9　和歌浦蒔絵十種香箱（ピーボディ・エセックス博物館）修理前
"Wakaura *Makie* Incense Box" (Peabody Essex Museum)
Before restoration

10　全景　修復後
After restoration

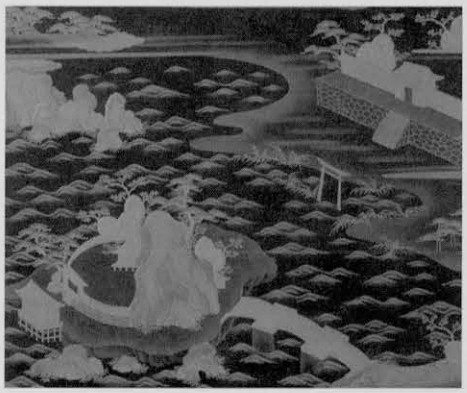
11　香箱角　修理後
Corner of the box after restoration

12　蓋裏　修理後
Inside of the lid after restoration

13　全景　修復後
After restoration

和歌浦蒔絵十種香箱

平成15・16年度修復事業



品名：和歌浦蒔絵十種香箱
所蔵：ピーボディ・エセックス博物館（1924年収蔵）

ピーボディ・エセックス博物館所蔵

和歌浦蒔絵十種香箱

松本達弥

1．概要

資料名称　和歌浦蒔絵十種香箱
所　　蔵　ピーボディ・エセックス博物館（1924年収蔵）
時　　代　江戸時代（17～18世紀）
法　　量　23.1×19.4×18.9
修復期間　平成15年６月～平成17年３月

2．形状、技法

方形、印籠造りの二段重ねの香箱（図１）で、蓋と身の角を唐戸面に仕立てる。内部には、香盤・香炉・香合・香包・雲母板・沈割道具・香箸・鷺の刷毛・道具立て・香札入れ・菊盤・巻子などが揃っている。

箱の表面には、万葉集にもよまれた、古来の景勝地である和歌浦の図を描く。蓋裏には、三羽の鶴に波頭と笹文様が描かれている（図３）。

表面全体を黒漆塗りし、波頭、洲浜、山などを研出蒔絵、松、雲、洲浜、岩山、神社などを薄肉高蒔絵に付描を加えて表現している。雲、洲浜、岩山には、切金を置きアクセントを付けている。

図１　全景　修復前
Incense Box, before restoration

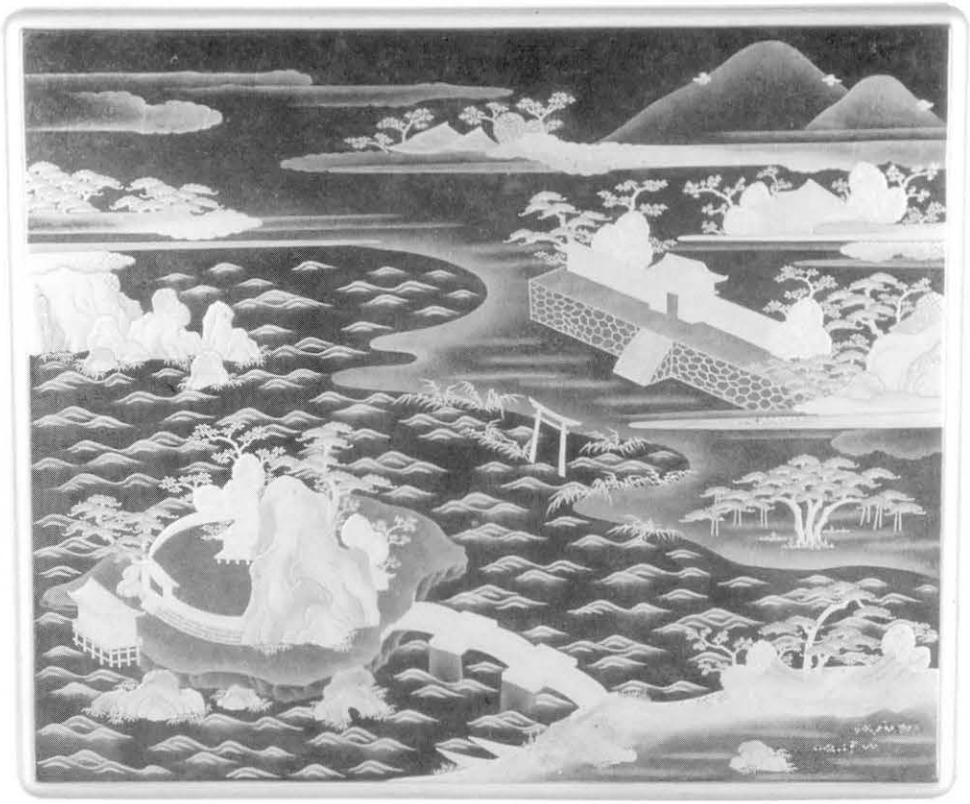


図2　蓋甲板　修復前
Top board of the lid, before restoration

3．損傷状態

・箱は長年、紫外線の入る場所に展示されていたらしく、甲板（図2）と正側面そして左右側面の漆塗膜の劣化が激しく、壁側に置かれていたと思われる面は劣化が少ない。
・身の上段は前後が逆さに長年展示されていたと思われ、正しい方向に直すと蓋と身の下段の漆塗膜の劣化状態に違いがある（図4・5）。
・箱の表面には、艶出しのために塗った塗料が劣化して黄色く変色し、塗膜には細かな断文が入り艶のない状態である。

図3　蓋裏　修復前
Underside of the lid, before restoration

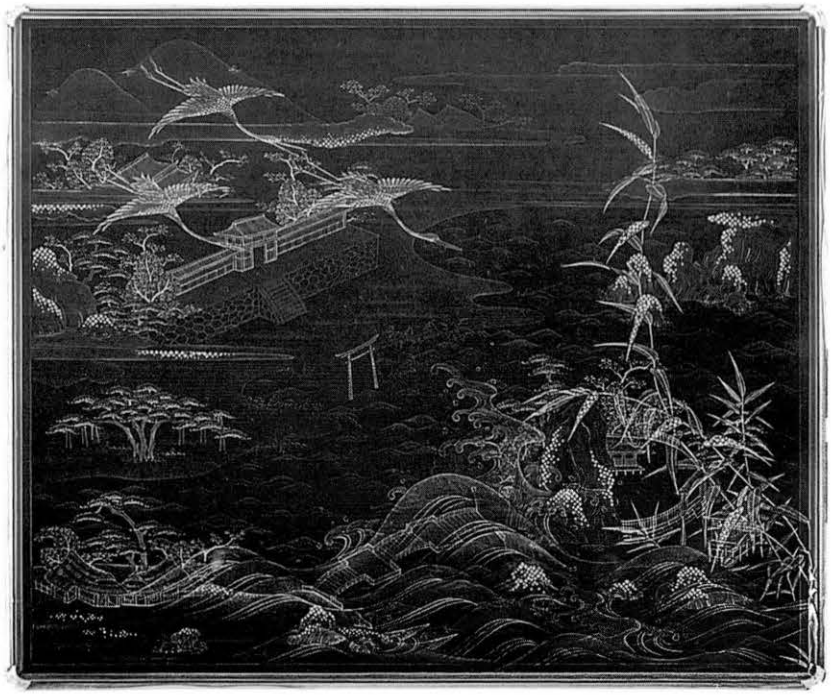


図27　デジタルX線透過写真
X-ray radiograph

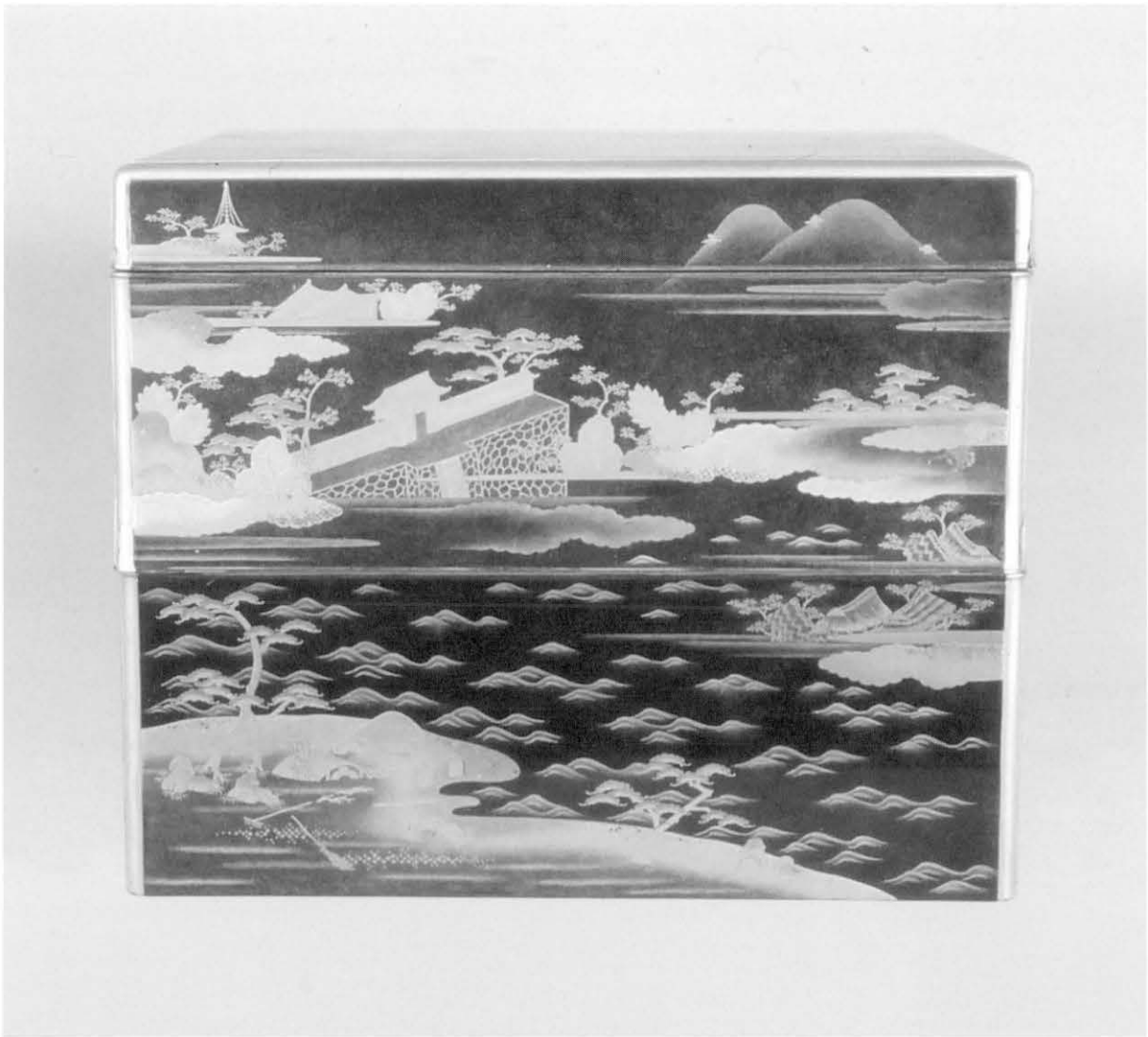


図4　正側面　修復前
Front, before restoration

図5　右側面
Right side, before restoration

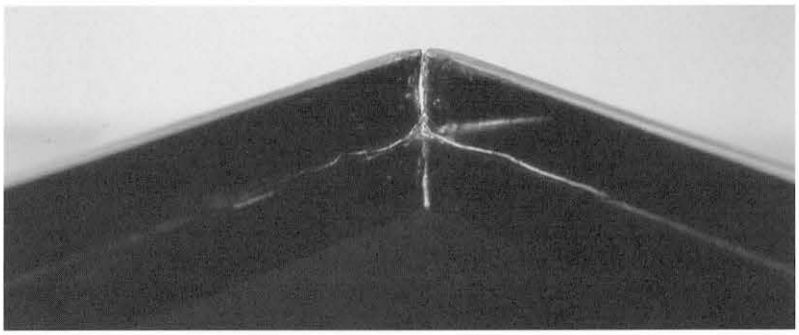


図６　身の上段内側　亀裂部分
Corner of the upper tier of the body seen from the inside, cracked portion

図７　身の上段角　亀裂部分
Corner of the upper tier of the body seen from the outside, cracked portion

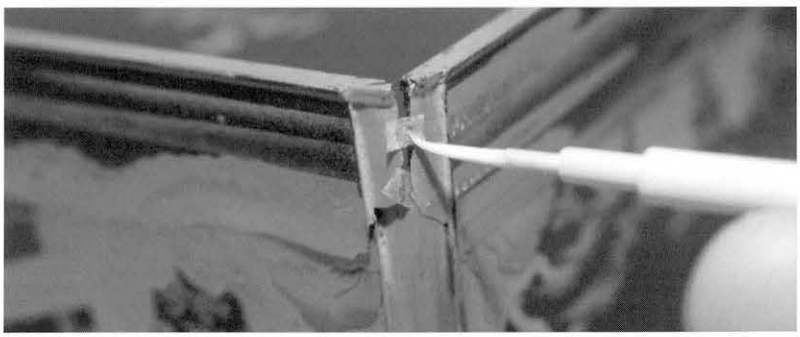


図８　仮り止め養生
Temporary facing

・蓋の側面角には、木地接合部と思われる箇所に亀裂が入り（図６・７）、後世修理で直された形跡がある。
・身の上段の正面左側角には、大きな亀裂が入り２㍉程透間が開いている。亀裂は角から側面に広がり、木地が反り返って拡大する恐れのある危険な状態である。この亀裂部分は後世修理されていた。
・身の下段角の玉縁及び立上り部分には打損による欠損がある。
・身の下段の内側見込み部分には、木地の接ぎ合わせ部分と思われる箇所に8㌢程の亀裂がある。
・身の上段の側面には、後世修理時に付いた指紋の跡がある。

4．修復仕様

修復は現在、文化庁の指導の下に行われている漆工文化財保存修復に則り、原則として現状維持修復を基本に行った。

5．修復工程

〈調査及び写真撮影〉

香箱（以後、本資料と呼ぶ）の構造、下地、加飾と現状の傷みを調査記録し、修復前と修復後の比較が出来るよう写真撮影を行った。

〈仮止め養生〉

本資料の亀裂部分の周辺塗膜は、剥落する恐れのある危険な状態にあるため、細かく切った雁皮紙を生麩糊にて仮止め養生し作業中の剥落を防止した。(図８)

〈クリーニング〉

クリーニングは、資料表面を覆っている挨は毛棒で取り去り、僅かに水分を含ませた木綿布にて汚れを除去した。

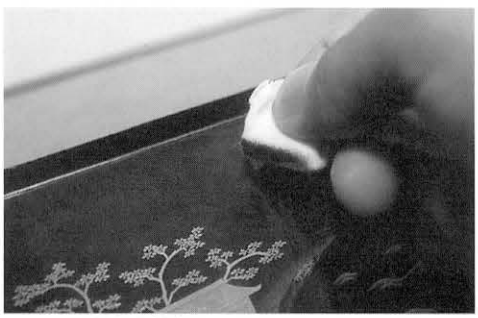


図９　塗料除去作業
Removing deteriorated restoration material from the coating film

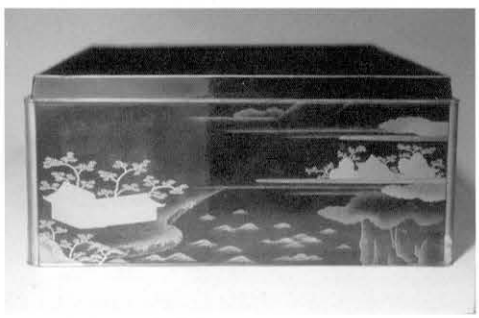


図10　塗料除去作業中
Object before and after the removal of deteriorated restoration material (left－after removal; right－before removal)

〈劣化塗料の除去〉

本資料は、艶のなくなった漆塗膜の復元のために塗られた塗料が劣化し、塗膜表面が黄色く変色していた。表面の漆塗膜には細かな断文があり、強い溶剤を使うと蒔絵部分に影響を与えるため、極力弱い溶剤を試してみた。結果、純水だけでは反応がなく、純水に少量のエタノールを加えただけで塗料は解けだした。従って、塗料の除去は綿布に少量の純水とエタノールを含ませて行った。(図９・10)

紫外線の影響が強い塗膜面は、塗料と漆塗膜がドロドロに解けてしまい、蒔絵部分の金粉が剥き出し状態にあったため、劣化塗料の除去は細心の注意を払い行った。

〈加湿による木地強制〉

本資料の角部及び塗膜の亀裂は、乾燥による木地の収縮が原因であると推測できるため、資料全体を加湿保存し柔軟性を取り戻す作業が必要になった。本資料を加湿した小箱に長期保存し、木地が柔軟になってから端金で微力の圧力をかけて強制し、反り返った部分を戻す作業を行った。木地強制は、一歩間違えると木地構造を崩壊する恐れがあるため少しずつ慎重に行った結果、作業は２ヵ月に

及んだ。

〈漆固め〉

表面塗膜に塗られた塗料を溶剤で除去したところ、一部分の漆塗膜は紫外線による劣化が激しく、艶の無い状態であった。特に身の上段の左側面は、黒漆地に薄蒔きされた金粉が辛うじてくっついている危険な状態であった。

漆固めは塗膜表面の細かな断文に漆を含浸し、塗膜強化と艶を取り戻す為に行った。漆固めに使用した漆は、木地呂漆＋梨子地漆＋生正味漆を５対４対１の割合で配合し、石油系溶剤のクリンソルＧで４倍に希釈し平筆で塗膜の断文に染み込ませた。塗膜の状態によって配合する漆の分量や溶剤の希釈濃度を変え、８～10回程度漆固めを行った。この際、含浸した漆は断文に吸わせるだけにして、切金や高蒔絵部分には残留の無いよう丁寧に溶剤で拭き取った。なお、塗膜の劣化が少ない部分は２～３回程度の漆固めに留めた（図11）。

〈亀裂部分の圧着〉

亀裂部分の接着は、反り返った塗膜を接着するため強力な接着剤が必要となった。接着剤は、グルテンの量を多くした小麦粉に生正味漆を練り合せ、接着力の強い麦漆を使用した（図12）。

蓋及び身の上段角部分の亀裂は、四角に及んでいたため同時に作業する必要があった。圧着は本資料を木枠内に固定して、竹ひごの弾力を利用した芯張り技法で行うことにした（図13・14）。

本資料の木地は非常に薄く造られているため、竹ひごの圧力を掛け間違えると木地が崩壊する危険性があった。木地構造を充分考慮し、竹ひごで押さえる位置や圧力の強さに配慮しながら圧着作業をすすめた。圧着状態を３週間ほど維持し、麦漆が完全に乾き絞まるのを待って本資料を木枠から外した。

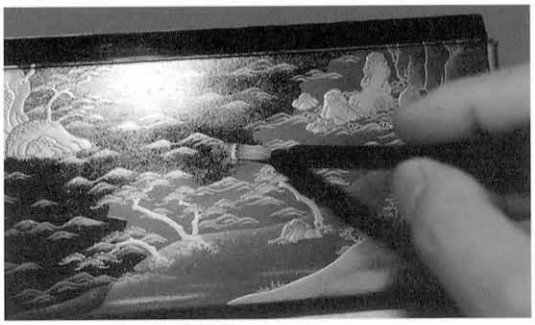


図11　漆固め（塗膜強化）
Urushi-gatame (reinforcement of the coating film)

図12　麦漆含浸
Impregnating *mugi-urushi*

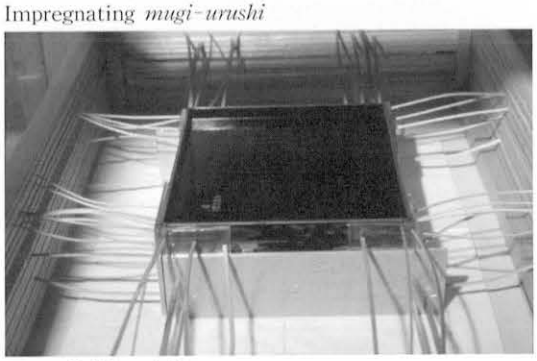


図13　芯張り　圧着
Press-stabilizing with *shimbari* sticks

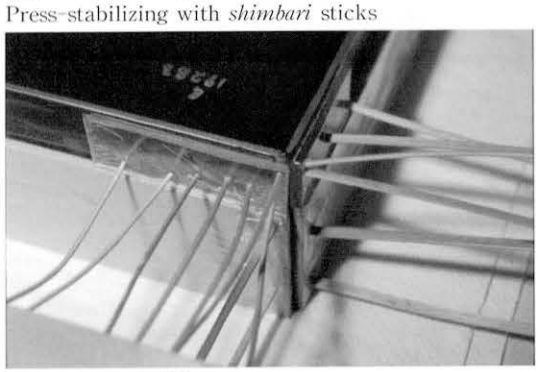


図14　芯張り　圧着
Press-stabilizing with *shimbari* sticks

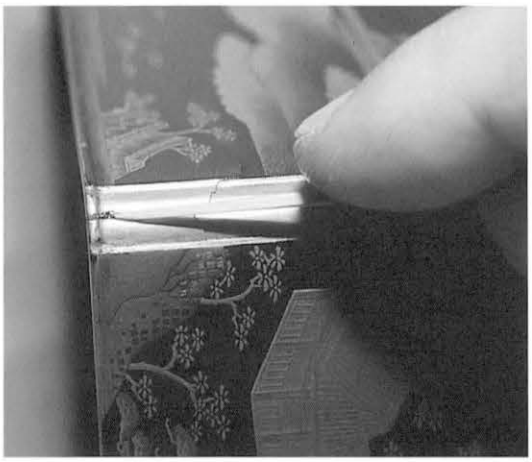


図15　刻苧充塡
Filling with *kokuso*

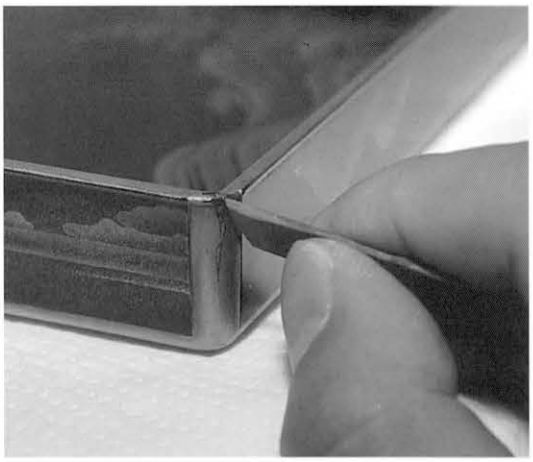


図16　刻苧付け部分　研ぎ
Grinding *kokuso* part

図17　際錆及び金錆
Applying *kiwasabi* using gold *sabi*

〈欠損部形状復元〉

塗膜の欠失した部分は、刻苧で形状復元を行った。刻苧は、刻苧用に調整した麦漆に楠材の木粉と麻の繊維を細かくした粉を混ぜ合わせ、珪藻土を焼いた地ノ粉を加えて作り、欠損部の形状が整うまで数回充塡し復元を行った。形状復元した部分は、砥石や鑢で刻苧肌を整えた（図15・16）。

〈際錆及び漆固め〉

形状復元した部分や亀裂部分には、手擦れや再剝落を防ぐため際錆を施した。漆塗膜が黒漆塗りの損傷部分の際錆は、呂色漆と生正味漆を混ぜた呂瀬漆に、微粒子の地ノ粉（輪島四辺地地ノ粉）を混ぜ合わせた錆を使用した。

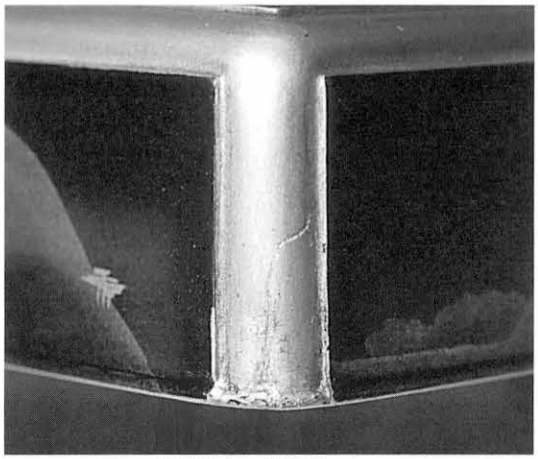


図18　亀裂部分　修復前
Cracked portion, before restoration

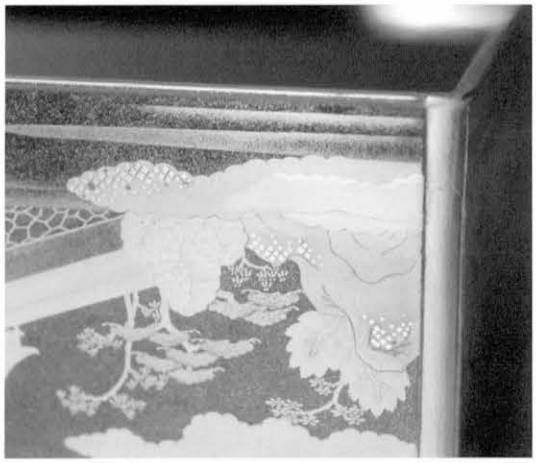


図19　亀裂部分　修復後
Cracked portion, after restoration

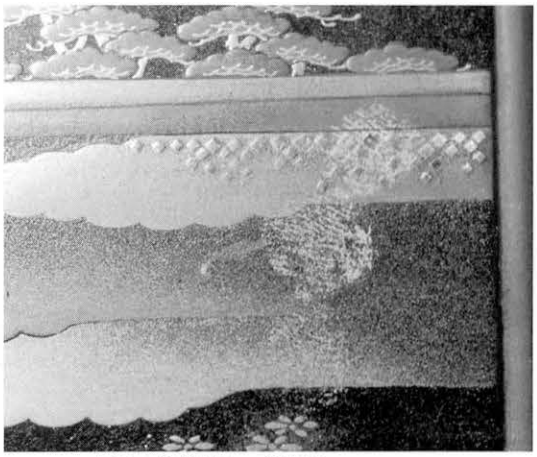


図20　亀裂部分　修復前
Cracked portion, before restoration

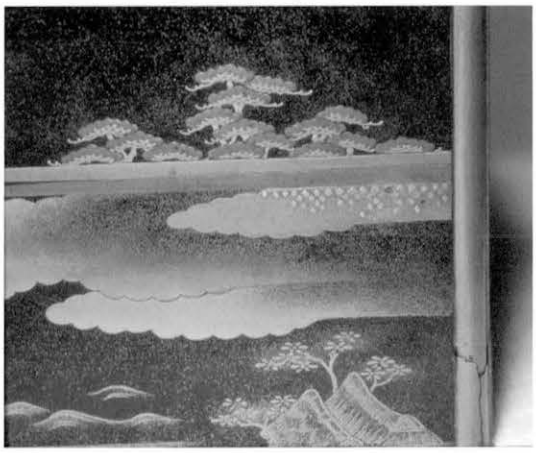


図21　亀裂部分　修復後
Cracked portion, after restoration

蒔絵の損傷部分の際錆は、木地呂漆と梨子地漆に微粒子の黄砥の粉（砥の粉を水簸して作った粉）と数種類の金粉を混ぜ合わせた金錆を施し、亀裂部分を目立たなくした（図17）。

塗膜表面の強化と修復をした部分の漆固めとして、生正味漆と木地呂漆を混ぜ合わせて溶剤で希釈し漆固めを行った。また、高蒔絵部分は、木地呂漆と梨子地漆を混ぜ合わせて漆固めを行い、付描の際などに余分な漆が残らないよう丁寧に拭きとった。

〈損傷部分の蒔絵復元〉

金錆を施した損傷部分をより目立たなくするため、金消粉で金地復元を行った。損傷部分に梨子地漆を薄塗りし、漆の乾きを待って真綿で金消粉を施した。なお、金消粉を施すだけでは目立ちすぎるため、梨子地漆を数回復元した部分に漆固めを行い、周辺塗膜との調和をとった。

図22　全景　修復後
Incense Box, after restoration

図23　正面　修復後
Front, after restoration

図24　左側面　修復後
Right side, after restoration

〈保存箱の制作〉

本資料の修復を終え、今後の保存環境によっては修復箇所が新たに損傷する危険性があるためと、永く後世に伝えるために保存用桐箱を新調した（図18～21）。

本資料の中には内容品が納められていて、長年収納していると重量が掛かり、損傷の原因になる恐れがあるため保存は本体と内容品を分けた収納を考えた。また、保存箱の下段には、調湿効果のあるアート・ソープ（湿度65%設定）を収納できる構造にした。保存箱は、桐製の慳貪箱とし、制作は会津の板物木地師の大塚隆氏に依頼した（図25）。

〈記録及び写真撮影〉

修復工程及び分析の記録をまとめ、修復後の撮影を行い全ての工程を終えた（図22～24）。

図25　桐製保存箱内部
Paulownia box for storage, inside

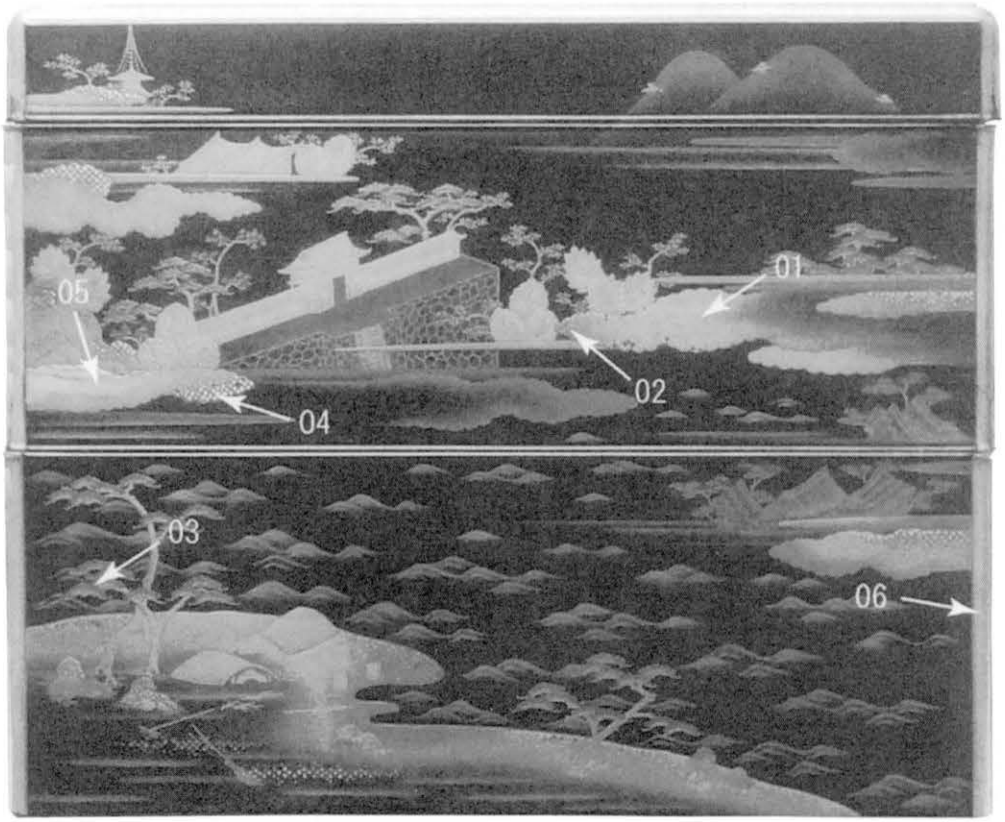


図26　蛍光X線測定位置
X-ray fluorescence, measuring points

和歌浦蒔絵十種香箱の蛍光X線分析結果

測定箇所	蛍光X線強度（cps）				化学組成（wt.%）		
	鉄	銅	銀	金	金	銀	銅
	Fe-Kα	Cu-Kα	Ag-Kα	Au-Lβ			
01　雲	21.3	11.0	0.2	121.2	97	1	2
02　雲	30.4	32.2	5.9	126.7	74	21	5
03　松の枝	26.5	39.2	6.0	131.4	74	20	6
04　切金	9.9	13.1	3.5	227.4	90	9	1
05　雲　補修	56.7	0.3	0.3	92.1	98	2	0
06　唐戸面	50.3	16.9	0.2	113.2	96	1	3

〈分析〉

修復と平行して蒔絵粉の蛍光X線分析と、木地構造の確認のためデジタルX線透過撮影を行った。尚、蛍光X線分析は、東京文化財研究所の早川泰弘氏、デジタルX線透過撮影は同研究所の三浦定俊氏に依頼した。

(蛍光X線分析)

本資料には数種類の蒔絵粉と金属材料が使われている。そのうち、雲、松の枝、切金、唐戸面、そして雲部分にある後世修理箇所について蛍光X線分析を行った。

・雲

雲部分には、異なる2種類の蒔絵粉が蒔かれている。先端部分に蒔かれた粉は、Au74%、Ag21%、Cu5%程度の組成で、所謂、青金粉が使われている。この粉は、波、岩山、州浜、松などにアクセントとして使われている。

・松の枝

松の枝部分に蒔かれた粉は、雲の先端部分に蒔かれた粉とほぼ同じ青金粉である。

・切金

分析の結果、金に10%程度の銀が含まれていることが確認された。現状の切金は、少し赤味がかった色をしていることから、金に含まれた銀の錆化によるものと思われる。

・雲の後世修理部分

分析の結果、金の純度はオリジナルの金に近いが、銅が全く含まれていないことから異なる材料である。修復の際、オリジナルの蒔絵粉を除去し、新たに蒔絵したと推測できる。

・唐戸面

雲部分に使われた丸粉と違い、粒子の細かな粉（消粉）が使われているが化学組成はほぼ同じである。

（デジタルＸ線透過撮影）

本資料の木地構造の確認のためデジタルＸ線透過撮影を行った結果、木地の材質、構造、布着せなど幾つかの情報が得られた。

・Ｘ線写真から本資料に使われた素地は、針葉樹の柾目取りした材が使われている。また、亀裂部分からの観察で木目や木質から、木地の材質は檜材と類似している。
・蓋の甲板及び身の底板は、柾目材を４枚接ぎ合わせて造られている。
・蓋、身の側面角の唐戸面の木地構造は、三角形の材を内側角に張り付けて補強した平留接ぎで組み立てられている。
・身下段の底板は、側板に嵌め込んだ構造である。
・蓋の甲板部分の木地厚は、約５ミリ、側板は約1.5ミリ、側面角（唐戸面）は約１ミリである。
・蓋は、甲板部分から側面にかけて布着せし、内側には布着せされていない。
・身の上段は、立上りから側面にかけて布着せされているが、内側や底裏には布着せは無い。
・身の下段は、立上りから側面、そして底裏にかけて布着せされているが内側には布着せは無い。

On the Restoration of "Wakaura *Makie* Incense Box" in the Collection of the Peabody Essex Museum

MATSUMOTO Tatsuya
Urushi Conservator／Artist

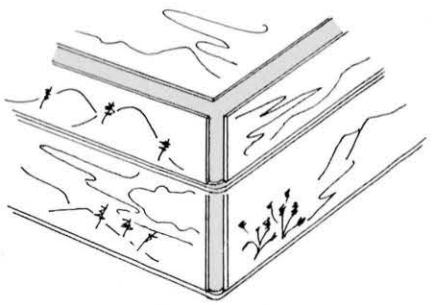
Name of the object: "Wakaura *Makie* Incense Box"
Owner: Peabody Essex Museum
Date of manufacture: Edo period (17-18th century)
Dimensions: 23.1 x 19.4 x 18.9
Period of restoration: June 2003－March 2005 (1 year and 10 months)

Description

The Incense Box (hereafter, "the object"; Fig. 1) is a two-tiered box rectangular in shape with an inro-style* lid used to contain incense and items for an incense identification game. The edges of the body and lid are made in *karatomen*-style*. Accompanying the incense box are a game board, incense burner, incense container, incense wrapper, mica, tools for preparing incense, a pair of tweezers for picking up incense, feather used as a brush, a stand for tools, a holder for incense cards, a scroll with a list of contents, and other items.

***Inro*-style**: In an *inro*-style, the inner side of the upper edge of the body is raised (*tachiagari*) so that it fits snugly into the lid.

Karatomen:
recessed convex beveled edge
(Shaded area on the illustration)



The landscape of Wakaura, a traditionally well-known place of scenic beauty that appears in "Manyo-shu," a collection of ancient Japanese poems, is depicted on the entire surface of the body. On the under face of the lid are three cranes, waves and a bamboo motif (Fig. 3).

The entire surface of the box is coated with black urushi. The waves, mountains and some of the beaches are depicted with *togidashi makie* while the pine trees, clouds, other beaches, rock and the shrine are expressed with *tsukegaki* on thin *takamakie*. *Kirikane* is used to accent the clouds, beaches and rocks.

Condition of Damage

- It seemed that the object was exhibited for a long time in a place where it was exposed to ultraviolet rays. For this reason, the urushi coating film of the top board (Fig. 2), the front board, and the left and right side boards had deteriorated severely, while the side which seemed to have been placed on the side of the wall had not deteriorated so much (Figs. 4, 5).
- It seemed that the upper tier had been exhibited with the front and the back misplaced so that when this mistake was corrected the condition of deterioration did not match those of the lid and the lower tier.
- The coating material on the surface of the object, which had been applied to give luster in a previous restoration, had deteriorated and yellowed. The coating film had lost its luster because microcracks had formed.
- There were cracks on each corner of the lid where the substrate seemed to have been joined. There was evidence that these cracks were restored in the past.
- There was a large crack on the front left corner of the upper tier of the object causing a gap of approximately 2mm. This crack extended from the corner to the side and there was a great risk of the substrate warping and the crack extending further. This crack had also been restored (Figs. 6, 7).
- Some parts of the edge on the lower tier had been lost due to impact.
- There was a crack approximately 8cm on the inside bottom of the lower tier where the pieces of wood had been joined to make the substrate.
- There was a fingerprint on the side of the upper tier, which seemed to have been made during a past restoration.

Restoration Specifications

Restoration was conducted in accordance with the principle of the maintenance of the present condition, which is the principle advocated today by the Agency for Cultural Affairs for the restoration of designated urushi art objects.

Restoration Processes

1. Preliminary investigation and documentation

The structure, foundation, decorations and the present condition of damage were investigated and documented. Photographs were taken so that the object may be compared before and after restoration.

2. Facing

Since the coating film surrounding the cracks was in danger of being dislodged, it was temporarily faced by using thinly-cut strips of *gampi* paper adhered with wheat starch paste in order to prevent it from becoming detached during restoration (Fig. 8).

3. Cleaning

Dust covering the surface of the object was brushed off and dirt was removed with a cotton cloth slightly moistened with water.

4. Removal of the deteriorated coating material

The coating material that had been applied to the object in a previous restoration to restore luster to the original coating film had deteriorated, causing the surface to become yellowish. There were microcracks that could not be seen with the naked eye on the surface coating film. Since the use of a strong solvent would affect the *makie* decoration, comparatively weak solvents were tested. It was found that pure water alone was not effective; when a small amount of ethanol was added to pure water, the coating material began to dissolve. So a cotton cloth moistened with a mixture of water and ethanol was used to remove the coating material.

On the part of the object where the urushi coating film on the surface had been severely affected by ultraviolet rays, not only the coating material but also the urushi coating film began to dissolve, causing the gold powder of the *makie* to become exposed. The greatest of care was taken to remove the deteriorated coating material (Figs. 9, 10).

5. Reinforcement of the substrate by humidification

Since it was assumed that the cracks on the corners of the object and on the coating film were due to the shrinkage of the substrate caused by the object having been stored in a low relative humidity environment, it became necessary to humidify the object in order for the substrate and the coating film to regain flexibility. For this reason, the object was placed in a gradually humidified box for about 2 months until flexibility returned. Then a very small amount of force was applied with a clamp in order to return the warped portion to its original position. Because this is a measure that can damage the structure of the substrate even with the slightest mistake, special care had to be taken.

6. *Urushi-gatame*

After removing the yellowed restoration coating material, it was found that a part of the urushi coating film had been severely damaged by ultraviolet rays and had completely lost its luster. The left side of the upper tier of the body, in particular, had been so damaged that the thinly sprinkled gold powder design was barely attached to the black urushi underneath.

Urushi-gatame was done by impregnating urushi into the microcracks on the urushi coating film in order to reinforce it and to return a little luster to it. For this process, *kijiro urushi, nashiji urushi* and *kijomi urushi* were mixed at a ratio of approximately 5 : 4 : 1. This was then diluted four times with a petroleum-based solvent, Cleansol G. A flat brush was used to apply this to the microcracks. The amount of urushi and the degree of dilution were adjusted according to the condition of the coating film. *Urushi-gatame* was repeated 8 to 10 times. It was made sure that the impregnated urushi would be absorbed into the microcracks only, and excess urushi was carefully wiped off with a solvent so that none would remain on the *kirikane* or the *takamakie* decorations. *Urushi-gatame* was done only 2 to 3 times on places where the coating film had not

deteriorated so much (Fig. 11).

7. Press-stabilization of the cracked parts

A strong adhesive was necessary in order to adhere the coating film that had become warped around the cracks. For this, wheat flour with more gluten was kneaded with *kijomi urushi* to make *mugi-urushi* having stronger adhesiveness (Fig. 12).

Since cracks had been found on all four corners of the lid and the upper tier, it was necessary to work on all these at the same time. It was decided to place the object in a wooden frame and to use the flexibility of bamboo *shimbari* sticks in order to press-stabilize (Figs. 13, 14).

Since the substrate of the object is very thin, there was a danger of damaging the substrate if force was applied wrongly to the bamboo sticks. So the structure of the substrate was carefully considered as was the placement of the bamboo sticks and the degree of force applied. Press-stabilization was continued for about 3 weeks and the object was removed from the wooden frame only after the *mugi-urushi* had hardened completely.

8. Reproduction of the missing parts

Parts of the coating film that had been lost were reproduced with *kokuso*. *Kokuso* was made by mixing camphor wood sawdust and finely cut hemp fibers to *mugi-urushi* adjusted for *kokuso* and adding *jinoko* (baked diatomaceous earth). *Kokuso* was applied in several thin layers to the missing parts until the original shape was reproduced. The reproduced portions were finished with a whetstone or a file (Figs. 15, 16).

9. *Kiwasabi* and *urushi-gatame*

Kiwasabi was applied to the parts where the shape had been reproduced and into the cracks in order to prevent abrasion and re-detachment. *Kiwasabi* on parts where black urushi had been used as coating film was made by mixing very fine *jinoko* (*Wajima yonhenji jinoko*) to *rose urushi* (a mixture of *roiro urushi* and *kijomi urushi*)

Sabi for *kiwasabi* for damaged portions of *makie* was made by mixing very fine yellow *tonoko* and several kinds of gold powder so that the restored portions would not be conspicuous (Fig. 17).

A mixture of *kijomi urushi* and *kijiro urushi* that was diluted with a solvent was used to reinforce the surface of the coating film and to consolidate the restored portions. To consolidate the *takamakie*, a mixture of *kijiro urushi* and *nashiji urushi* was used. Excess urushi was carefully wiped off so that it would not remain on the *tsukegaki*.

10. Reproduction of the *makie* on the damaged portions

In order to make the restored portion where gold *sabi* had been applied less conspicuous, gold *keshifun* was sprinkled. For this, *nashiji urushi* was applied very thinly to the restored portions, and a type of gold powder called *keshifun* was applied with silk floss just before the urushi hardened. Since gold *keshifun* alone would be too conspicuous, *nashiji urushi* was used several times to consolidate the restored portions and to match these portions with the surrounding

coating film (Fig. 18, 19, 20, 21).

11. Manufacture of a storage box

Once the restoration of the object was completed, a paulownia box was made to store the object in since there is a possibility that the restored portions may be damaged anew because of future storage environment. The box was also made because it is hoped that the object may be passed down to future generations. It was feared that the many items kept in the Incense Box might cause damage because of their weight. So it was decided to store these items separately from the Box. The lowest shelf was made in such a way that a humidity controlling agent, Art Sorb (65% RH) may be placed. The storage box was made of paulownia with a *kendon*-style* door by Mr. Otsuka Takashi of Aizu (Fig. 25).

> ***Kendon* -style**: The door sits within a rebate in the frame and can be removed by lifting it upwards into a recess which is slightly deeper than the one at the bottom, then pulling it outwards with the aid of a fabric or built-in handle.

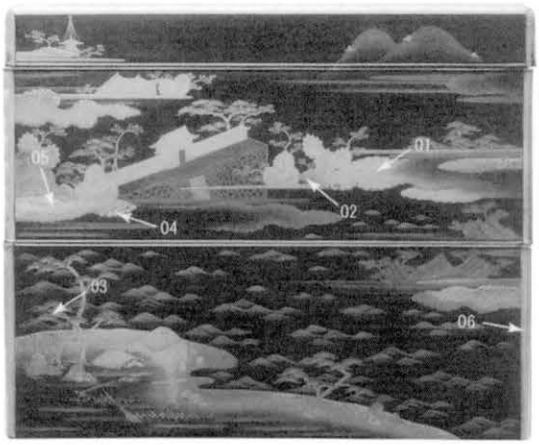
保存箱
A storage box with a *kendon*-style door

Documentation and photographing

Restoration processes and technical analyses were documented and photographs of the object after restoration were taken (Figs. 22, 23, 24).

X-ray Fluorescence Analysis of the "Wakaura *Makie* Incense Box"

Measuring points
Fig. 26



Results of X-ray fluorescence analysis of the "Wakaura *Makie* Incense Box"

Measuring points	X-ray fluorescent intensity (cps)				Chemical composition (wt.%)		
	Iron	Copper	Silver	Gold	Gold	Silver	Copper
	Fe-Kα	Cu-Kα	Ag-Kα	Au-Lβ			
01 Cloud	21.3	11.0	0.2	121.2	97	1	2
02 Cloud	30.4	32.2	5.9	126.7	74	21	5
03 Branch	26.5	39.2	6.0	131.4	74	20	6
04 *Kirikane*	9.9	13.1	3.5	227.4	90	9	1
05 Cloud (restored)	56.7	0.3	0.3	92.1	98	2	0
06 *Karatomen*	50.3	16.9	0.2	113.2	96	1	3

Analysis

At the time of restoration, X-ray fluorescence analysis of the *makie* powder was conducted and X-ray radiographs were taken to reveal the structure of the substrate. X-ray fluorescence analysis was conducted by Hayakawa Yasuhiro of the National Research Institute for Cultural Properties, Tokyo and X-ray radiography by Miura Sadatoshi of the same Institute.

X-ray fluorescence analysis (Fig. 26)

Several kinds of *makie* powder and metals were used in the manufacture of the object. Of these, X-ray fluorescence analysis was conducted of the materials used on the clouds, branches of pine trees, *kirikane* decoration, *karatomen*, and a trace of past restoration found on a cloud.

- Clouds

  Two different kinds of *makie* powder were used to create the clouds. Gold powder same as that used today for *makie* was used mainly for the clouds (01). *Aokin* powder was used on the tips of

the clouds (02); its composition is approximately 74% Au, 21% Ag and 5% Cu. The same powder was also used to accent the waves, rocks, beaches and pine trees.

- Branches of pine trees

  Aokin powder almost similar to that used on the tips of the clouds was used on the branches of pine trees.

- *Kirikane*

  XRF analysis confirmed that the gold *kirikane* contains approximately 10% silver. Since the color of the *kirikane* today is slightly brownish, it is believed that this is due to the oxidation of the silver contained in the gold alloy.

- Previously restored part on a cloud

  XRF analysis showed that the purity of gold used in the restoration is very close to that of the original gold decoration, but because there is no trace of copper it is different from the original. It is assumed that the original *makie* powder was removed at the time of a previous restoration and sprinkled with new powder.

- *Karatomen*

  Unlike the *marufun* gold powder used on the clouds, the *makie* powder on this part is *keshifun* having fine particles, but their chemical composition is quite similar.

X-ray radiography (Fig. 27)

In order to confirm the structure of the substrate, X-ray radiographs were taken of the object. As a result, some information concerning the type of wood, structure of the substrate and the use of *nunokise* was obtained.

- X-ray radiographs showed that a straight-grained coniferous wood was used for the substrate of the object. Observation of the wood grain and quality of wood as seen from the cracked parts showed that it is very similar to cypress.
- The top board of the lid and the bottom board of the body are respectively composed of four pieces of straight-grained wood joined together.
- The corners of *karatomen* along the edges of the lid and the body were reinforced by attaching triangular pieces of wood on the inner side.
- The bottom board of the lower tier of the body was fitted into the side boards.
- The thickness of the top board of the lid is approximately 5mm, that of the side boards is approximately 1.5mm, and that of the edges along the sides (*karatomen*) is approximately 1mm.
- *Nunokise* was applied from the top board of the lid to its sides, but not on the underside.
- On the upper tier of the body, *nunokise* was applied from the *tachiagari* (riser portion of the body) to the sides, but not on the inside of the underside of the bottom.
- On the lower tier of the body, *nunokise* was applied from the *tachiagari* to the sides and on the underside of the bottom board but not on the inside.

Technical Terms

Tsukegaki 付描
A type of *makie* decoration technique in which details in the design are depicted by using *hiramakie* (flat *makie*) on top of other decorations.

Kirikane (*kirigane*) 切金
A technique used much in combination with *takamakie* (raised *makie*) to depict moss on sandy beaches or embankments. Thin metal foils are cut into regular shapes and glued into place with urushi. Then *makie* is applied and the whole surface is abraded and polished.

Kijiro urushi 木地呂漆
Translucent urushi made by removing water from raw urushi in a process known as *kurome* and stirring the urushi in a process called *nayashi*.

Nashiji 梨地
A type of *makie* decoration technique made by sprinkling *nashiji* powder on thinly coated urushi, covering it with *kijiro urushi* and abrading (*togi*) and polishing (*migaki*) the surface after it has dried. It is so called because its surface resembles that of *nashi* (a Japanese pear).

Makie 蒔絵
Traditional way of decorating urushiware. Motifs are drawn with urushi on the surface and *makie* powder is sprinkled before the urushi has hardened.

Takamakie 高蒔絵
A type of *makie* decoration technique in which urushi or urushi foundation material is used to raise designs. Gold or silver powder is sprinkled on the surface to highlight the designs.

Keshifun 消粉
The finest *makie* powder. Metal leafs are kneaded into thick malt syrup and pulverized. Then the mixture is dissolved in water and the powder is taken out. *Keshifun* is used for marking the rough outline of a *makie* design (*okime*) or in *keshifun makie*. *Keshifun* cannot be polished but it can be burnished with a dog's tooth.

Marufun 丸粉
Makie powder which is globular in shape. *Marufun* comes in several sizes and is used to depict designs.