〔報告〕 Scientific Analysis of Two Christian Lecterns in Portugal: Investigation of Surface Decoration

KOBAYASHI Koji, KAMIYA Yoshimi*,
CHI Chih lien and KURASHIMA Reo

1. Introduction

1-1. Contents and Background of This Report

This article reports on an investigation of the surface decoration of two lecterns used for Mass book reading, that are owned by private individuals residing in Lisbon and have been passed down in Portugal. The objects investigated are a *makie*- and mother-of-pearl-decorated Nanban lectern with a pine tree motif (Figure 1; hereinafter referred to as "Lectern (1)") and a gold-leaf (foil) and mother-of-pearl-decorated Luso-Asian Nanban-style lectern bearing the IHS insignia and Chinese inscriptions (Figure 2; hereinafter "Lectern (2)").

Both lecterns were transported to Japan in January 2024 and investigated at the Tokyo National Research Institute for Cultural Properties (hereinafter "Tobunken"), as well as at other institutions. This article constitutes the second part of an investigation report, following the study of the wooden substrates of the lecterns published in the same journal (No. 64) in the previous issue. For details regarding the background of the investigation, please refer to that report.[1)]

Fig. 1 Nanban lectern: Lectern (1) @Ichiro Nakamura

Fig. 2 Luso-Asian Nanban-Style lectern: Lectern (2) @Ichiro Nakamura

*Meiji University

1－2. Purpose of the Investigation

Nanban lecterns, which were likely produced in Kyoto and exported during the first half of the 17th century, are typically decorated with the Jesuit IHS insignia at the center of the backboard. In contrast to this common feature, Lectern (1), dating to the 1630s —a period when Christianity was strictly prohibited by the Tokugawa shogunate— exhibits a circular lacquer re-coating with a pine tree motif applied over the location where the insignia would normally appear. X-ray computed tomography (CT) has confirmed that traces of the original IHS symbol remain beneath the re-coating,[2] suggesting that the modification was intended to completely erase Christian symbols and to present the object as a non-Christian item. To substantiate this hypothesis, however, it was necessary to determine whether the re-coating was applied in Japan prior to its export overseas.

Meanwhile, Lectern (2), believed to have been produced in the early 17th century and classified as a Luso-Asian Nanban-style object, is a rare example bearing inked Chinese inscriptions on both sides of its wooden substrate. The two inscriptions include the characters "澳門," meaning Macau, indicating that the lectern was decorated in Macau, within the Guangdong region.[3] Based on this evidence, Lectern (2) serves as a benchmark for Luso-Asian Nanban-style objects, making detailed information on their decorative materials and techniques particularly significant. Such data for both lecterns is invaluable not only for understanding these specific objects but also for the conservation and restoration of similar objects distributed worldwide.

This report presents the results of investigations into both lecterns, including analyses of coating materials, decorative techniques, and production processes. The study was based on examinations of the objects themselves, as well as analyses of coating samples collected—with the owners' consent—by Dr. Ulrike Körber during consolidation treatment prior to shipment to Japan.

2. Samples and Analysis Conditions

2－1. Analysis Flow

In this study, a two-stage investigation was conducted consisting of on-site analysis and analysis of collected samples. The overall flow of the analysis is illustrated in Figure 3.

The on-site analysis (Section 3-1) involved a nondestructive investigation conducted directly on the lecterns themselve to obtain information on their surface condition and elemental composition while minimizing physical intervention. This was achieved through surface observations using a digital microscope and X-ray fluorescence (XRF) analysis.

The analysis of collected samples (Section 3-2) aimed to clarify the morphology of decorative metal materials. This included observations of the external morphology using a digital microscope, as well as high-magnification observations using a scanning electron microscope (SEM) to determine the shape and size of metal foils and powders.

In addition, to examine the coating structure and material composition, cross-sectional samples were prepared from the selected coating fragments and observed using a fluorescence microscope. Elemental analysis was conducted using an SEM equipped with energy-dispersive X-ray spectroscopy (hereafter "SEM-EDS"). Furthermore, thermally assisted

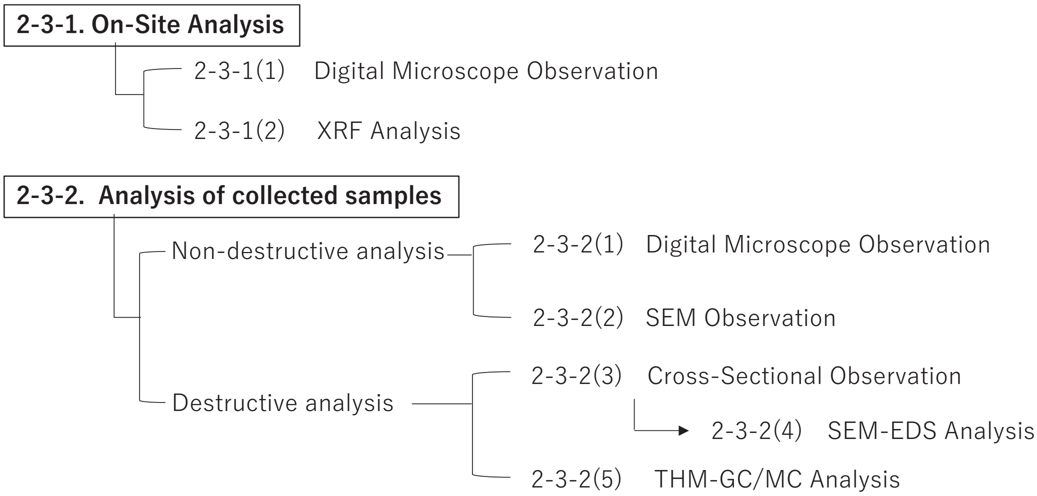

Fig. 3 Analysis flow

hydrolysis and methylation-gas chromatography-mass spectrometry (hereafter "THM-GC/MS") was employed to analyze organic components contained in the minute coating fragments.

2－2. Sampling, Observation, and Measurement Locations

Figures 4 and 5 illustrate the five digital microscope observation points and the nineteen XRF measurement points on each lectern examined during the investigation at Tobunken, as well as the eight sampling locations from which minute coating fragments were obtained by Körber. These locations and points are also summarized in Tables 1-3. The symbols used are as follows: ▲ (triangle, T) denotes the digital microscope observation points; ● (circle, C) represents the XRF measurement points; and ■ (square, S) indicates the sampling locations utilized for digital microscopy, SEM observation, cross-sectional observation, SEM-EDS, and THM-GC/MS analysis.

Fig. 4 Sampling and measurement location on Lectern (1) ▲ (triangle, T) denotes the digital microscope observation points; ● (circle, C) represents the XRF measurement points; and ■ (square, S) indicates the sampling locations utilized for digital microscopy, SEM observation, cross-sectional observation, SEM-EDS, and THM-GC/MS analysis.

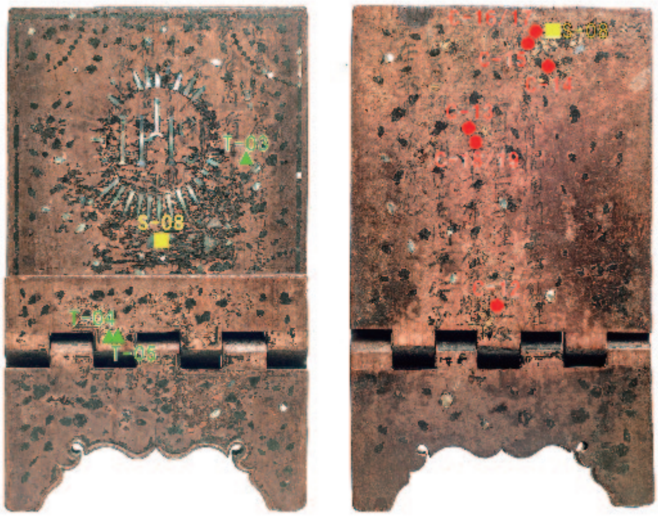

Fig. 5 Sampling and measurement location on Lectern (2) ▲ (triangle, T) denotes the digital microscope observation points; ● (circle, C) represents the XRF measurement points; and ■ (square, S) indicates the sampling locations utilized for digital microscopy, SEM observation, cross-sectional observation, SEM-EDS, and THM-GC/MS analysis.

2−3. Analytical Methods and Measurement Conditions

The instrumentation and analytical conditions used in this study are described below.

2−3−1. On-site Analysis

2−3−1 (1). Digital Microscope Observation

Surface observations were conducted on the lecterns at Tobunken using a digital microscope. The observations were performed with an RH-2000 digital microscope body equipped with an MXB-2500REZ lens (HiROX).

2−3−1 (2). XRF Analysis

To nondestructively determine the elemental composition of the decorative and foundation layers, XRF measurements were conducted using a Bruker ARTAX™ micro-X-ray fluorescence (μ-XRF) analyzer (Rh target, SDD-type detector) installed at Tobunken. Measurements were performed under ambient atmospheric conditions, under which elements lighter than Si are difficult to detect. The measurement conditions were as follows: tube voltage 50 kV, tube current 200 μA, measurement time 30 s per point, and an analysis spot diameter of 100 μm.

2−3−2. Analysis of Collected Samples

2−3−2 (1). Digital Microscope Observation

Surface observation of minute fragment samples was conducted at Meiji University using a VHX-7000 digital microscope (KEYENCE Corporation) equipped with VHX-E20 and VHX-E100 lenses. To compensate for surface height differences, the depth compositional function

Table 1 Observation points for Digital Microscope

Lectern	Sample no.	Point comment
Lectern(1)	Triangle 01	**Re-coated center circle line**
	Triangle 02	**Original** geometric pattern
Lectern(2)	Triangle 03	Mother-of-pearl shell leaf
	Triangle 04	reddish brown leaf
	Triangle 05	Gold foil leaf

Table 2 Measurement locations for XRF analysis

Lectern	Sample no.	Point comment	Color
Lectern(1)	Circle 01	Outer foundation layer (original)	Black
	Circle 02	Cracked foundation layer (original)	Gray
	Circle 03	Central foundation layer (re-coated)	Gray
	Circle 04	Golden line near HIS center (original)	Gold
	Circle 05	Exposed reddish-brown lacquer near HIS center (original; gold peeled)	Red
	Circle 06	Gold *makie* (pine motif) near HIS center (re-coated)	Gold
	Circle 07	Gold *makie* on the back (original)	Gold
	Circle 08	Silver *makie* on the book rest (original)	Gray
	Circle 09	Exposed reddish-brown lacquer on silver makie (book rest, original; gold peeled)	Red
	Circle 10	Silver *makie* on the back (original)	Gray
	Circle 11	Golden line on silver *makie* (back, original)	Gold
Lectern(2)	Circle 12	Foundation layer	Gray
	Circle 13	Black lacquer surface	Black
	Circle 14	Black lacquer surface	Black
	Circle 15	Gold leaf decoration	Gold
	Circle 16	Reddish-brown lacquer leaf decoration	Red
	Circle 17	Golden line on reddish-brown lacquer leaf	Gold
	Circle 18	Mother-of-pearl decoration	White
	Circle 19	Golden line on mother-of-pearl decoration	Gold

Table 3 Samples for various analysis

Lectern	Sample no.	Sample comment	Cross Section	GC/MS	DMS	SEM
Lectern(1)	Square01	Upper panel front, **original** coating, geometrical part, eventually with all layers, but foundation maybe separate	NA	NA	○	○
	Square02	Upper panel front, center black lequer part, possibly all the layers, **Re coated**	○	○	NA	NA
	Square03	Upper panel front, "glue"/lacquer to fix raden, it is dark colored and looks more like lacquer than nikawa, scraped sample. **Original**	NA	NA	○	○
	Square04	Upper panel front, "Gold" paint in **re-coated** circular area, exterior circle collected from top of mothe of pearl fragment	NA	NA	○	○
	Square05	Upper panel front, black lacquer from **re-coated** area.	○	○	NA	NA
	Square06	Lower front panel, **original** gilding	○	○	○	○
Lectern(2)	Square07	Upper panel front (possibly all the coating layers)	○	○	○	○
	Square08	Upper panel backside surface (possibly all the coating layers)	○	NA	○	○

was employed to acquire multiple focused images, which were subsequently combined into composite images.

2 − 3 − 2 (2). SEM Observation

For detailed observation of the decorative metal materials, a tabletop scanning electron microscope (Miniscope TM4000Plus, Hitachi High-Tech) was used. Backscattered electron (BSE) images were acquired from uncoated samples at an accelerating voltage of 15 kV in charge-reduction mode. Observations were conducted at a magnification of 1,000×.

2 − 3 − 2 (3). Cross-sectional Observation

Samples were fixed and embedded in epoxy resin on polypropylene plates, and smooth cross sections were prepared using a microtome (HistoCore MULTICUT R). Cross-sectional images were acquired under epifluorescence illumination using an upright fluorescence microscope (Olympus BX-51) equipped with a mirror unit (filter cube: Olympus U-MWU2).

2 − 3 − 2 (4). SEM-EDS Analysis

Elemental analysis of the coating samples was performed using SEM-EDS (Thermo Scientific Phenom ProX) equipped with a backscattered electron detector. The measurements were conducted in low-vacuum mode (60 Pa) at an accelerating voltage of 15 kV. for 30 s. For the analysis of uncoated samples, data were collected for 30 s at 15 kV, maintaining a count rate exceeding 17,000 cps (counts per second).

2 − 3 − 2 (5). THM-GC/MS Analysis

To identify the type of lacquer contained in the coating fragments, THM-GC/MS was conducted. Measurements were performed using a gas chromatograph-mass spectrometer (Agilent Technologies, 7890A GC system and 5975C inert MSD with triple-axis detector), a pyrolyzer (Frontier Laboratories, Multi-Shot Pyrolizer EGA/PY-3030D), and a capillary column (Frontier Laboratories, Ultra ALLOY$^+$ PY-1, 30 m × 0.25 mm × 0.25 μm). A 1 μL aliquot of 1 M tetramethylammonium hydroxide in methanol solution was added to a minute amount of sample and pyrolyzed at 500℃ under a helium atmosphere. The oven temperature was initially held at 40℃ for 2 minutes, then increased at a rate of 12℃ /min to 320℃ and maintained for 10 minutes. The interface temperature was set to 320℃, and measurements were performed in electron ionization (EI) mode with an ionization voltage of 70 eV.

3. Analysis Results

Following the analytical workflow described in Section 2, the results obtained by each analytical method are presented separately for each lectern.

3－1. On-site Analysis

3－1 (1). Digital Microscope Observation

Lectern (1)

At the T-01 location (Figure 6, left), the circular border line of the central re-coated area located in the upper left portion of Lectern (1) was observed. This area was examined at higher magnification (Figure 6, right). The enlarged image clearly shows a thick golden line composed of fine metallic powder applied to the surface, crossing over the underlying original decorative pattern. A clear difference in texture is evident between this overlying golden line and the underlying original golden area, which appears partially intermixed with reddish-brown regions. The presence of these two distinct decorative metal lines indicates differences in the techniques and materials used, as well as in their periods of application.

The reddish-brown areas observed in the original decorative pattern are attributed to the loss of the overlying gold material due to friction, thereby exposing the underlying reddish-brown lacquer lines. Figure 7 (T-02) shows a close-up image of the original decoration pattern on Lectern (1).

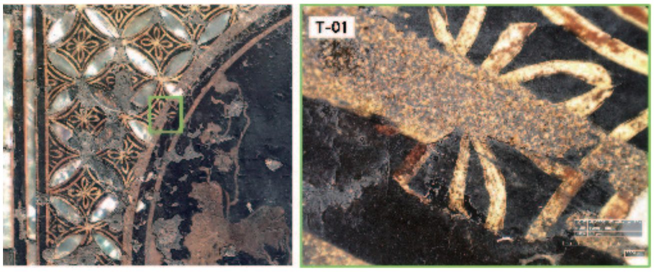

Fig. 6 Golden line depicted over the original pattern

Fig. 7 Original geometric pattern on Lectern (1)

Lectern (2)

Digital microscope images of the leaf patterns observed on Lectern (2) are shown in Figure 8. The T-03 location corresponds to a leaf composed of mother-of-pearl, and an enlarged image of the golden vein is shown in Figure 8 (T-03 bottom). The T-04 location corresponds to a reddish-brown leaf decorated with golden lines along its periphery and vein, and an enlarged image of the vein is shown in Figure 8 (T-04 bottom). The T-05 location corresponds to a golden leaf with a black vein, and an enlarged image is shown in Figure 8 (T-05 bottom). The enlarged image of T-05 reveals that the black vein is positioned slightly lower than the surrounding golden area, indicating that the vein was not applied over the golden leaf using black lacquer. In addition, yellow particles were observed scattered throughout the reddish-brown area of the T-04 leaf.

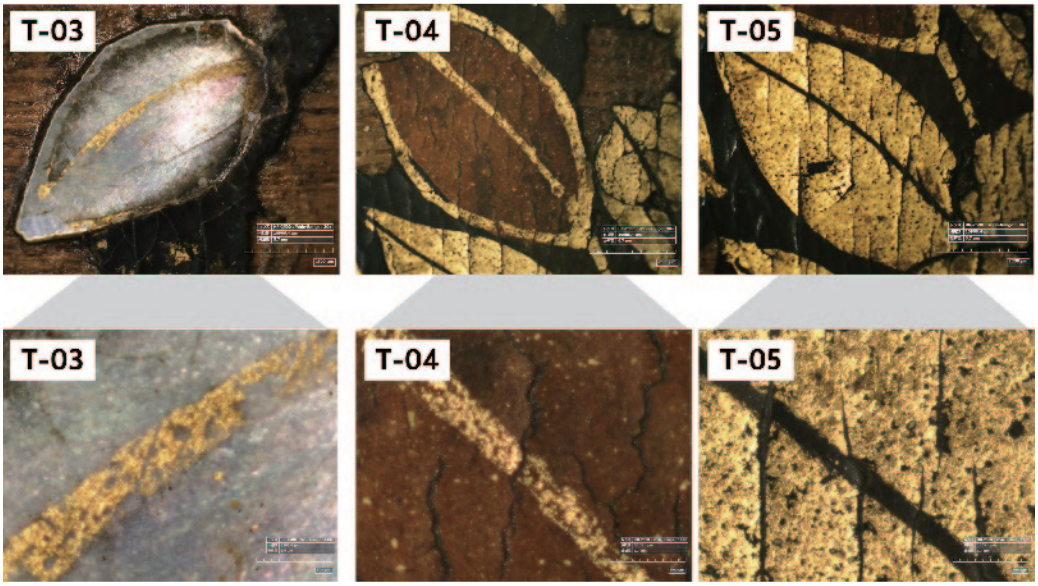

Fig. 8　Detail of leaves and veins on Lectern (2)

3 − 1 (2). XRF Analysis

Lectern (1)

XRF analysis was conducted at eleven measurement points on Lectern (1) (Table 2, Figure 9), and the integrated intensities of the detected elements are summarized in Table 4.

In the foundation layer of the original areas (C-01, C-02), Fe was strongly detected along with Ca, K, Ti, Mn, and S (Figure 10).　In the foundation layer of the re-coated area (C-03), the same elements were detected; however, the Fe intensity was approximately 2.07 times higher than that of the original foundation layer, and trace amounts of Si were additionally detected (Table 4).　A weak Pb peak was also detected in C-02.

For the surface decoration, XRF analysis was conducted on the original golden line (C-04) and at an area where the golden material had peeled off, exposing the underlying reddish-brown lacquer layer (C-05).　The corresponding spectra are shown in Figure 11(1).　Compared with the original foundation layer (C-01), Au was clearly detected at C-04 along with Hg and Cu, and Fe exhibited a higher intensity.　In contrast, Au was not detected at C-05; instead, Fe, Hg, and Cu showed markedly higher intensities than those observed at C-04, and S was also detected.

For the gold *makie* decoration, XRF spectra obtained from the original (C-07) and re-coated locations (C-06) are presented in Figure 11(2).　At C-07, Fe, Au, and Hg were detected, whereas at C-06, only Au was detected relative to the re-coated foundation layer (C-03).

The silver *makie* decorations on the book rest and back (C-08 to C-11) are interpreted as original, and their XRF spectra are shown in Figure 12(1) and (2).　Strong Ag and Cu signals were detected in the silver *makie* areas (C-08 and C-10), along with trace amounts of Hg.　The Cu Kα/Ag Lα intensity ratios (Table 4) were 0.6 at C-08 and 0.5 at C-10.　In contrast, Ag was not detected at the contour golden line (C-11) or at the area where the golden line had peeled off, exposing the underlying reddish-brown lacquer layer (C-09).　At these locations, Fe and Hg

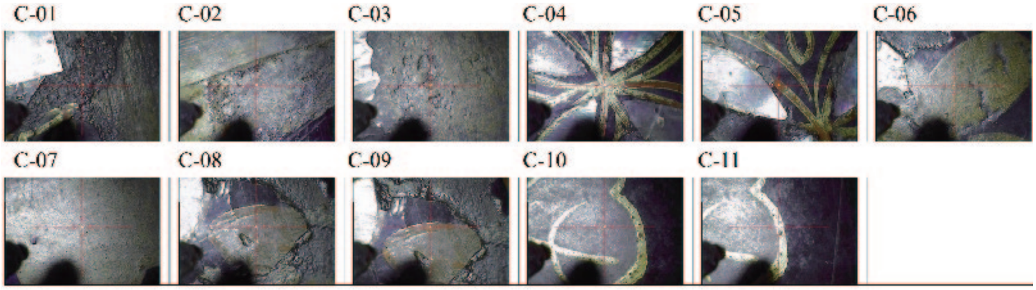

Fig. 9 Measurement locations on Lectern (1)

Table 4 Integrated intensities (cps) of elements detected at each XRF measurement point on Lectern (1)

number	Detected Elements (cps)														CuKα /AgLα
	SiKα	SKα	AgLα	KKα	CaKα	TiKα	MnKα	FeKα	CuKα	AuLα	PbLα	HgLα	SrKα	AgKα	
C-01		14		155	383	92	27	1152							
C-02		36		132	456	67	21	897			42				
C-03	12	32		99	562	81	24	2379							
C-04				122	247	94	34	3792	50	519		65			
C-05		19		128	328	93	26	5277	98			216			
C-06		13		78	463	48	33	2162		118			38		
C-07				135	126	94	22	3451		363		65			
C-08			513	27	269	20	18	1619	287	36		29		86	0.6
C-09				139	350	153	34	4323				74			
C-10		42	502	88	132	51	18	2648	239	46		69		42	0.5
C-11		12		92	117	89	39	5643		478		232			

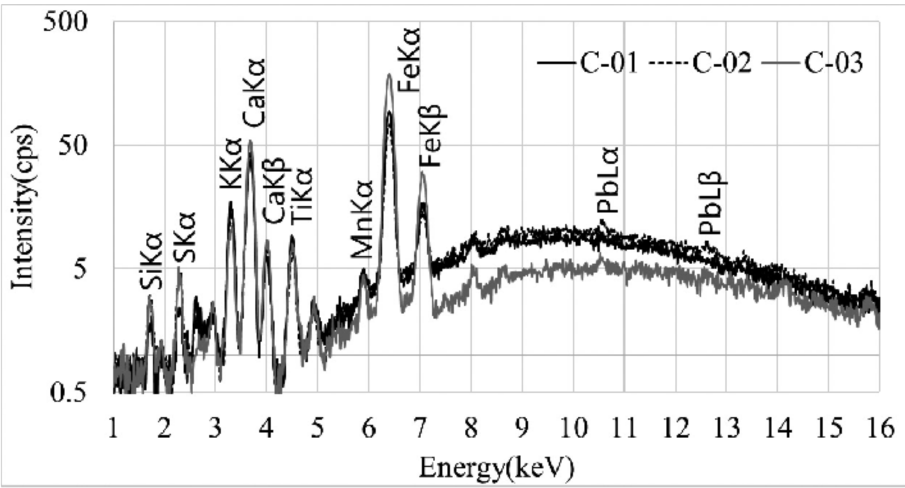

Fig. 10 XRF spectra of the foundation layers on Lectern (1) (log scale)

were detected with higher intensities than those observed at C-08 and C-10, and Au was detected at C-11.

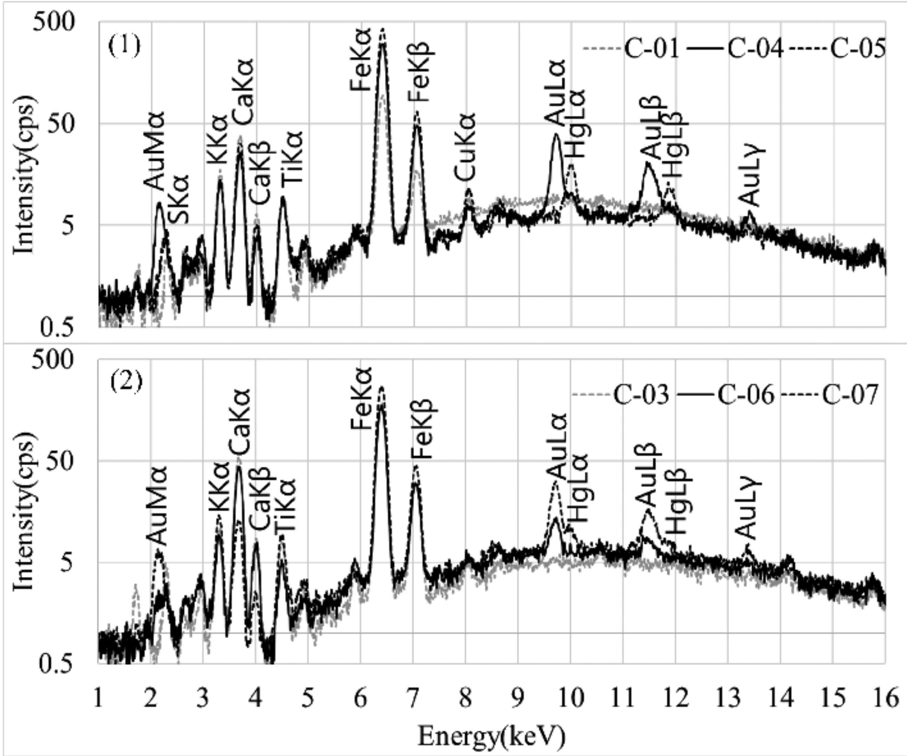

Fig. 11　XRF spectra of the golden decorated areas on Lectern (1) (log scale): (1) golden line decorations; (2) gold *makie* decorations

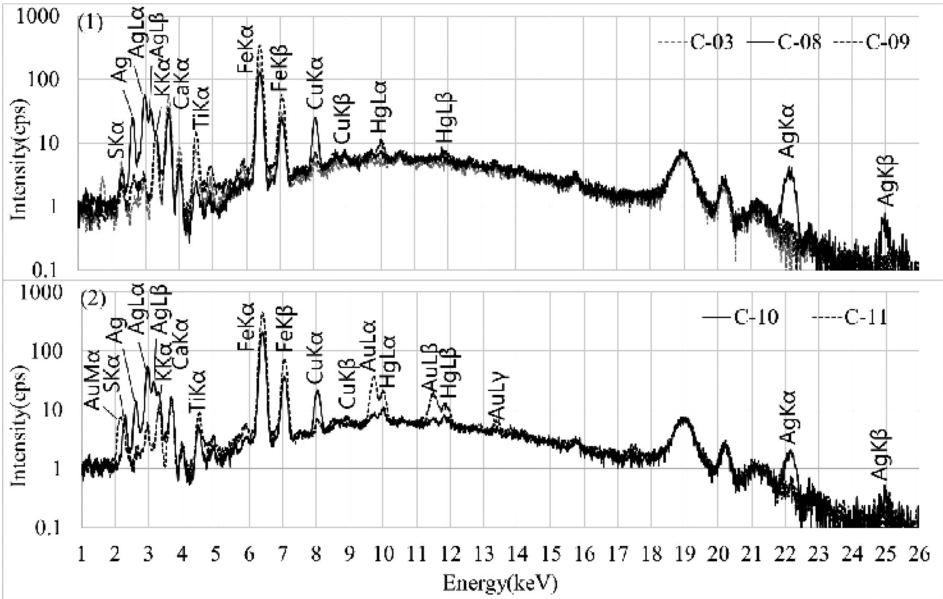

Fig. 12　XRF spectra of the silver *makie* decorated areas on Lectern (1) (log scale): (1) on the book rest; (2) on the back of the book rest

Lectern (2)

XRF analysis was conducted at eight measurement points on Lectern (2) (Table 2, Figure 13), and the integrated intensities of the detected elements are summarized in Table 5.

The black lacquer areas were analyzed at C-13 and C-14. At both points, Fe was strongly detected along with Ca, K, Ti, Mn, Rb, and Sr, and peaks tentatively assigned to As were also observed. In the foundation layer (C-12), Si, S, and Cr were additionally detected (Figure 14). Based on the elemental intensities (Table 5), Mn exhibited slightly higher intensities in the black lacquer areas, whereas most other elements showed higher intensities in the foundation layer.

The decorative elements analyzed included the golden leaf pattern (C-15), the reddish-brown leaf pattern (C-16), the golden lines applied over these leaves (C-17), the mother-of-pearl (C-18), and the golden lines applied over the shell (C-19). These results, along with the spectrum of the black lacquer area (C-13), are shown in Figure 15 for comparison of elemental compositions.

In the golden leaf pattern (C-15), Au and Cu were detected along with trace amounts of As [Figure 15(1)]. In the reddish-brown leaf pattern (C-16), Fe and As exhibited higher intensities than those observed in the black lacquer area, and S was also detected. In the golden lines (C-17), the intensities of Fe and As were lower than those in C-16, while Au and Cu were clearly detected [Figure 15(2)]. In the golden line on the mother-of-pearl shell (C-19), Au and Cu were detected in addition to Ca and Sr originating from the shell itself [Figure 15(3)]. The Cu Kα/Au Lα intensity ratio (Table 5) in areas where both Au and Cu were detected was approximately 0.1.

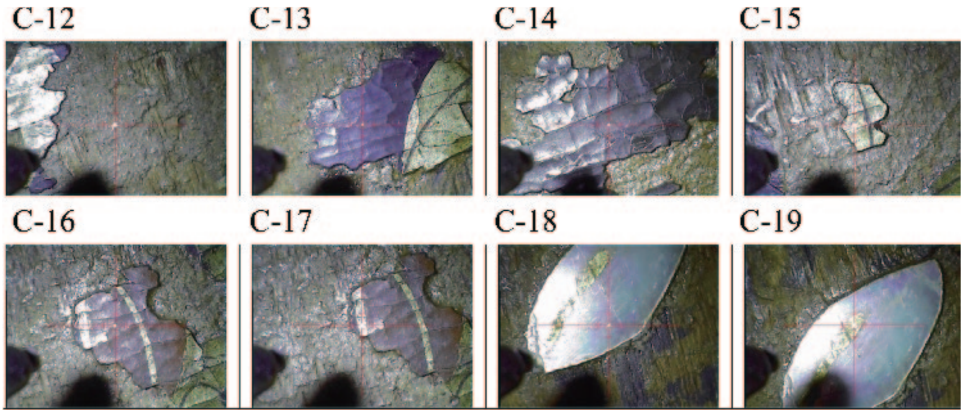

Fig. 13 Measurement locations on Lectern (2)

Table 5 Integrated intensities (cps) of elements detected at each XRF measurement point on Lectern (2)

number	Detected Elements (cps)													CuKα /AuLα
	SiKα	SKα	KKα	CaKα	TiKα	CrKα	MnKα	FeKα	CuKα	AuLα	AsKα	RbKα	SrKα	
C-12	12	15	119	1361	649	55	74	4548				48	20	
C-13			78	1162	22		163	2359			18	23	12	
C-14			51	1331	30		156	2797			25	36	25	
C-15			35	626	29		163	2507	117	1528	93	36	12	0.1
C-16		74	60	1085	18		141	3406			2441	13	19	
C-17			46	667	28		174	2151	70	968	263	33	14	0.1
C-18				10984									151	
C-19				6005					79	788			147	0.1

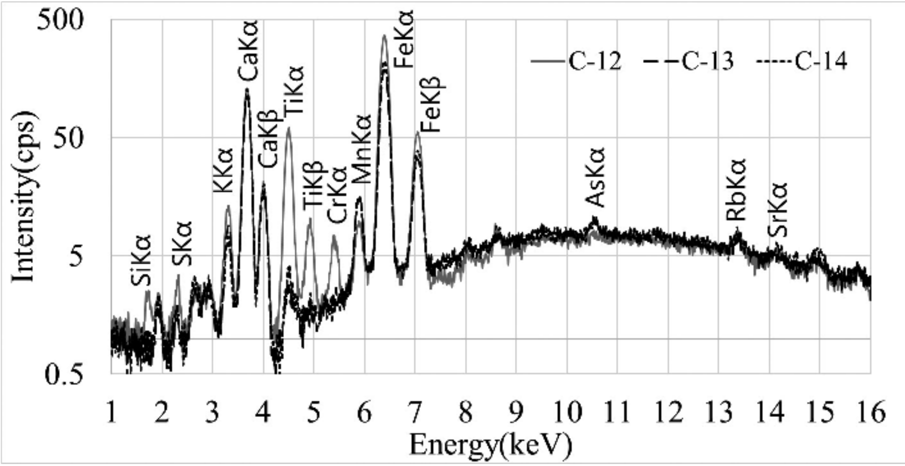

Fig. 14　XRF spectra of the black lacquer and foundation layers on Lectern (2) (log scale)

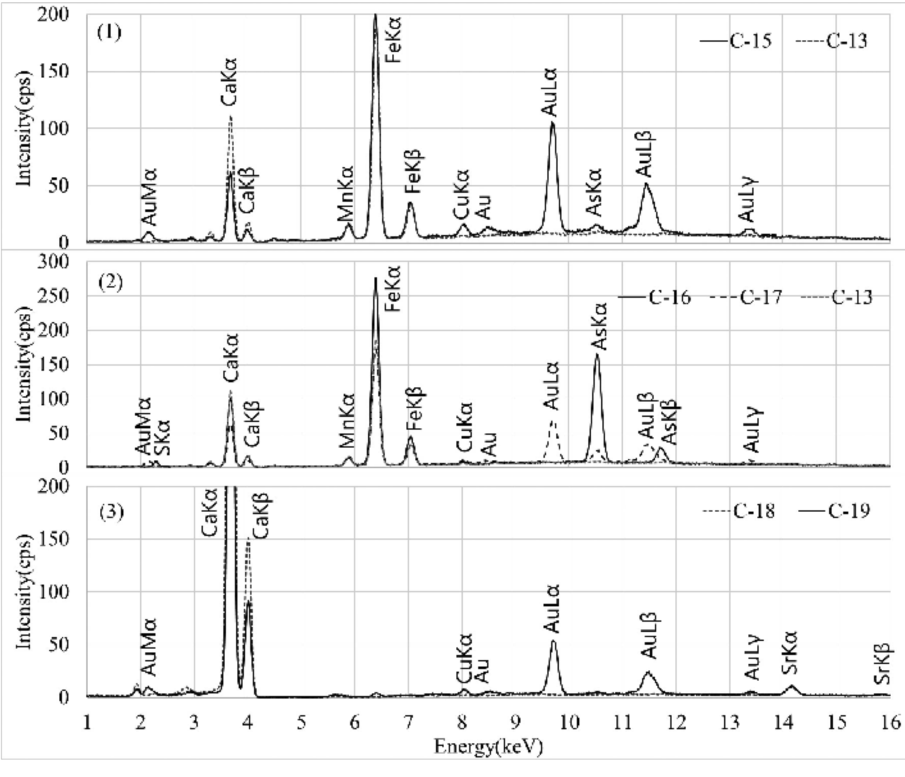

Fig. 15　XRF spectra of the decorative areas on Lectern (2): (1) gold leaf decoration; (2) reddish-brown lacquer leaf decoration; (3) mother-of-pearl decoration

3－2. Analysis of Collected Samples

3－2 (1) / (2). Digital Microscope Observation and SEM Observation

Lectern (1)

Figure 16 presents a comparison of the digital microscope images and SEM images of coating samples collected from Lectern (1). Enlarged digital microscope images of the original coating areas (S-01, S-03, and S-06) and the re-coated area (S-04) are shown in the upper row of Figure 16. The surface condition of the re-coated area differs clearly from that of the three original areas. However, in all samples, the thickness and the morphology of the metallic materials could not be clearly determined from digital microscope observation alone.

Because the morphology of the golden metallic materials observed *in situ* remained ambiguous, SEM observations were conducted on small coating samples collected from both the original and re-coated areas (S-01, S-03, S-06, and S-04). Backscattered electron images obtained at high magnification (Figure 16, bottom) show that none of the metallic materials exhibit spherical morphology. This observation indicates that the metallic materials are not composed of rounded filing powder; instead, both the original decorative patterns and the re-coated lines are composed of thin, foil-like metallic materials.

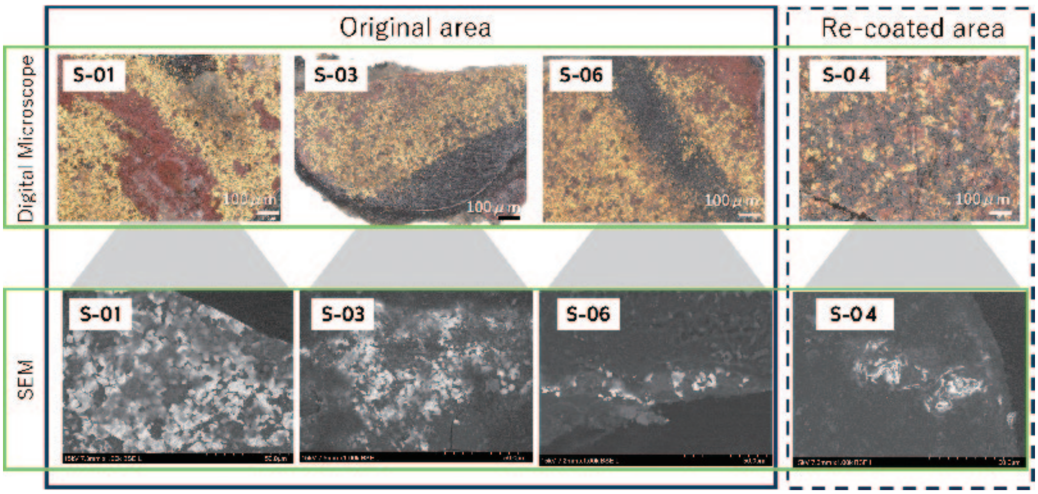

Fig. 16 Comparison of the metal material shapes on Lectern (1) by digital microscope and SEM

Lectern (2)

Digital microscope images of coating samples S-07 and S-08 collected from the front and back surfaces of Lectern (2) are shown in Figure 17. In both samples, the golden decorative areas consist not of metallic powders but of flat metallic foils with similar morphology. Figure 17 presents SEM images of the metallic components of the samples shown in Figure 17. Comparison of the SEM images reveals that the metallic materials in both samples are morphologically similar, consisting of thin, uniform foils that cover relatively wide areas with overlapping metal flakes.

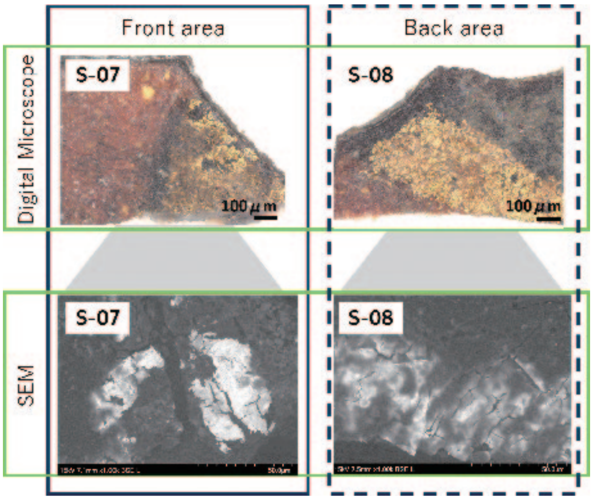

Fig. 17 Digital microscope image of the lacquer coating sample and Metal material shapes by SEM of Lectern (2)

3 − 2 (3) / (4). Cross-sectional Observation and SEM-EDS Analysis

Lectern (1)

Sample S-02, collected from the re-coated surface, was confirmed by cross-sectional observation to have a four-layer structure (Figure 18). SEM-EDS analysis detected C, Na, Al, Si, Ca, and Fe in the black G1 layer and Na, Al, Si, Ca, and Fe in the white G2 layer. As these elements are predominantly mineral-derived, both G1 and G2 are interpreted as foundation layers. The relatively high carbon content detected in the G1 layer suggests that carbon powder may have been added. In the black L1 and brown L2 layers, only C and O were detected, indicating that these layers are pigment-free coating layers. Sample S-05, also collected from the re-coated surface, exhibited mottled surface coloration; however, cross-sectional observation revealed a five-layer structure (Figure 19). The L1, L2, G1, and G2 layers exhibited the same structural characteristics as those observed in S-02. In addition, C and O were detected in the black L3 layer, which constitutes the outermost surface. Sample S-06 , collected from the original *makie* decoration, was also examined in cross-section. A large amount of Fe was detected in the layer immediately beneath the *makie* gold powder (Figure 20, arrow), indicating the presence of an iron-rich layer associated with the original decoration.

Lectern (2)

Sample S-07 was confirmed to have a structure consisting of at least five layers with different color tones (Figure 21). SEM-EDS analysis detected Na, Al, Si, Ca, and Fe in the white G1 layer, and Al, Si, Ca, and Fe in the white G2 layer. As these elements are primarily mineral-derived, both G1 and G2 are interpreted as foundation layers. In the white L1 layer, the whitish-brown L2 layer, and the brown L3 layer, only C and O were detected, suggesting that these layers are pigment-free coating layers. In contrast, the yellow L4 layer contained not only C and O but also As and S, and Fe was additionally detected in reddish-brown particles dispersed within the layer. Au was also detected near the outermost surface. Although the

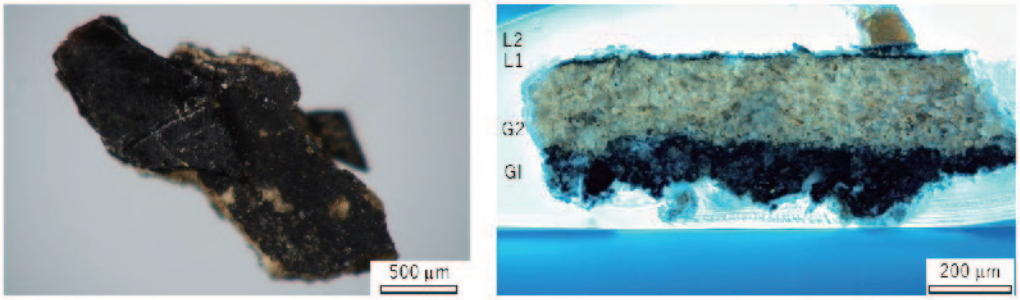

Fig. 18 S-02 Sample (left) and the cross-section image (right)

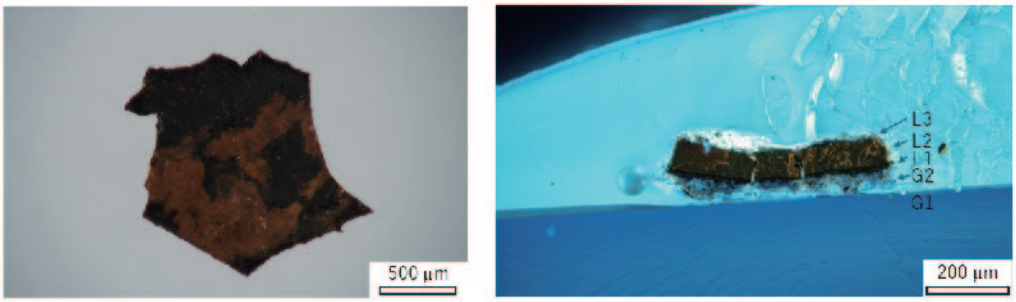

Fig. 19 S-05 Sample (left) and the cross-section image (right)

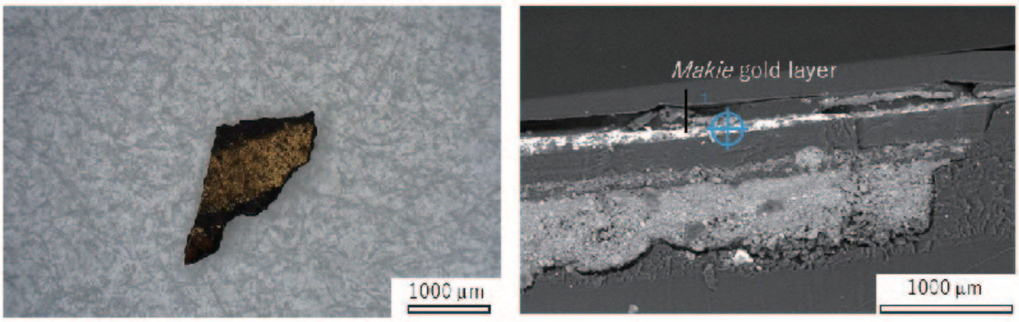

Fig. 20 S-06 Sample (left) and the cross-section image (right)

number of coating layers differed between samples S-07 and S-08, their overall layer structures were similar (Figure 22).

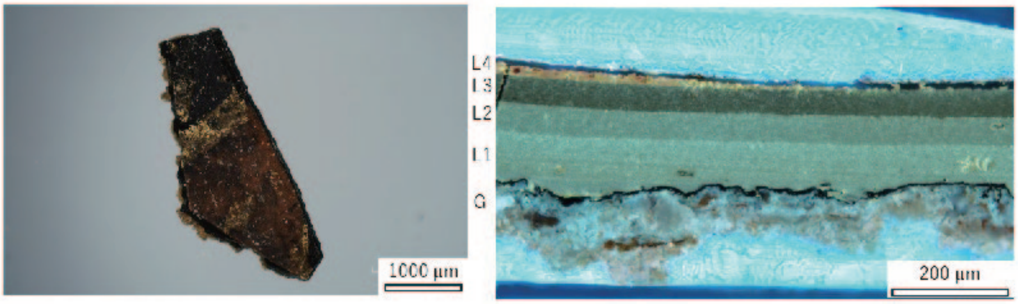

Fig. 21 S-07 Sample (left) and the cross-section image (right)

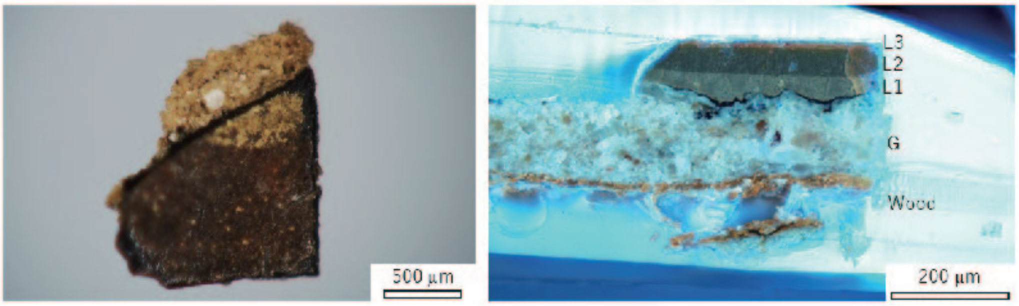

Fig. 22 S-08 Sample (left) and the cross-section image (right)

3－2 (5). THM-GC/MS Analysis

THM-GC/MS analysis was performed on the collected minute coating samples. Identification of coating constituents was achieved by extracting characteristic ion chromatograms. The detection of methyl 8-(2,3-dimethoxyphenyl) octanoate, produced by oxidative cleavage of urushiol (m/z 294), and 1,2-dimethoxy-3-pentadecylbenzene, a derivative of the main component of urushiol (and also a minor component of laccol) (m/z 348), indicates that the lacquer was derived from a lacquer tree (*Toxicodenron vernicifluum*) grown in Japan and mainland China. In contrast, detection of 1, 2-dimethoxy-3-heptadecylbenzene, a derivative of the main component of laccol (m/z 376), suggests the use of lacquer derived from an *Anacardiaceae* tree (*Toxicodenron succedaneaum*) grown in regions ranging from southern coastal China to northern Vietnam and Taiwan.[†1,4)]

Lectern (1)

Extraction of ion chromatograms at m/z 294, 348, and 376 yielded different compositional profiles depending on the sample. In the original coating sample (S-06) and the re-coated sample (S-02), urushiol-derived compounds—methyl 8-(2,3-dimethoxyphenyl) octanoate (m/z 294) and 1,2-dimethoxy-3-pentadecylbenzene (m/z 348)—were detected, whereas the laccol-derived compound at 1,2-dimethoxy-3-heptadecylbenzene (m/z 376) was not detected (Figure 23). In contrast, the re-coated sample S-05 contained both urushiol- and laccol-derived components, with all three characteristic ions (m/z 294, 348, and 376) detected (Figure 24).

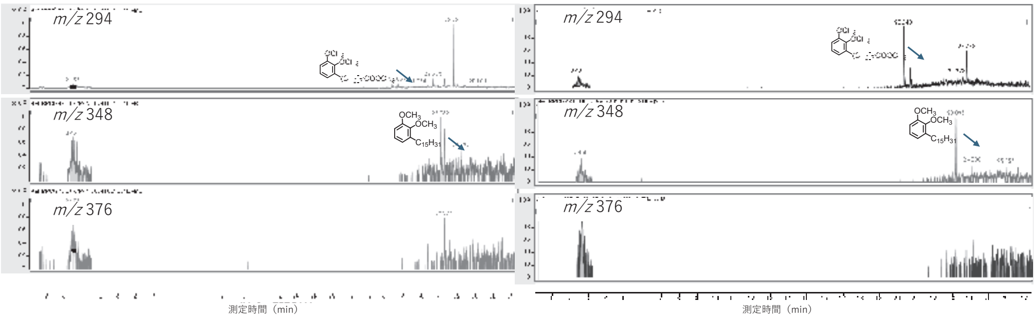

Fig. 23 Selected ion chromatograms of the S-02 (left) and S-06 (right) samples

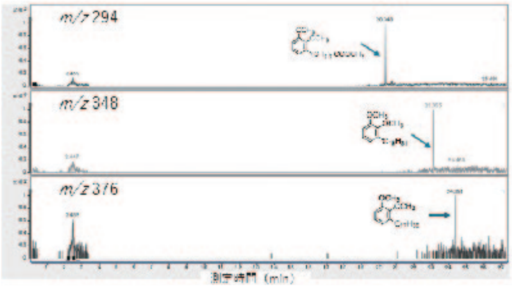

Fig. 24 Selected ion chromatograms of the S-05 sample

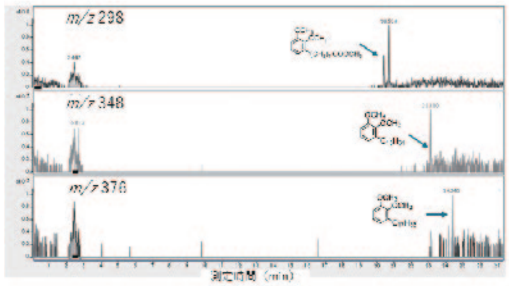

Fig. 25 Selected ion chromatograms of S-07 Sample

Lectern (2)

THM-GC/MS analysis of sample S-07 detected both urushiol- and laccol-derived compounds, as confirmed by extracted ion chromatograms at *m/z* 294, 348, and 376 (Figure 25).

4. Discussion

In this section, the observational results are first discussed in accordance with the analytical methodology described in Section 2, followed by a historical interpretation of the results for each lectern.

4－1. Discussion of the Scientific Results

4－1－1. Lectern (1)

Digital microscope observations of Lectern (1) revealed a clear chronological difference between the original and re-coated decorative elements. This was evidenced by apparent variations in color tone and surface texture, specifically in the size and appearance of the constituent metallic particles. Furthermore, although SEM observations comfirmed that both the original and re-coated decorations were executed using the same *keshi-fun makie* technique—a type of Japanese *hira-makie* employing finely processed metal foil powders—a critical distinction lies in the particles themselves; those used in the original areas were significantly smaller than the particles in the re-coated portions (Figure 16). This disparity indicates that distinctly different foil powders were employed for each application.

Furthermore, the *keshi-fun* particles used in the re-coated areas exhibited a layered morphology resembling a “cabbage-like” (laminar structure) cross-section (Figure 16, right), which is consistent with the *keshi-fun* particle shapes previously reported in works from the same historical period.[5)]

XRF analysis indicated that the foundation layers in both the original and re-coated areas were composed of mineral-based materials containing Fe, Ca, K, Ti, Mn, and S, suggesting the use of soil- or clay-derived materials. However, the foundation layer of the re-coated area (C-03) exhibited higher Fe and Si intensities than those of the original foundation layers. This difference suggests that a foundation material with a slightly different formulation and relatively higher Fe and Si contents was used during the re-coating process.

Previous studies have reported the intentional addition of Pb to lacquer layers as a drying agent or colorant.[6),7)] However, in the present study, Pb was detected only at a single location (C-02) and at a weak intensity within the foundation layer of Lectern (1). Consequently, the intentional addition of Pb cannot be substantiated. The possibility of contamination—such as the adhesion of airborne dust or accidental inclusion of materials from the workshop environment—cannot be excluded. Therefore, the origin of the detected Pb must be interpreted with caution.

With respect to the decorative metals, gold was most likely used as the principal metal in the original golden lines (C-04), the original gold *makie* (C-07), and the re-coated gold *makie* (C-06). Although Cu was detected in the area where the golden line had peeled off (C-05), it remains unclear whether Cu was intentionally alloyed with gold or present as an impurity. Accordingly, the origin of Cu in these areas cannot be conclusively determined.

In the area where the golden line had peeled off, and the underlying reddish-brown lacquer layer was exposed (C-05), the detection of Fe, Hg, and S suggests the use of a pigment-containing lacquer layer composed of iron-based red pigments, such as *bengara*, and mercury sulfide-based pigments, such as cinnabar or vermilion. These elements were also detected in the original gold *makie* area (C-07), supporting the presence of a reddish-brown pigmented lacquer layer beneath the gold decoration. This interpretation is consistent with the stratigraphy observed in microscopic cross-sectional examinations. The absence of detectable Hg in the re-coated gold *makie* (C-06) is likely attributable to the overall weak signal intensity rather than its complete absence, as Hg may have been present below the detection limit of the analysis.

The silver *makie* areas, which are considered to represent original decoration, were produced using a material composed predominantly of Ag, with Cu present either as a secondary metallic component or as an impurity. The contour golden line (C-11) was produced using gold. The detection of Fe and Hg in the underlying reddish-brown lacquer layer beneath this contour line suggests the use of iron-based and mercury sulfide-based red pigments, consistent with those identified beneath other gold decorative elements.

Lectern (1) possesses two foundation layers, and the overall coating thickness tends to be greater than that observed in Lectern (2). The thin black L1 layer is presumed to contain carbonaceous material, possibly charcoal powder. However, the adhesion between this layer and the overlying layers appears to be weak, which may have resulted in partial detachment of the L2 layer during cross-sectional sample preparation. This uneven layer structure likely contributed to the reduced clarity of some cross-sectional images. As discussed above, the pigments used in the reddish-brown lacquer layers associated with the *makie* decoration were most likely *bengara* and cinnabar or vermilion.

THM-GC/MS analysis of the original coating sample from Lectern (1) detected only urushiol-based lacquer derived from a lacquer tree (*Toxicodenron vernicifluum*) grown in Japan and mainland China. In contrast, the two re-coated samples yielded different compositional profiles: one contained only urushiol-based lacquer, while the other contained both urushiol and laccol, the latter originating from an *Anacardiaceae* tree (*Toxicodenron succedaneaum*) growing in regions extending from southern coastal China to northern Vietnam. These results indicate that although urushiol lacquer was consistently used for the original decoration, both urushiol and laccol lacquers were employed during the re-coating process. The absence of detectable laccol in one of the re-coated samples may be attributed to several factors: laccol may not have been present in the analyzed area at the time of the re-coating; its concentration may have been present below the detection limit; or the lacquer layer containing laccol may have been lost during sampling or analysis preparation.

4－1－2． Lectern (2)

SEM observation (Figure 17) revealed that the golden lines on both the front and back of Lectern (2) were produced using foil sheets rather than the *keshi-fun* gold powder, which was identified on Lectern (1). This decorative technique, identified as *hakue*, corresponds to that employed on previously known lectern of this style.[8)] This finding reconfirms that *hakue* was a widely used decorative technique in the Macau (Cantonese) region.

Based on the XRF results, the elemental composition of the foundation layer indicates that Fe, Ca, K, Ti, Mn, S, Rb, Sr, and Si were the principal constituent elements. These elements are likely derived from soil- or clay-based materials used in the preparation of the foundation layer. With regard to Cr, the possibility of artificial contamination cannot be excluded, and its origin therefore requires careful consideration.

Au and Cu were detected in the golden leaf patterns, the golden lines, and the golden lines applied over the mother-of-pearl shell. On the basis of the Cu Kα/Au Lα intensity ratios, it is highly probable that gold containing minor amounts of Cu as an impurity was used for these decorative elements.

The detection of As, S, and Fe in the reddish-brown leaf patterns suggests that the yellow particles observed during digital microscope observation (3-1(2), Figure 8) correspond to yellow pigments incorporated into the colored lacquer. Considering both the particle color and elemental composition, these pigments are most likely arsenic sulfide compounds, such as orpiment (As_2S_3), combined with iron-based red pigments, including *bengara*.

Regarding the origin of the As detected in the black lacquer areas (C-13 and C-14) and the golden leaf pattern (C-15), no distinct red pigment layer was observed on the surface (3-1(2), Figure 8). However, cross-sectional observation (3-2(3) / (4), Figure 21) revealed the presence of a yellow substance in the L4 layer, in which both As and S were also detected. This strongly suggests that the As detected at these points originated from the arsenic sulfide pigments contained in the L4 layer. Furthermore, the detection of As in the black lacquer and golden decorative areas may reflect dispersion or trace contamination of yellow pigment components from this layer.

Cross-sectional observation indicates that Lectern (2) possesses at least three pigment-free lacquer coating layers. The marked color differences observed between the upper and lower layers suggest possible differences in the properties of the lacquer itself.

In the sample of Lectern (2), two types of lacquer—urushiol and laccol—were detected. This result suggests either intentional mixing during application or the use of these lacquers in separate coating layers. Based on the aforementioned cross-sectional observations, the latter interpretation is more likely.

Moreover, as shown in Figure 26, the black veins of the leaf pattern—confirmed to lie below the surface of the golden leaf—exhibit features resembling "sweep" marks characteristic of individual brush strokes at the termini of the black lines. These features suggest that the thin lines were created using the Japanese needle-scratching technique known as *harigaki*,[9] by incising through the *hakue* foil surface.[†2,10]

Fig. 26 *Harigaki* similar black lines on Lectern (2)

4－1－3. Comparison between the lecterns

Major discrepancies identified between the original and re-coated decorations of Lectern (1) and Lectern (2) can be summarized as shown in Table 6.

With respect to the foundation layers, both lecterns employed mineral-based materials containing Fe, Ca, K, Ti, Mn, and S, indicating the use of soil- or clay-derived materials in both cases. However, Lectern (2) exhibits relatively higher detection intensities of Fe, Ca, Ti, and Mn, as well as the presence of Rb and Sr, which were not detected in Lectern (1). These differences suggest variations in the sources of the foundation materials or in their preparation methods.

In terms of decorative metals, gold was used as the primary decorative material in the original golden lines, original gold *makie*, and re-coated gold *makie* on Lectern (1). In contrast, for Lectern (2), the gold leaf patterns, golden lines, and golden lines applied over mother-of-pearl were most likely produced using gold containing trace amounts of Cu as an impurity.

Regarding reddish-brown materials, Lectern (1) is inferred to have employed a combination of iron-based red pigments, such as *bengara*, and mercury sulfide-based red pigments, represented by cinnabar or vermilion. By contrast, the reddish-brown leaf patterns and underlying lacquer layers of Lectern (2) suggest the use of colored lacquer composed of arsenic sulfide-based yellow pigments, such as orpiment, in combination with iron-based red pigments.

Table 6 Comparison of decoration materials, techniques between the two lecterns

	Nanban Lectern (1)		Luso-Asian Nanban-style Lectern
	Original decoration	Re-coated decoration	Lectern (2)
Foundation	Fe, Ca, K, Ti, Mn, S, and Si		Stronger Fe, Ca, K, Ti, Mn, S, Si Rb, Sr
Redidish-brown lacquer	Iron-based red pigment (such as bengara) Cinnabar (HgS)		Iron-based red pigment (such as bengara) Arsenic sulfide-based yellow pigment (As_2S_3)
Drying agent	?	×	×
Lacquer component	Urushiol	Urushiol Laccol	Laccol + Urushiol
Decoration technique	*Keshi -fun* (Crushed metal foil powder) *makie*		*Hakue* (Metal foil pasting technique)
Golden material	Au		Au + Cu

4－2. Discussion from Historical Perspective

4－2－1. Lectern (1)

THM-GC/MS analysis of Lectern (1), as described above, revealed a noteworthy finding. Only urushiol, derived from the urushi tree (*Toxicodendron vernicifluum*) was detected in the original coating, whereas the re-coated lacquer contained not only urushiol but also laccol derived from the wax tree (*Toxicodendron succedaneum*). In Kyushu, Japan, where wax trees were intensively planted, these trees were used exclusively for wax extraction.[†3] Three hypotheses have been proposed regarding the origin of wax trees in Japan: that they were imported from China between the late 16th and early 17th centuries; that they were transplanted to Kagoshima from trees growing wild on the southern islands of the Japanese archipelago in the same period; or that they are native to Japan. However, no definitive conclusion has been reached.[11)] Historical documents from the Edo period indicate that the commercial use of wax trees began to spread widely in the late 17th century, and by the late 18th century they were actively cultivated in various regions of western Japan, including Kyushu, San'in, and Shikoku; in these regions, however, cultivation was undertaken specifically for wax production.[12)] These findings indicate that the laccol-containing lacquer detected on Lectern (1) was most likely derived from imported sap.

Furthermore, European historical sources—specifically the *Diaries kept by the Heads of the Dutch Factory in Japan*—provided detailed records of lacquer imports. The Hirado diaries record that on November 18, 1640, 47,000 *cattijis* of "Chinesen lack" (Chinese lacquer), which is likely to have been laccol lacquer, were imported to "Nangasackij" (Nagasaki) by "Chinese Joncken" (Chinese junk ship). The Nagasaki diaries further record that on July 14, 1641, 450 *cattiji* of "lack" (lacquer) were imported from "Hocchieuw" (Fuzhou); on July 26 of the same year, 650 *cattiji* of "Tonkinsen lack" (Tonkin lacquer); on the following day, July 27, 350 *cattiji* of "lack" (lacquer) from "Canton"; and on October 11, 9,150 *cattij* of "Chinese lacq" (Chinese lacquer) imported by "Chinesen" (Chinese), as well as 650 *cattij* of "Toncquinsen lack" (Tonkin lacquer) imported from "Tokcquin" (Tonkin) to "Nangasacqui" (Nagasaki) on the same day.[13),14),15)] Although laccol lacquer adhering to Vietnamese pottery and lacquer-making tools has been excavated from the former Yanagi'ike Junior High School site in Kyoto City—an early- to mid-17th century lacquer workshop site,[16)] —Lectern (1) is likely the first known example of Japanese lacquerware object in which laccol lacquer has been analytically identified.

Prior to the expulsion of the Portuguese from Japan in 1639, there are no known records indicating that Portuguese merchants imported laccol lacquer or Southeast Asian thitsiol lacquer through the Nanban trade.[17)] The only documented evidence of lacquer imports from Thailand and Cambodia during this period relates to the red-seal ship (Shuinsen) trade authorized by the Tokugawa shogunate.[18)] Moreover, the aforementioned Kyoto lacquer workshop site, along with archaeological site in Osaka (a merchant's residence) and Nagasaki (possibly a magistrate's office), are the only three locations where Southeast Asian lacquer adhering to imported pottery has been identified.[19),20)] Considering this historical context, it is likely that lacquer imports began before the 1630s and that only these three cities had access to and utilized imported lacquer sap during this period.

Although the centrally re-coated decoration on Lectern (1) clearly differs from the original decoration in both quality and chronology—and the original decoration was most likely executed in Kyoto—the use of the uniquely Japanese *keshi-fun makie* technique in both areas strongly suggests that the re-coating was also carried out in Japan. Given the historical distribution of imported lacquer, Nagasaki is the most plausible location for this re-coating.

4－2－2. Lectern (2)

Analysis of the lacquer coating of Lectern (2) revealed the presence of both *Toxicodendron vernicifluum* (urushiol) and *Toxicodendron succedaneum* (laccol). Although the present study does not clarify how these two lacquers were employed, the pronounced color difference between the upper and lower layers suggests that they were applied separately at different layers.

Maria João Petisca analyzed numerous examples of lacquerware produced in the Guangdong region from the 17th to the 19th centuries and reported that the combined use of both lacquer species on a single object was primarily observed in 19th-century works.[21)] By contrast, analyses of a Luso-Asian Nanban-style lectern in the Asia Civilization Museum—stylistically comparable to the present lectern and believed to date to the early 17th century,[22)]—as well as a similar lectern in a private collection dated to approximately the same period,[23)] detected only laccol lacquer. In addition, laccol was identified on two rectangular mother-of-pearl trays preserved down in Portugal, decorated with gold metal foil and mother-of-pearl, in a manner comparable to Luso-Asian Nanban-style objects.[24),†4,25),26),27)]

In light of these examples, the detection of both urushiol and laccol in Lectern (2),which is believed to date to the early 17th century, suggests that the use of multiple lacquers—as proposed by Petisca—may have begun earlier than previously recognized. Petisca and her colleagues have also reported numerous cases in which the two types of lacquer were not only mixed but also applied as separate layers.[28] Whether such stratified application of different lacquers was already practiced during this period remains an open question requiring further investigation.

5. Conclusion and Future Perspectives

This study investigated Nanban and Luso-Asian Nanban-style lecterns through scientific analysis to clarify their decorative materials, techniques, and historical contexts.

For Lectern (1), the primary objective was to determine when and where the re-coating of the central area of the backboard was carried out. Clear differences in chronology and in the appearance of decorative materials were identified between the original lacquer decoration and the later re-coated decoration. Nevertheless, the lacquer foundation layers of both phases exhibit nearly identical elemental compositions derived from soil- or clay-based materials. Furthermore, iron-based red pigments such as *bengara,* in conjunction with cinnabar or vermilion were used in the reddish-brown lacquer layers beneath the gold decoration in both cases. Of particular importance is the fact that *keshi-fun* gold powder was employed as the *makie* material in the gold decorations of both the original and re-coated areas. Although lacquerware artists and researchers have studied contemporary lacquerware techniques and historical records regarding *keshi-fun makie*, empirical verification based on extant historical lacquerware still remains very limited. However, there is a documented report that examines the morphology of *keshi-fun* powder in lacquerware dating to the first half of the 17th century, including examples of Nanban lacquerware, and the results of the present case are consistent with these findings.[29]

In addition, the present investigation revealed that, alongside urushiol-based lacquer, laccol-based lacquer was also used in the centrally re-coated area of Lectern (1). Given the historical circumstances of Japan in the first half of the 17th century—especially in the 1630s, when this lectern is thought to have been produced—laccol lacquer at that time was almost certainly an imported material. Furthermore, access to such imported lacquer sap appears to have been limited to Kyoto, Osaka, and Nagasaki. It is difficult to assume that Nanban lacquerware, almost certainly produced in Kyoto, would have undergone such modification in nearby Osaka shortly after its completion. Accordingly, the most plausible conclusion is that the alteration of the central area of Lectern (1) was carried out in Nagasaki. Thus, although the decorative materials and techniques used in the original and re-coated areas are broadly similar, they also exhibit notable differences. When these material distinctions are considered alongside the historically limited availability of laccol lacquer and the absence of any compelling motive to erase Christian symbols outside Japan—where Christianity was not prohibited—it is reasonable to conclude that the erasure of the Christian symbol and the subsequent re-coating of Lectern (1) were undertaken within Japan, most likely in Nagasaki, by artisans or workshops different from those responsible for the original decoration, shortly before export.

With regard to Lectern (2), this study clarified the materials and techniques employed in the *hakue*-foil decoration produced in Macau. One particularly significant finding is that the combined use of urushiol and laccol lacquers in Guangdong-region lacquerware—previously discussed primarily on the basis of examples dating from the 18th century onward—can be traced back to as early as the beginning of the 17th century. In addition, arsenic sulfide-based yellow pigments were detected in the reddish-brown lacquer layer beneath the *hakue* decoration, suggesting a possible relationship between pigment selection and foil decoration techniques. Moreover, the possibility that the black veins of the leaf patterns were rendered using the Japanese *harigaki* technique has been suggested. If this technique were indeed employed in Macau, it would indicate a direct transmission of Japanese lacquerware techniques to the region.

Overall, Lectern (1) and Lectern (2) exhibit distinct characteristics in their foundation layers, lacquer compositions, decorative techniques, and metallic materials. These differences indicate that the two lecterns belong to different technical traditions and were produced in different regions, reflecting distinct lacquer-decorated cultures. At the same time, shared features allow both lecterns to be regarded as important comparative materials for advancing the study of Nanban lacquer and Luso-Asian Nanban-style lacquerware.

Although the present study examined only a single example of each stylistic group, the results demonstrate the value of integrated scientific analysis in elucidating the materials and techniques of both groups of lacquerware. Application of similar analytical methods to a larger number of objects will enable a more precise understanding of regional variation, technological transmission, and chronological transition. Several specific issues remain to be addressed. For instance, the relationship between *hakue*-foil decoration and the use of arsenic sulfide-based yellow pigments requires further investigation through a comparative examination of additional objects.[†5] Furthermore, the possibility that the black veins of the leaf patterns on Lectern (2) were rendered using the Japanese *harigaki* technique merits closer scrutiny. If confirmed, this would raise the further possibility that Japanese *makie* artisans were involved in the production of Christian lacquerware there, rather than mere technical transmission. Further investigation and discussion will be necessary to substantiate this hypothesis.

Finally, the accumulation of analytical data on lacquer composition, pigments, and metallic materials will not only deepen historical understanding but also contribute to informed conservation and restoration strategies for Nanban and Luso-Asian Nanban-style lacquerware. Continued interdisciplinary research integrating conservation science, art history, and historical documentation is therefore essential.

Acknowledgment

The author is grateful to Clement Onn (温俊玉), Julie Chang (張倚竹), Maria João Petisca, Masahide Inuzuka (犬塚将英), Mihoko Oka (岡美穂子), Noriyoshi Nishida (西田典由), Shuichi Noshiro (能城修一), Takayuki Honda (本多貴之), and Ulrike Körber for their valuable support and suggestions. (Alphabetical order)

This work was supported by JSPS KAKENHI, Grant-in-Aid for Scientific Research (A), Exploring the Cultural Exchange History of Mother-of-Pearl Decoration in Asia: From the Viewpoint of Material and Cultural History (Principal Investigator: Kobayashi Koji), Grant

Number 20H00037.

Notes

† 1 Kamiya et al. (reference no. 4) provide a detailed account of the distribution of *Toxicodendron succedaneum* along the coastal regions of eastern China.

† 2 Professor Norihiko Ogura of Tokyo University of the Arts, who specializes in lacquer art, notes in the entry "Harigaki" in the *Dictionary of Lacquer work* that this technique is also applied to *hakue*.

† 3 The author is grateful to Dr. Shuichi Noshiro for providing this information.

† 4 References nos. 25, 26, and 27 also provide examples of Chinese lacquerware— ranging from the Song and Qing dynasties to export lacquers of the 16th to 19th centuries—in which *Toxicodendron succedaneum* was detected.

† 5 Arsenic has been used historically in the production of *hakue*-foil decoration in workshops operated by the Fine Arts Department of the Thai government.

References

1) Koji Kobayashi, Ichiro Nakamura, Toshiyuki Torigoe, and Shuichi Noshiro. "Scientific Analysis on Two Christian Lecterns in Portugal: A Wooden Substrate Investigation." *Science for Conservation*, No. 64, The Tokyo National Research Institute for Cultural Properties. pp. 43-60 (2024). https://www.tobunken.go.jp/ccr/pdf/64/6405.pdf Accessed January 8, 2026.

2) Ibid. 1), Kobayashi, et al. (2024), pp. 51-53.

3) Ulrike Körber. "India, Japan, or China? The Complex Origins of Chinese Lacquered Luso-Asian Objects in the Scope of the Jesuit Missions in Asia." in *Bernardo Ferrao e as Artes Decorativas no Oriente e no Mundo – Estudos e Homenagem*, eds. Jose Augusto de Sottomayor-Pizarro & Ana Cristina Sousa, Porto: Circulo Dr. Jose de Figueiredo, pp. 235-236 (2022).

4) Yoshimi Kamiya, Takayuki Honda, Yoshitaka Nagai, Chuichi Watanabe, Tetsuo Miyakoshi, Ningyuan Wang, Guoping Sun, Leping Jiang, Bin Liu, Shuichi Noshiro, and Shinichi Nakamura. "Use of lacquer collected from *Toxicodendron succedaneum* for the Neolithic lacquerware detected in Zhejiang Province of China." *Journal of Cultural Heritage*, No. 77, pp. 254-264. (2026). https://doi.org/10.1016/j.culher.2025.12.003 and https://doi.org/10.1016/j.culher.2026.02.003 Accessed January 8, and February 18, 2026.

5) Yoshimi Kamiya. "An Investigation of *Hira-makie* Technique and Materials as Seen Primarily in Namban Lacquer-The Analysis of Gold Forms via Scanning Electron Microscope-." *The Journal of Art Studies*, No. 429, Tokyo National Research Institute for Cultural Properties, pp. 508-509, Fig. 25-32 (2020). (in Japanese) https://tobunken.repo.nii.ac.jp/records/9001 Accessed January 8, 2026.

6) Julie Chang S. C. "*A Cross-Disciplinary Approach to Chinese Lacquer Technology*." PhD Dissertation at the University College London (UCL) (2020). https://discovery.ucl.ac.uk/id/eprint/10090986/ Accessed January 8, 2026.

7) John Winter. "East Asian paintings—Materials, structures and deterioration problems." in *Cleaning, Retouching and Coatings*, eds. J. Mills & P. Smith London: International Institute for

Conservation of Historic and Artistic Works (IIC), pp. 26-35 (1984).

8）Ibid. 5), Kamiya (2020), pp. 508-509, Fig. 33-34.

9）Taishu Komatsu. "Kodaiji *makie*." in *Fundamentals of Lacquer Art Appreciation*, eds. Taishu Komatsu & Hiroshi Kato, Tokyo: Shibundo, pp. 92-93, Fig. ① (1997). (in Japanese)

10）Norihiko Ogura. "Harigaki." *Dictionary of Lacquer Work* eds. The Academy of Lacquer Research, Tokyo: Kadokawa Gakugei Shuppan Publishing Co., p. 335 (2012).

11）Yuichiro Hiraoka. "The Origin of *Toxicodendron Succedaneum* in Japan and Used of Traditional Varieties for Japan Wax Production." in *Agrifore Report, Bulletin and Annual Report Shizuoka Professional University of Agriculture Shizuoka Professional University Junior College of Agriculture*, No. 4, Shizuoka Professional University of Agriculture Shizuoka Professional University Junior College of Agriculture, pp. 67-71 (2024). (in Japanese) https://spua.repo.nii.ac.jp/records/2000102 Accessed January 8, 2026.

12）Kikuo Noguchi. "The Propagation of Wax Tree Growing in the Edo Period," *Annals of Historical and Geographical Studies*, No.1, College of General Education, Kyushu University, pp. 1-24 (1977). (in Japanese) https://dl.ndl.go.jp/pid/2261255 Accessed January 8, 2026.

13）Nobuhiko Kitano. *Study of the Urushi material and technique in the Momoyama Cultural Period*. Tokyo: Yuzankaku Publishing, p. 146 (2018). (in Japanese)

14）The Historiographical Institute, The University of Tokyo. *Diaries kept by the Heads of the Dutch Factory in Japan*, Vol. IV. Tokyo: The University of Tokyo, p. 306 (1981). https://clioimg.hi.u-tokyo.ac.jp/viewer/view/idata/850/8500/58/0104/0305?m=all&n=20 Accessed January 8, 2026.

15）The Historiographical Institute, The University of Tokyo. *Diaries kept by the Heads of the Dutch Factory in Japan*. Vol. V. Tokyo: The University of Tokyo, pp.101, 110, 111, 184, 187 (1984). https://clioimg.hi.u-tokyo.ac.jp/viewer/list/idata/850/8500/58/0105/ Accessed January 8, 2026.

16）Ibid. 13), Kitano (2018), pp. 143-44, 181.

17）Yohei Kawaguchi. "Manufacturing in Japan in the Age of Discovery: Technology, Materials, and Trade." *Bulletin of the National Museum of Japanese History*, No. 210, The National Musuem of Japanese History, p. 193 (2018). (in Japanese)

18）Seiichi Iwao. *Studies in the History of Trade under the Vermillion-Seal of the Tokugawa Shogunate. Revised and enlarged Edition*. Tokyo: Yoshikawa-Kobunkan Publishing, pp. 288-301 (1985). (in Japanese)

19）Ibid. 13), Kitano (2018), pp. 136-139.

20）Ibid. 17), Kawaguchi (2018), pp. 193-195.

21）Maria João Petisca, Catherine Matsen., New contributions on the use of *Toxicodendron succedaneum* in Cantonese lacquerware, *ICOM-CC Beijing 2021 Preprints*, pp. 5-8 (2021). https://www.icom-cc-publications-online.org/4484/New-contributions-on-the-use-of-Toxicodendron-succedaneum-in-Cantonese-lacquerware Accessed January 8, 2026.

22）Birte Koehler, Lynn Chua, Clement Onn., Examination of lacquer layers on a 16th-century missal stand, *ICOM-CC Beijing 2021 Preprints*, https://www.icom-cc-publications-online.org/4405/Examination-of-lacquer-layers-on-a-16th-century-missal-stand. Accessed January 8, 2026.

23）Maria João Petisca. "*Investigations into Chinese Export Lacquerware: Black and Gold. 1700-1850*." Ph.D. Dissertation at the University of Delaware. pp. 294-5 (2019). https://udspace.udel.edu/items/3272b73a-42db-4e8c-8192-93364bdd3ab3/full Accessed January 8, 2026.

24) Ulrike Körber, Michael R. Schilling, Cristina Barrocas Dias, and Luis Dias. "Simplified Chinese Lacquer Techniques and Nanban Style Decoration on Luso-Asian Objects from the Late sixteenth or Early Seventeenth Centuries." *Studies in Conservation*, Vol. 61 2016, sup3. pp. 75-78 (2016). https://www.tandfonline.com/doi/full/10.1080/00393630.2016.1227052 Accessed January 8, 2026.
25) Xinying Hao, Michael R. Schilling, Xin Wang, Herant Khanjian, Arlen Heginbotham, Jing Han, Stephanie Auffret, Xianjun Wu, Beisong Fang, and Hua Tong. "Use of THM-PY-GC/MS technique to characterize com-plex, multilayered Chinese lacquer." *Journal of Analytical and Applied Pyrolysis*, No. 140. Elsevier B.V. pp. 339-348 (2019). doi:10.1016/j.jaap.2019.04.011.
26) Yaling Qin, Zhanyun Zhu, Ying Zhu, Michael Schilling, Jinzhang He, Lan Zhang, Tong Chen, and Ping Zhou. "Exploring thitsi in Qing Dynasty lacquerware: insights from a preliminary study." npj heritge Science, 13 (2025) 46. Springer Nature Limited doi:10.1038/s40494-025-01568-3.
27) Arlen Heginbotham, Julie Chang, Herant Khanjian, Michael R. Schilling. "Some observations on the composition of Chinese lacquer." *Studies in Conservation*. Vol. 61 2016, sup3, pp. 28-37 (2016). doi: 10.1080/00393630.2016.1230979.
28) Catherine Matsen, Maria Petisca, and Stephanie Auffret. "When science reveals craft practices: Recent findings in the py-GC/MS analysis of Chinese export lacquer." *ICOM-CC 2017 Copenhagen preprints*, pp. 3-4 (2017). https://www.icom-cc-publications-online.org/1612/When-science-reveals-craft-practices--Recent-findings-in-the-py-GCMS-analysis-of-Chinese-export-lacquer Accessed January 8, 2026.
29) Ibid. 5), Kamiya (2020), pp. 514-517.

Keywords: 南蛮漆器（Nanban lacquer）；ポルトガル・アジア南蛮様式漆器（Luso-Asian Nanban-Style Lacquer）；デジタル・マイクロスコープ観察（Digital Microscope Observation）；蛍光Ｘ線分析（X-ray fluorescence analysis (XRF)）；走査型電子顕微鏡観察（Scanning Electron Microscope (SEM) Observation）；資料断面観察（Cross-Sectional Observation）；熱分解ガスクロマトグラフィー質量分析（Thermal Heating Method (THM)- Gas Chromatography/Mass Spectrometry (GC/MS) Analysis）；文化財保存（Conservation of Cultural Properties）

Scientific Analysis of Two Christian Lecterns in Portugal: Investigation of Surface Decoration

KOBAYASHI Koji, KAMIYA Yoshimi*, CHI Chih lien and KURASHIMA Reo

Following on from the wooden substrate investigation results, reported in No. 64 of this journal last year, the surface decoration investigation of the two lecterns in Portugal—a *makie* and mother-of-pearl decorated Nanban lectern with pine-tree motif [Lectern (1)], and a gold-leaf (foil), mother-of-pearl decorated Luso-Asian Nanban-Style lectern with an IHS insignia and Chinese inscriptions [Lectern (2)] —is reported. In this investigation, digital microscope observation, scanning electron microscopy (SEM) was conducted by Kamiya, and X-ray fluorescence (XRF) by Chi, cross-sectional observation, pyrolysis gas chromatography/mass spectrometry (THM-GC/MS) by Kurashima, and Kobayashi edited the overall.

These analyses revealed that, for Lectern (1), although the original decoration and the central re-coated decoration part, applied with a time gap, differ significantly in appearance, both are essentially lacquered with the same materials and the gold material and technique for both decorations on the two lecterns is utilizing the *keshi-fun makie*—a technique using finely crushed foil powder—which is believed to be uniquely Japanese. This investigation further revealed that laccol lacquer derived from the wax tree grown in coastal regions from southern China to northern Vietnam was also used for re-coating, in addition to urushiol lacquer. These facts lead us to speculate that both the original and re-coated decoration of this lectern were applied in Japan, and that the latter was possibly in Nagasaki, using imported sap in the first half of the 17th century.

Urushiol and laccol lacquer were found on Lectern (2), suggesting that two kinds of lacquer sap may have been applied in separate layers. This result shows that the mixed use of these two kinds of lacquer sap was already practiced in the early 17th century, contrasting previous researches which suggest that the multiple use of lacquer sap in Canton mainly spread after the 19th century. A resemblance between fine black lines depicting leaf veins and other parts of flowers and the *harigaki* needle-scratching technique suggests that Japanese lacquer techniques may have directly influenced the production of Christian lacquerware in the Macau region. However, careful verification is needed to determine whether they are indeed the same technique as the needle-scratching technique.

Furthermore, although these two lecterns were made around the same time and share similar decorative styles, analysis has revealed that they were produced in clearly different regions and under different technical traditions. It is expected that the results of this analysis will provide useful information for future conservation and restoration of objects of these two styles distributed around the world.

*Meiji University

ポルトガルに伝えられたキリスト教書見台二基の科学分析
―表面装飾の調査―

小林　公治・神谷　嘉美*・紀　芝蓮・倉島　玲央

昨年度の本誌64号木胎調査結果報告に引き続き、本報告では同じく個人所蔵ポルトガル伝世の書見台2基［松樹蒔絵螺鈿南蛮漆器書見台 Lectern（1)、中国語銘 IHS 箔絵螺鈿ポルトガル・アジア様式書見台 Lectern（2)］の表面装飾調査結果を報告する。本調査では、デジタル・マイクロスコープ観察と走査型電子顕微鏡観察（SEM）を神谷が、蛍光Ｘ線分析（XRF）を紀が、試料断面観察、反応熱分解ガスクロマトグラフ質量分析（THM-GC/MS）を倉島が担当し、小林が総括した。

分析の結果、書見台（1）については、時間差をもってなされた当初装飾と中央部中心の上塗り装飾とが大きく様相を異にしながらも基本的に同種の材料による漆塗膜であり、金色装飾には共に日本独自の技法とみられる金属箔の微粉末を使用する消粉蒔絵が用いられていることが判明した。またさらに、上塗り塗膜からはウルシオール漆に加え、中国南部からベトナム北部沿海地域に分布するハゼノキに由来するラッコール漆が検出された。これらのことから、この書見台の当初および上塗り装飾はいずれも日本国内でなされたこと、そして上塗り装飾は17世紀前半に輸入された漆樹液を用いおそらく長崎でなされたと推測するに至った。

書見台（2）については、ラッコール漆に加えてウルシオール漆が使用されていたことが判明し、さらに両者は層毎に塗り分けられていた可能性を指摘した。この結果はこれまでの研究で、19世紀以降になって広まるとみられていた両種漆の混合使用が17世紀初め頃に遡って始まっていた可能性を示唆することになった。またこの書見台に認められる葉脈や花弁の黒色細線表現は針描技法に類似していることから、日本の漆工技法が直接的にマカオ域でのキリスト教具漆器制作に関係していた可能性が予測されるものの、それが確実に針描と同じ技法であるかの判断には、さらなる検討が必要となろう。

さらにこれらの書見台2基は、ほぼ同時期に造られ類似した装飾表現を持っているものの、本分析結果を比較することで、それぞれは明確に異なる地域、異なる技術伝統の下で造られたものであることが認識された。今回判明した諸分析結果は、世界各地に所在する両様式器物の保全や修復に有効な情報となることが期待される。

*明治大学