinet has a door that lifts open in the front and seven drawers arranged in three tiers inside. In Europe, this type of cabinet is usually placed on top of a tall stand like a desk. The style of the cabinet is thought to be one that corresponds to what is referred to as “escritorios” in documents of Spanish people who came to Japan in those days. The fall front is made in such a way that it will stay horizontal. Traditionally, documents would be placed here for writing.

The outer side of the cabinet and the front face of the drawers are decorated with a design of consecutive lozenges in *raden* and *hiramakie*. The inner side of the door is coated with black urushi; its four sides are bordered with a design of cobblestones in *hiramakie* and *raden* while the inner side of the border is a design of the vines and leaves of *kuzu* plant in *hiramakie*, *enashiji* and *raden*.

Decorating the entire outer surface of an object with geometric designs in *raden* like this is thought to show the influence of craftwork from western India and the Islamic world. These are places that Europeans who arrived in Japan from the Momoyama period to the early Edo period and placed orders for urushiware stopped on their journey to East Asia, where *raden* work was popular and where many craftworks similarly covered with *raden* are still to be found. It seems that a system for producing export urushiware in large quantity was established in Japan and that decoration using *raden* and geometric designs became popular. This cabinet is thought to have been manufactured during that time.





## Appendix 5.1. Results of X-ray Fluorescence Analysis

Yasuhiro Hayakawa  
National Research Institute for Cultural Properties, Tokyo

### Date and place of analysis

Tuesday, March 22, 2011

Restoration Studio (Urushi), National Research Institute for Cultural Properties, Tokyo

### Apparatus and conditions for analysis

Apparatus :	Portable X-ray fluorescence spectrometer SEA200 (Seiko Instruments Co. Ltd)
Target :	Rh (rhodium)
Tube voltage, current :	50 kV, 100 $\mu$ A
X-ray radiation diameter :	$\phi$ 2 mm (collimator without filtering)
Measuring time :	100 sec.
Measuring atmosphere :	Air
Distance between the apparatus and the sample :	approximately 10 mm
Measuring points :	See Table 5.2 and Fig. 5.23

### Analytical results

- X-ray fluorescence intensity obtained is shown in Table 5.3.
- The following points should be taken into careful consideration when interpreting the measured results.
  - (1) With X-ray fluorescence analysis, it is possible to identify elements contained in a sample but it is not possible to find their structure (chemical formula)
  - (2) It is not possible to detect organic substances (major elements C, N, O, H) or dyes in this measurement.
  - (3) It is not possible to detect light elements even if they are inorganic substances (i.e. Al, Si, S, Cl)
  - (4) X-ray fluorescence intensity obtained shows an average composition from the surface to a set depth (for metallic copper, approximately several 10  $\mu$ m in depth).
  - (5) It is difficult to determine only from a single measurement whether several elements are combined or whether they are in layers.
  - (6) Since detection efficiency of X-ray fluorescence differs greatly by energy, the ratio of intensity in X-ray fluorescence and the actual ratio of concentration do not coincide.

### <Comments>

- At measuring points Nos. 1 and 7, Hg was detected in addition to Au. It is possible that there is red material (vermilion) underneath the gold line.
- At measuring points Nos. 2, 3, 4, 6 and 8 gilding is done on copper base.

- The color at measuring point No. 5 remains whitish silver. Iron gilded with chromium is used.
- The metal used at measuring point No. 9 is iron, but chromium was not detected here.

## 付録 5.2. 修復材料の分析

東京文化財研究所  
早川 典子

### 試料

- A. 下地に使用されていた黒色材料（やわらかい）
- B. 作品全体に塗られていた黄色塗料（70%エタノールに溶解する）
- C. 白色充填材
- D. 螺鈿の接着剤（茶色透明）

### 参照試料

- (a) パラフィンワックス
- (b) シェラック
- (c) ジェッソ（リキテックス製）
- (d) ポリ酢酸ビニルエマルジョン接着剤

### 赤外線スペクトル分析

分析機器：FT-IR 8700（島津製作所）による ATR 分析（Dura sample IR）

- 得られたスペクトルを Fig. 5.24 ~ Fig. 5.27 に示す。
- 試料 A のスペクトルからは 5 つの強い吸収が得られた。C-H 伸縮振動由来の  $2915\text{cm}^{-1}$  と  $2845\text{cm}^{-1}$ 、C-H<sub>2</sub> 変角振動由来の  $1460\text{cm}^{-1}$ 、CH<sub>3</sub>-C 変角振動由来の  $1375\text{cm}^{-1}$ 、CH<sub>3</sub> の横揺れ振動由来の  $720\text{cm}^{-1}$  である。これらの吸収は参照試料 (a) のパラフィンワックスにほぼ一致するが、試料 A では -C=O 由来と思われる  $1735\text{cm}^{-1}$  の吸収も確認されるため、パラフィンワックス以外に何かの有機物を含んでいる可能性が高い。
- 試料 B のスペクトルは  $4000\text{cm}^{-1}$  ~  $1200\text{cm}^{-1}$  の領域では、参照試料 (b) シェラックに一致するが、指紋領域での吸収は異なる。試料 B は水、アセトン、メタノールなどに不溶で 70%エタノールにのみ溶解するという性状からシェラックの可能性が高いと思われたが、シェラックに何らかの物質が混入したものか、もしくは C=O を含む何らかの有機物（アクリル樹脂など）である可能性も残る。
- 試料 C のスペクトルからは  $1400\text{cm}^{-1}$  と  $870\text{cm}^{-1}$  の吸収が確認され、これらは炭酸カルシウム由来だと考えられる。ただし、それ以外にも吸収が確認されるため、参照試料(c)ジェッソのような有機物の接着剤を含む炭酸カルシウムと考えられる。
- 試料 D のスペクトルは参照試料 (d) にほぼ一致するため、酢酸ビニル樹脂が主成分であると考えられる。

## Appendix 5.2. Report on the FT-IR of the Restoration Materials

Noriko Hayakawa  
National Research Institute for Cultural Properties, Tokyo

### Samples

- A. Black soft material as foundation
- B. Yellow paint on the whole object dissolved in 70 % ethyl alcohol
- C. White filling material
- D. Translucent brown adhesive underneath a *raden* shell piece

### Reference materials

- (a) Paraffin wax
- (b) Shellac
- (c) Gesso produced by Liquitex Co.Ltd
- (d) Polyvinyl acetate emulsion adhesive

### Fourier transform infrared spectroscopy

Instrument : FT-IR 8700 (Shimadzu Corporation) with Dura sample IR attached

- Spectra are shown in Fig. 5.24 - Fig. 5.27.
- Five absorptions in spectrum sample A corresponded to reference (a) paraffin wax :  $2915\text{ cm}^{-1}$  and  $2845\text{ cm}^{-1}$  were assigned to C-H stretching vibrations,  $1460\text{ cm}^{-1}$  was assigned to C-H<sub>2</sub> bending vibration,  $1375\text{ cm}^{-1}$  was assigned to CH<sub>3</sub>-C bending vibration and  $720\text{ cm}^{-1}$  was assigned to CH<sub>3</sub> rocking vibration. It was supposed that sample A was paraffin wax containing some organic material because  $1735\text{ cm}^{-1}$  absorption thought to be -C=O group was detected.
- Spectrum sample B corresponded to reference (b) shellac in the region  $4000\text{ cm}^{-1} \sim 1200\text{ cm}^{-1}$ . These spectra were different in the finger print region. Sample B was insoluble in water, acetone and methanol. It was assumed that sample B was shellac containing some materials, but it was also thought this was resin mixture containing C=O bond, for example acrylic resin.
- Absorptions of  $1400\text{ cm}^{-1}$  and  $870\text{ cm}^{-1}$  in the spectrum of sample C were assumed to be of calcium carbonate origin. This sample was thought to be a mixture of calcium carbonate with binding media like gesso as reference (c).
- Spectrum of sample D almost corresponded to reference (d). It was considered polyvinyl acetate.

Table 5.1 寸法  
Dimensions

横 Width (cm)	奥行 Depth (cm)	高さ Height (cm)
39.4	25.3	26.1

金具も含む  
including the metal fittings

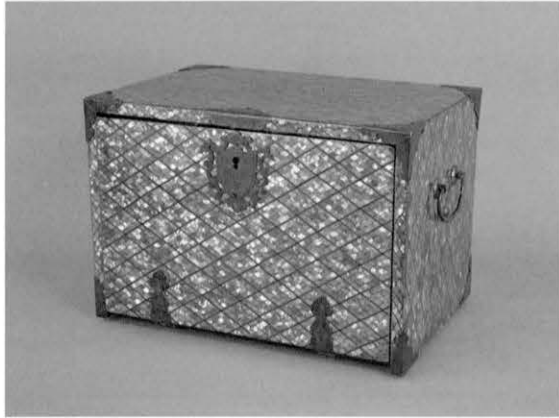
Table 5.2 蛍光 X 線分析位置  
Measuring points for X-ray fluorescence analysis

測定箇所 No.	部位 Measuring point
1	金色線 Gold line
2	取手金具 Handle, metal fitting
3	菊座金 Chrysanthemum washer
4	隅金具 Corner metal fitting
5	鍵 Lock
6	鍵部 座金 Lock, washer
7	引出の金色線 Gold line on the drawer
8	引出の引手金属 Pull metal of the drawer
9	正面蓋 鍵裏金属 Front lid, metal on reverse side of the lock

Table 5.3 蛍光 X 線分析結果  
Results of X-ray fluorescence analysis

測定箇所 No.	蛍光 X 線強度 (cps)								
	カルシウム Calcium (Ca-K $\alpha$ )	クロム Chromium (Cr-K $\alpha$ )	鉄 Iron (Fe-K $\alpha$ )	銅 Copper (Cu-K $\alpha$ )	亜鉛 Zinc (Zn-K $\alpha$ )	銀 Silver (Ag-K $\alpha$ )	金 Gold (Au-L $\beta$ )	水銀 Mercury (Hg-L $\beta$ )	鉛 Lead (Pb-L $\beta$ )
1	141.9		43.5				0.2	0.2	
2			0.7	1693.2			0.2		0.2
3			0.3	1553.6			6.8	3.3	0.1
4			0.5	1924.4			0.1		0.1
5	2.5	5.5	1650.9						
6				1731.0			0.2		0.2
7	76.8		11.6				13.1	10.7	
8				2643.4			0.1		0.2
9			1497.7						



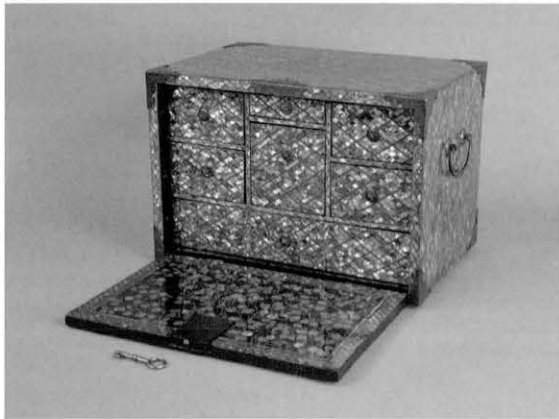


a 修復前 Before restoration

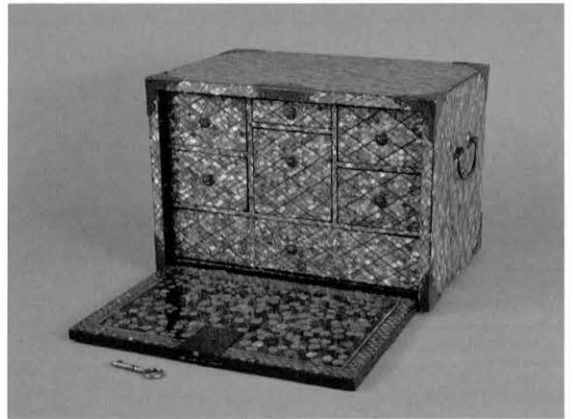


b 修復後 After restoration

Fig. 5.1 全体 Whole

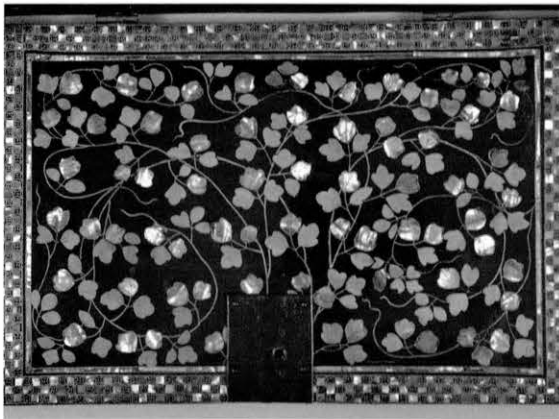


a 修復前 Before restoration

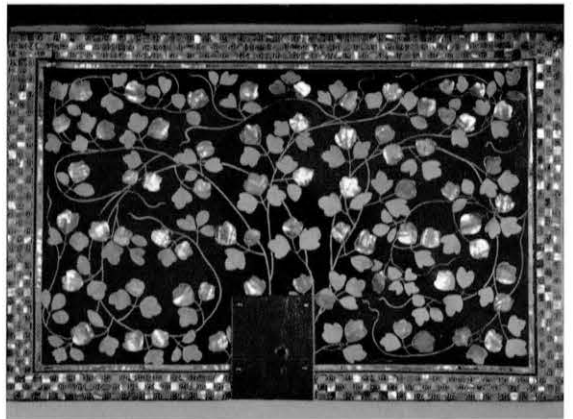


b 修復後 After restoration

Fig. 5.2 全体 Whole



a 修復前 Before restoration

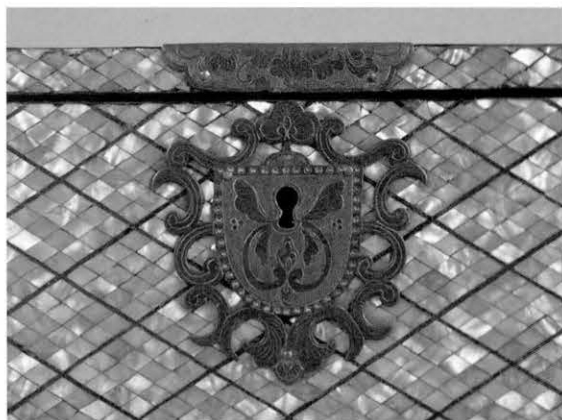


b 修復後 After restoration

Fig. 5.3 蓋裏 Inner side of the lid



a 修復前 Before restoration



b 修復後 After restoration

Fig. 5.4 鍵金具と釘の損傷 Metal lock plate and damaged nail



a 修復前 Before restoration



b 修復後 After restoration

Fig. 5.5 テープ接着材の付着 Trace of adhesive tape



a 修復前 Before restoration



b 修復後 After restoration

Fig. 5.6 螺鈿の修理箇所 Raden restored in the past

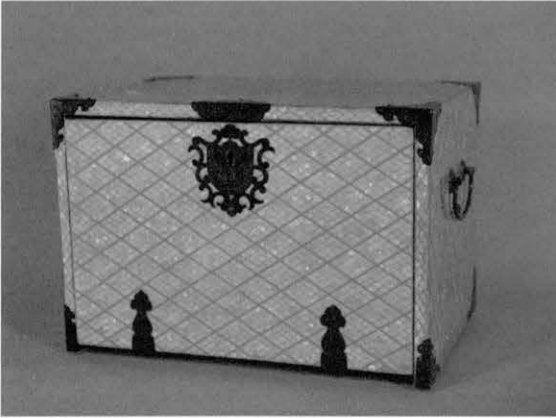


Fig. 5.7 紫外線光による蛍光 修復前  
Fluorescence under UV light, before restoration

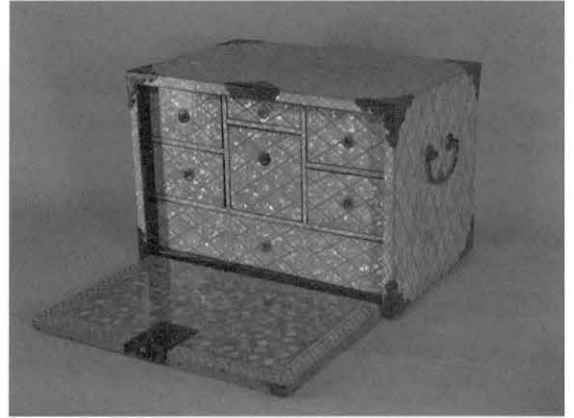


Fig. 5.8 紫外線光による蛍光 修復前  
Fluorescence under UV light, before restoration

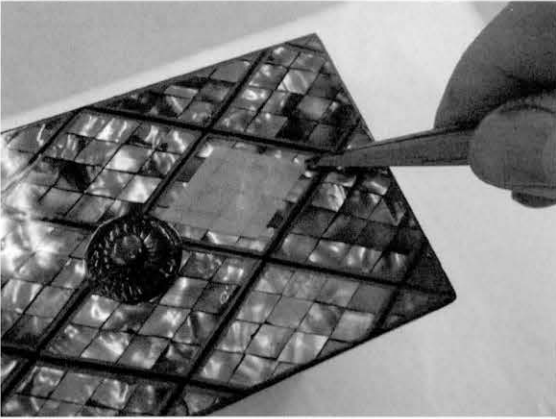


Fig. 5.9 西洋塗料の除去 不織布とエタノールによる塗料の膨潤 修復中  
Removing Western coating materials, swelling coating materials with nonwoven cloth and ethanol, during restoration

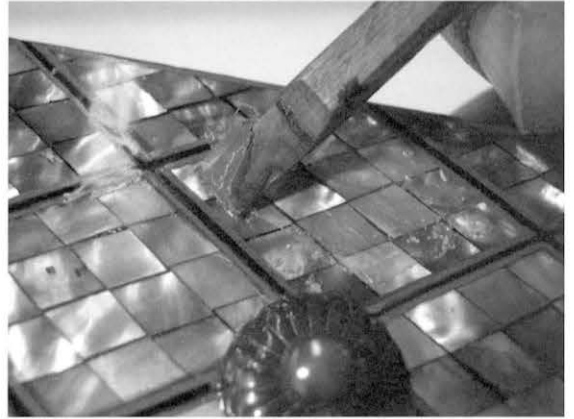


Fig. 5.10 西洋塗料の除去 亀甲筥による塗料の除去 修復中  
Removing Western coating materials with a tortoise spatula, during restoration

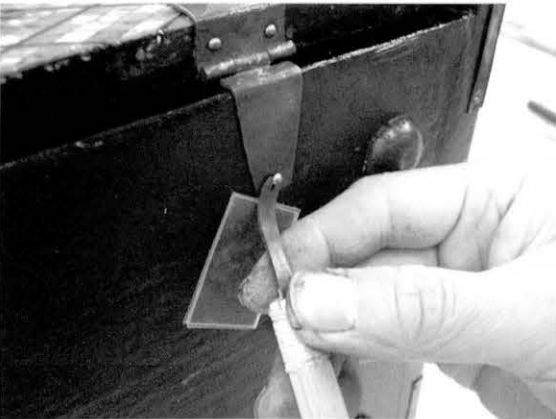


Fig. 5.11 金具の取り外し 蝶番裏の釘 修復中  
Removing a metal fitting, removing a nail on the reverse side of a hinge, during restoration

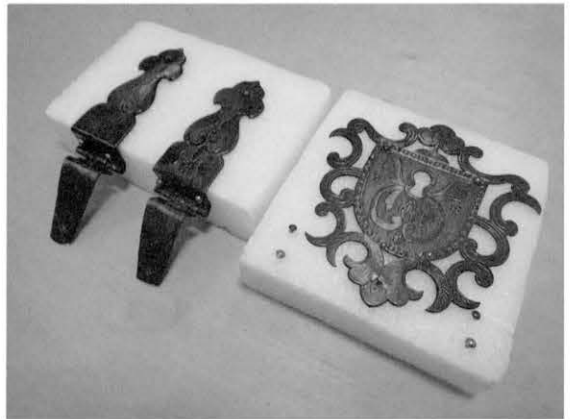


Fig. 5.12 取り外した金具の保管状態 修復中  
Storing the removed metal fittings, during restoration



Fig. 5.13 膠水溶液による螺鈿の剥落止め 天板部分 修復中  
Consolidating *raden* by using animal glue solution, top board, during restoration

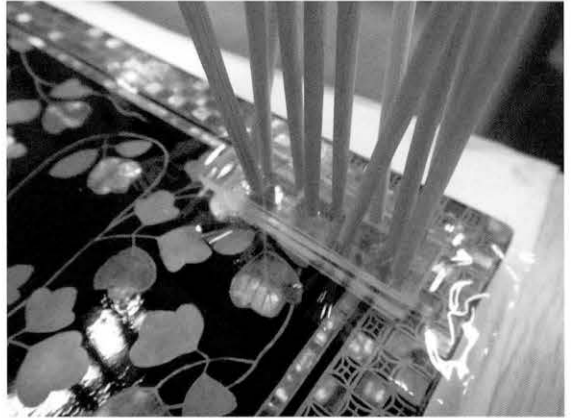


Fig. 5.14 漆塗膜の剥落止め 蓋裏部分 修復中  
Consolidating urushi coating film, inner side of the fall front, during restoration

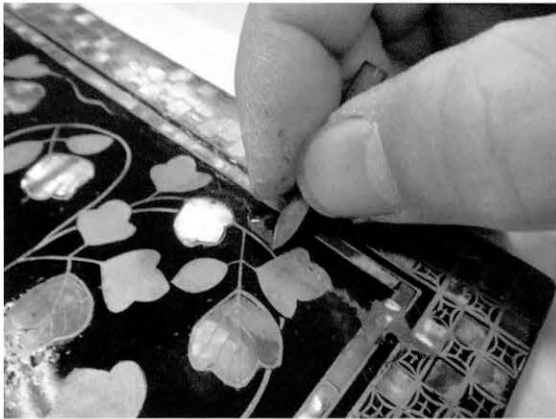


Fig. 5.15 亀裂箇所の下地の充填と調整 扉内側部分 修復中  
Filling a crack with foundation and making adjustment, inner side of the fall front, during restoration



Fig. 5.16 亀裂箇所の漆による色調整 扉内側部分 修復中  
Adjusting the color of a crack with urushi, inner side of the fall front, during restoration



Fig. 5.17 漆塗膜と蒔絵の補強 右側面部分 修復中  
Reinforcing the urushi coating film and *makie*, right side, during restoration



Fig. 5.18 後世修復時に新補された螺鈿の色調整 右側面部分 修復中  
Adjusting the color of *raden* applied in a past restoration, right side, during restoration



Fig. 5.19 隅金具と取り付け 修復中  
Attaching a corner metal fitting, during restoration

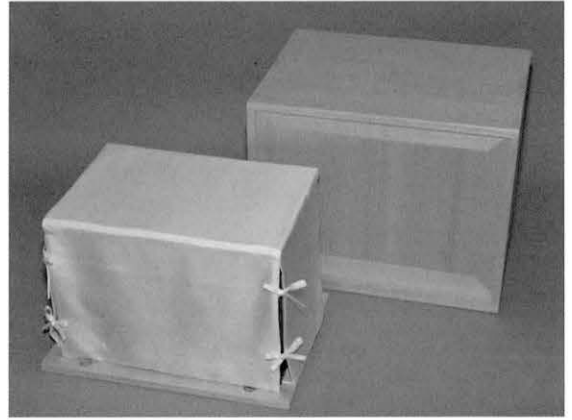


Fig. 5.20 桐箱と外覆の作製 修復後  
Paulownia box and the outer cover, after restoration

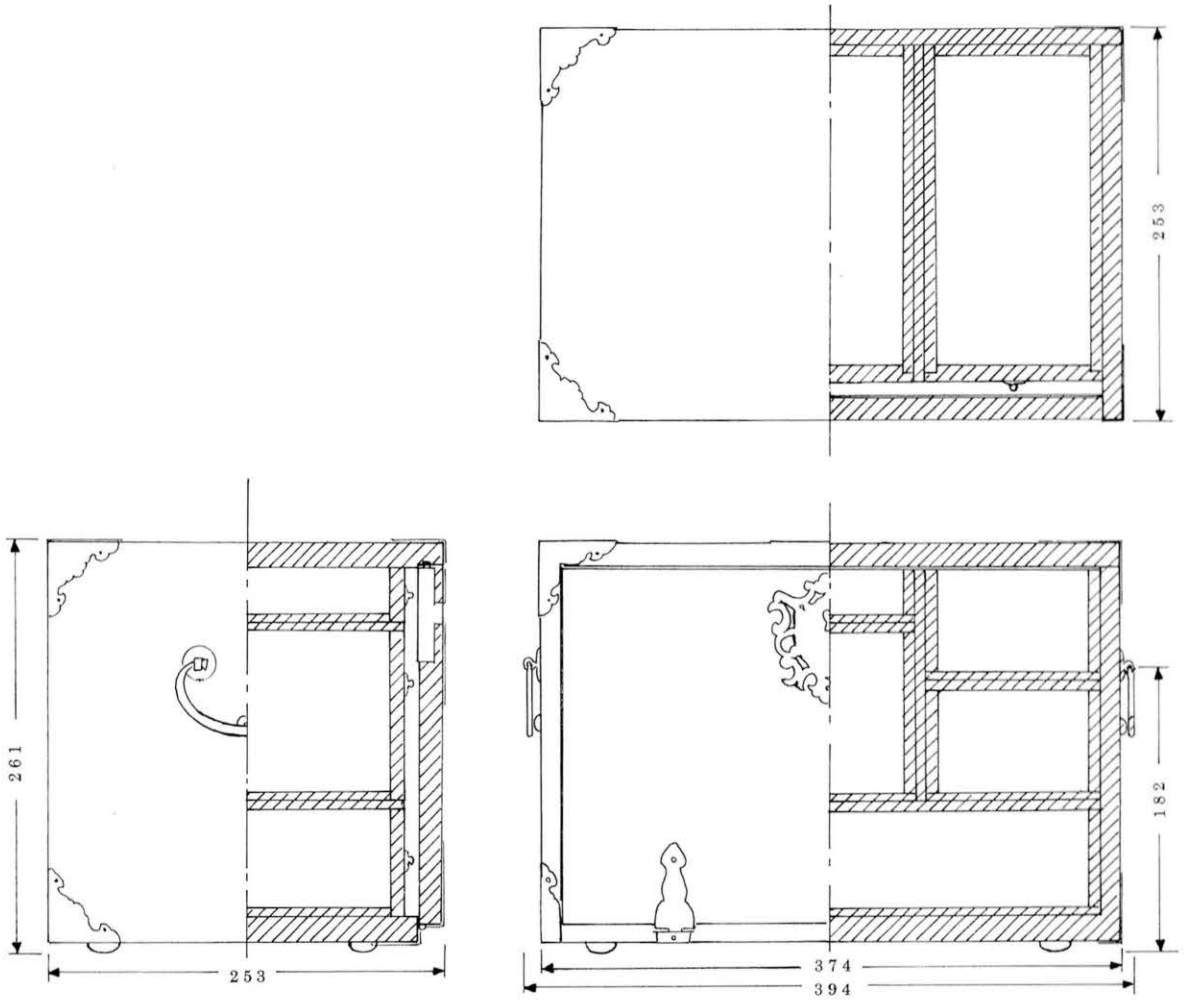
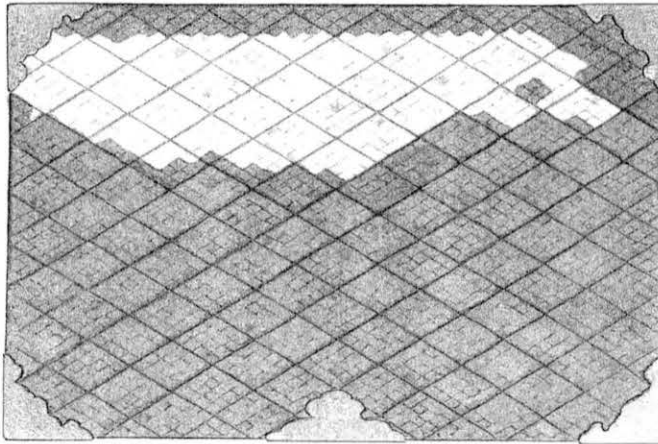
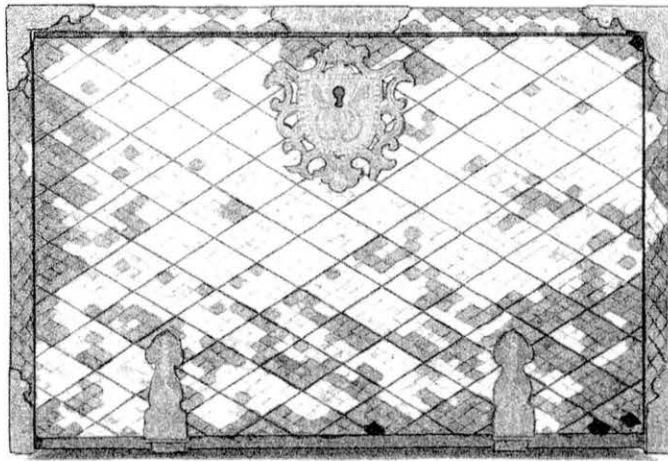


Fig. 5.21 菱繫文螺鈿筆筒 三面图  
Trihedral figure of Cabinet with Lozenge Design





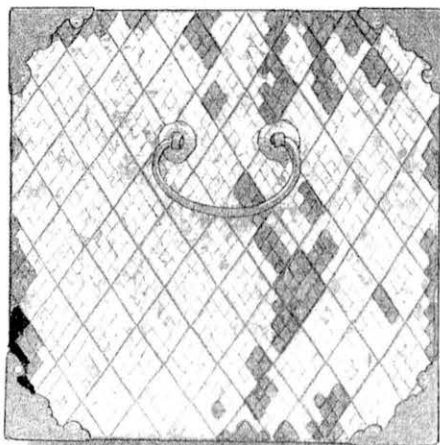
a 天板  
Top



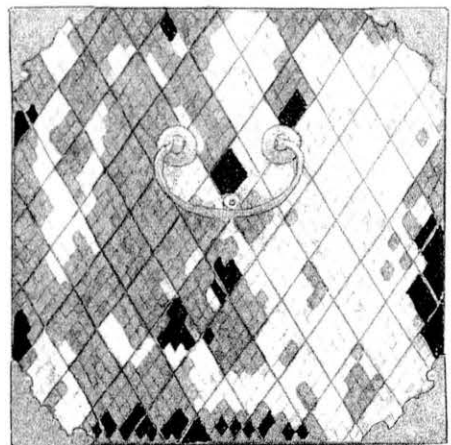
b 正面  
Front

貼直し  
Reattached during  
past restorations

後補  
Added during past  
restorations



c 左側面  
Left side



d 右側面  
Right side

Fig. 5.22 菱繫文螺鈿箆筒 螺鈿後世修復箇所  
Parts treated in past restorations of *Cabinet with Lozenge Design*



Fig. 5.23 螢光 X 線分析位置  
Measuring points for X-ray fluorescence analysis

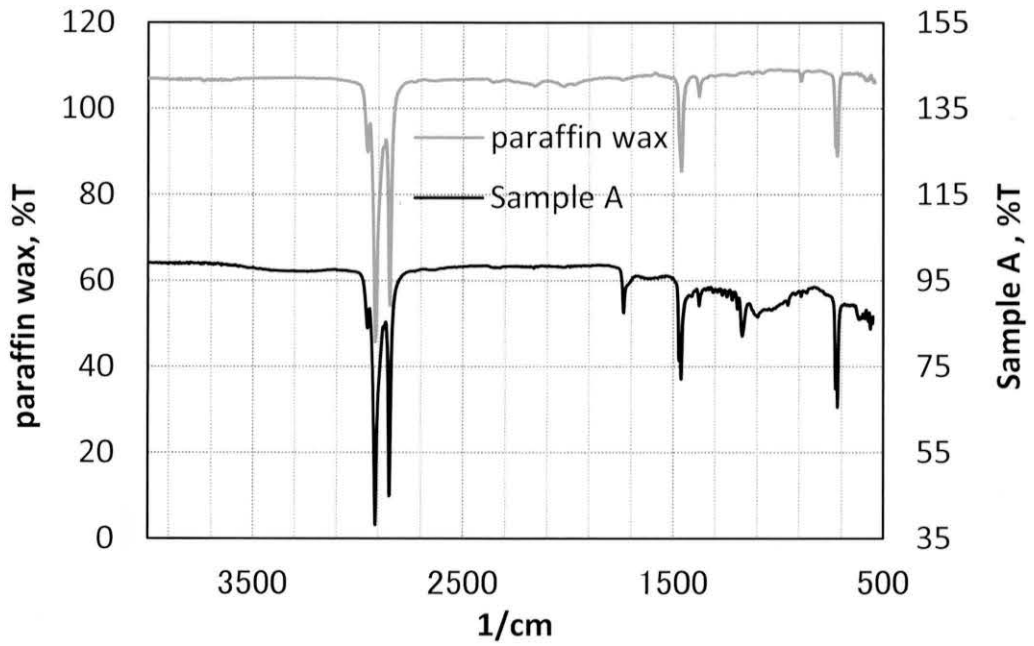


Fig. 5.24 赤外線スペクトル分析 試料 A  
Fourier transform infrared spectroscopy, Sample A

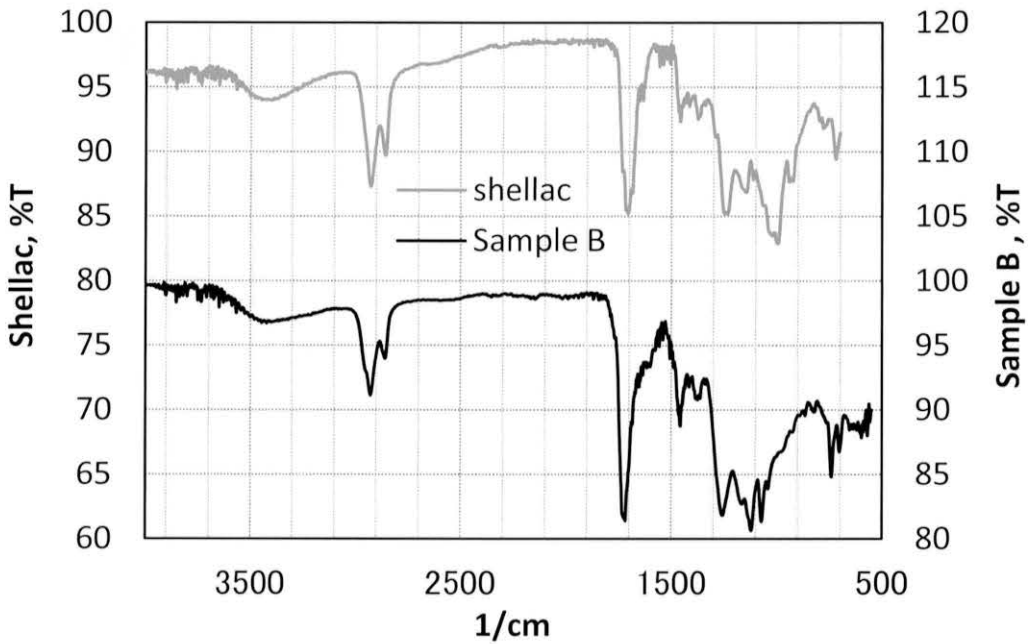


Fig. 5.25 赤外線スペクトル分析 試料 B  
Fourier transform infrared spectroscopy, Sample B

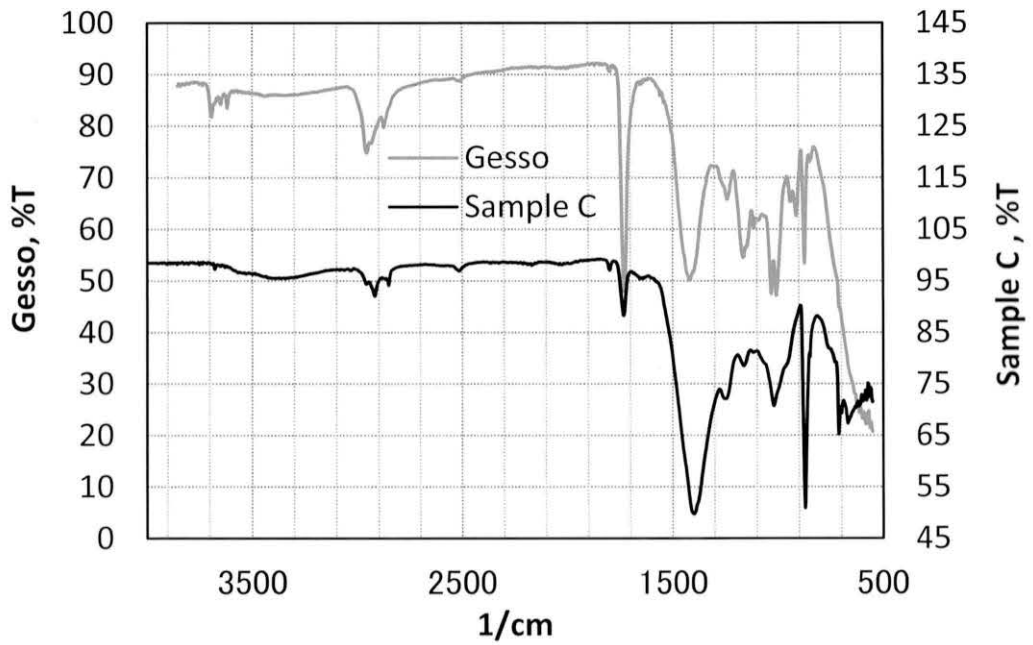


Fig. 5.26 赤外線スペクトル分析 試料 C  
Fourier transform infrared spectroscopy, Sample C

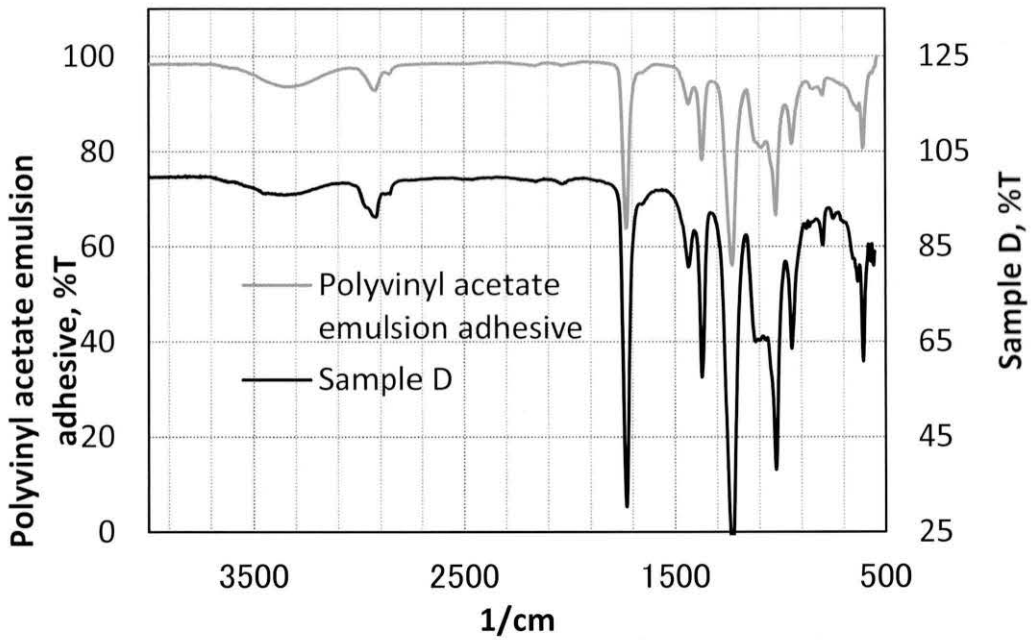


Fig. 5.27 赤外線スペクトル分析 試料 D  
Fourier transform infrared spectroscopy, Sample D