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Supplementary issue paper

Simplified Chinese lacquer techniques and *Nanban* style decoration on Luso-Asian objects from the late sixteenth or early seventeenth centuries

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The meeting of multiple cultures and their mutual influence during the Portuguese expansion in Asia led to the emergence of different types of fusion styles in objects commissioned by the settlers, merchants, and religious orders present in Portuguese India. The east-Asian lacquer coatings of modestly sized wooden objects of various types dating from the sixteenth and early seventeenth centuries have been analyzed as part of the research for a doctoral thesis that aims to establish their cultural and geographical attribution within the context of the Getty Conservation Institute's lacquer research project. Among the objects were three seventeenth-century lacquered trays from Portuguese museums and private collections that had previously been classified as Japanese *Nanban*, Chinese or Ryukyuan lacquers or even as Indo-Portuguese artifacts. The materials and techniques that were identified show close similarities with Chinese techniques mentioned in historic accounts — the only existing Ming Chinese *Treatise on lacquering* *Xiushi lu* and the eighteenth-century memoirs of the Jesuit priest d'Incarville. These nearly 400-year-old artifacts are among the first lacquered objects commissioned by Europeans and probably the first of Chinese origin. Their detailed technical study contributes to international lacquer research and complements existing knowledge and perceptions of the lacquering processes that were applied in response to an early European demand for exotic items.

Keywords: Laccol, Lacquer analyses, *Toxicodendron succedanea*, Chinese export lacquerware, Luso-Asian art, *Xiushi lu*, Portuguese expansion

Introduction

The Portuguese expansion in Asia in the course of the sixteenth century resulted in extensive exchanges on a cultural and economic level through various forts, settlements, and factories established along the Asian coastline. The network extended from southern Africa along the Indian coast via southeast Asia and southern China to Japan and was linked together by both a powerful fleet and the newly accessible intra-Asian trading routes that gave direct access to rare and precious merchandise, raw materials and luxury goods. Exchange took place on a broad front due to the presence of many cultures and religions, resulting in the emergence of a constantly changing network of both long-lasting and more ephemeral trade connections. These all took place within the context of a vast political-administrative-military

complex with Goa as the seat of the Viceroy, the strategic center of the Christian mission and the capital of Portuguese India (*Estado da Índia*) (Loureiro, 2000, 2015).

Portuguese settlers stimulated the production of everyday objects adapted to their habits. In addition, the religious orders that had been expanding into various regions of Portuguese India since the beginning of the diplomatic missions and commercial activities, required furnishings and liturgical equipment for their newly founded churches, as well as portable utensils to support their missions (Correia, 2011). Together, these resulted in the emergence of an industry located in Goa to cater for such demands (Silva, 2000, p. 88; Pinto, 2003). Although the Portuguese had attempted to establish official trade relations in Canton (Guangzhou) as early as the 1520s, it was not until the mid-sixteenth century that they gained permission to set up an official base in Macao that finally gave them direct access to highly desirable Chinese goods and which subsequently became the

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most important trading port and hub connecting the three main trading routes: Macau-Malacca-Goa-Lisbon, Canton-Macau-Nagasaki, and Macau-Manila-Mexico (Loureiro, 2015, p. 79). From the beginning of official trading activities, and depending on the status of a person, everyone on board a carrack was entitled to carry freight on their own account — so-called liberties, which were stored in numerous chests aboard (Boyajian, 2008, p. 39). In addition to official trade supervised by the Portuguese crown, private Portuguese and Chinese merchants operated in the South China Sea trading network (Guangdong, Fujian, and Zhejiang) as a result of informal partnerships they had already established in the previous decades (Loureiro, 2000, p. 61).

In the course of the sixteenth and early seventeenth centuries a variety of different types of fusion arts emerged along the Asian coastline, including Indo-Portuguese, Sino-Portuguese, and *Nanban* art. The study of these objects has, however, shown additional influences reflected in their heterogeneous appearance, which add a unique character to them and make it difficult to determine their cultural and geographical origin. They were grouped together under the term ‘Luso-Asian objects’, to reflect their combination of influences from more than two geographically different locations.

Objects investigated

This study focused on the lacquer coatings of three rectangular trays with identical tropical hardwood cores. Manufactured in India for southern European buyers, they were then coated with an east-Asian lacquer and embellished with gold leaf decoration, alone or in combination with mother of pearl inlays. As many earlier examples of such objects came from Portuguese monasteries and convents, there have been repeated questions concerning their origin. This is the first time that their lacquer coatings have been studied in such detail; they have been chosen on account of the interesting results obtained in the analyses and because they are representative of a larger group of at least 25 known examples. The three trays also share the same decorations and raise the same questions about their origins as a further group of related objects with different typologies (Körber, forthcoming).

These trays belong to a subgroup of modest sized objects within a group of lacquered Luso-Asian items with the same fusion of decorative techniques, all of which were destined for liturgical use: lecterns, trays, and portable oratories of diverse shapes. Some show carved Eucharistic symbols or monograms of religious orders. Today, many are part of Portuguese museum or private collections. It has been suggested that these trays were used in their religious settings for the presentation of conventual sweets during special religious holidays (Pinto & Canavarro, 1989,

p. 100; Borges, 2013, p. 45). Although purpose and use are obscure, this could explain why almost all the trays that survive within Portuguese museum collections were once listed in the inventories of monasteries that were dissolved from the nineteenth century onward.

Trays 1 and 2 are part of the collection of the Museu Nacional de Arte Antiga, Lisbon, Portugal, (MNAA, inv. 44 band, 2 band) while tray 3 comes from a private collection in Porto, Portugal. They are related to other small objects such as missal stands or oratories with a similar carved wooden structure embellished with gold leaf decoration (Japanese *haku-e*, Chinese *tie jin qi*) (Arakawa, 1996, pp. 197–217; Frick, 2015, personal communication) and mother-of-pearl inlays (Japanese *raden*, Chinese *luotian*) (Herberts, 1963, pp. 267, 341; Garner, 1979, p. 210; Kopplin, 2002, pp. 212, 215).

General structure and description

All three trays consist of a smooth rectangular bottom panel, with or without carved floral motifs in low relief in the form of rosettes in the center or quarter rosettes in each corner. The panel is attached with hooked iron nails to the undersides of the four sloping sides that have a carved border with a petal motif on their insides. The sides are joined with inclined dovetails. The wooden structures are entirely covered with Asian lacquer and decorated in a similar manner. The carved areas were originally completely highlighted in gold, while the flat areas are covered with a plain black lacquer surface decorated with motifs typical of the Chinese decorative repertoire, either in gold leaf (tray 1) or gold in combination with mother-of-pearl inlay (trays 2 and 3). The undersides of the trays have a red coating.

Tray 1 has depictions of magpies and butterflies among tree peonies toward the top, with squirrel-like beasts and jumping carps in a water scene with lotuses toward the bottom, all framed by a double-line border (Arakawa, 1996; Kreiner, 2003, p. 374) (Fig. 1). Since the gilding has largely been worn off,



Figure 1 Tray 1, Museu Nacional de Arte Antiga, Lisbon, inv. 44 band (6 × 63 × 36.5 cm) ©LJF-DGPC, Luis Piorro.



Figure 2 Tray 1, top surface showing worn gilding with the exposed red bole layer and the wooden core in areas where the lacquer coating has been lost.

traces of gold, the red bole layer and the incised lines of the needle drawing remain, making the motifs more visible in oblique light (Figs. 2 and 3). On the outside of the sloping sides there is an undulated decorative band of linked lotus and chrysanthemum flowers (Fig. 4). Before it became part of the museum collection in 1903, this tray belonged to the Santa Clara convent in Évora.

Similar friezes are present on other examples of Luso-Asian furniture, for example the interior of the lid from a lacquered chest housed in the Palácio Nacional de Sintra (PNS 2963) in Portugal, or on the upper edge of the sides of the ‘Pope’s trunk’



Figure 3 Tray 1 seen in oblique light, showing the incised drawing of a detail of a bird in the gilded decoration.



Figure 4 Tray 1, detail of the inlaid silver decoration of the floral border on the outside of the sloping sides, with a reconstruction of its original pattern.

(Museen des Hofmobiliendepots Wien, MD047590), which was detailed in the inventory of the Kunstkammer of Emperor Rudolph II from 1607 to 1611 (Trnek & Silva, 2001, cat. 69; Körber, forthcoming).

Similar undulating borders with a floral design appear on Ryukyuan lacquerware, for instance on a lacquered tray on a high foot with painted birds, flowers and grapevines from c.1700 to 1800 that is in the collection of the Los Angeles County Museum of Art, Los Angeles, CA, USA (M.81.189).

The decoration on tray 2 features flowering branches, speckled deer and magpies framed by a single gold line. It is executed in a combination of gold leaf and mother-of-pearl inlay; the latter is characterized by very thin pieces of colored iridescent shell. The smooth lacquer surface is framed by a band with a carved diamond pattern (Pinto, 1990, p. 57;



Figure 5 Tray 2, MNAA, inv. 2 band (6 × 71 × 45 cm) ©LJF-DGPG, Luis Piorro.



Figure 6 Tray 2 showing a detail of the gold decoration and mother-of-pearl inlay.

Neuwirth, 1998, pp. 122–3; Frade & Körber, 2011, pp. 39–44; Körber *et al.*, 2011, p. 3) (Figs. 5 and 6). In 1887, this tray was transferred from the Nossa Senhora da Quietação convent in Lisbon into the museum collection).

The same techniques are present on Tray 3, which is from a Portuguese private collection (Figs. 7 and 8). Its smooth, black, lacquered surface is covered with gilded motifs of flowering branches, magpies, squirrels, and monkeys and a snake monkey all framed by a double-line border. Some leaves and flowers are inlaid with mother-of-pearl, in the same way and with the same colorful iridescence as in tray 2 (Pinto & Canavarro, 1989, pp. 100–1, cat. 75; Pinto, 1990, p. 56; Cunha, 1998, p. 434).

Its red lacquer reverse bears an inscription: *Angela dos Seraphins*, perhaps the religious name of a nun. In 1673, an abbess by the name of Angela dos Serafins served as mother superior of a Benedictine monastery in Viana do Castelo, suggesting this nun may have been one of its previous owners, as both script and spelling could date from the seventeenth century (Pinho, 2010) (Fig. 9).

A similar tray is held by the Kyushu National Museum (H133). Equally small in size, it presents comparable motifs with flowering branches and birds using gilded decoration and mother-of-pearl inlays framed by a double-line border.

While the Chinese motifs depicted in gold (applied as metal leaf) on tray 1 are similar to those present on other Luso-Asian artifacts, trays 2 and 3 show a characteristic combination of gold leaf decoration and mother-of-pearl inlays that led them to be classified previously as *Nanban* lacquerware. There are, however, only two other known rectangular *Nanban* trays of uncarved wood in existence (Cunha, 1998, p. 434; Impey & Jörg, 2005, p. 198; Vinhais & Welsh, 2008, p. 336).



Figure 7 Tray 3, private collection, Porto (3.5 × 38.5 × 23.3 cm) ©Pedro Lobo.

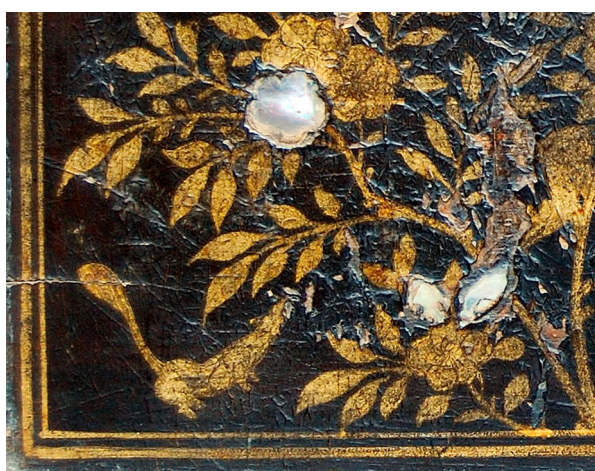


Figure 8 Detail of the decoration on tray 3.

Other objects with the same characteristics

A wooden lacquered oratory with Indo-Portuguese carving, bearing the same combination of techniques as trays 2 and 3, is still housed in the Encarnación monastery in Madrid (00620040) (Dias, 2008b, p. 106; Kawamura, 2003, p. 112, 2013, pp. 43–44). A missal stand in Indo-Portuguese style with decorative band of consecutive spirals that can be found on other lacquered Luso-Asian furniture was purchased at auction and is now in the Nanban Bunkakan in Osaka (Impey & Jörg, 2005, p. 175, cat. 407). This missal stand bears the IHS insignia of the Society of Jesus (Arakawa, 1996, pp. 208–10; Neuwirth, 1998, p. 120; Impey & Jörg, 2005, p. 175). A similar missal stand, decorated with extraordinary Chinese clouds and unusual stars, is owned by the Santa Casa di Loreto (founded 1220) and has been studied and examined recently in the Vatican Museums in Rome.¹ It shows the same decorative band of consecutive spirals and similar techniques and materials were employed in its manufacture. In addition, it seems

¹Conservator Catherine Rivière at the Laboratorio Polimerico of the Vatican Museums, Rome (director Stefania Pandozy) and analyst Francesca Cibin at the Laboratorio di Diagnostica per la Conservazione ed il Restauro (director Ulderico Santamaria). Koji Kobayashi is thanked for his kind invitation and for sharing his findings.



Figure 9 Inscription with the name 'Angela dos Seraphins' on the red lacquered reverse of tray 3.

likely that many further objects of this type still lay hidden, unanalyzed or incorrectly classified in collections around the world.

Previous attributions

As mentioned above, the floral motifs in gold combined with mother-of-pearl and the obvious similarities with *Nanban* decorations have often led these and similar items to be classified as *Nanban*. Following a suggestion by a Japanese lacquer specialist, a possible Ryukyuan provenance for these trays was first proposed in 1989 (Pinto & Canavarro, 1989, pp. 100–1; Arakawa, 1996, pp. 207–17). Later attributions tended to favor a Chinese or Ryukyuan origin (Pinto, 1990, pp. 56–57). In addition, an Indo-Portuguese origin for such items has been suggested as it has been argued that Chinese lacquer decorations were perhaps imitated by Indian craftsmen (Carvalho, 2001, pp. 152–3).

Findings from previous studies of Luso-Asian lacquerware

These three trays have been subject to an earlier study in the context of a research project conducted at the Laboratório José de Figueiredo — Departamento Geral do Património Cultural (LJF-DGPC) in Lisbon between 2009 and 2012.² This earlier study identified the lacquer species, the inorganic materials and the presence of a drying oil in lacquer layers, but it was not possible to be more specific about the type of drying oil or to determine the source (blood, glue, etc.) of the proteinaceous binders in ground layers.

Nevertheless, this previous study concluded that the coatings were not of Japanese origin as the stratigraphies and materials employed did not correspond to those found on *Nanban* lacquerware examined at the LJF-DGPC (Frade, 2011; Frade & Körber, 2011; Körber *et al.*, 2011).

Although at first sight the decoration of these objects shows similarities with *Nanban* lacquerware, on closer examination differences in style and technique became apparent. *Nanban* lacquerware

purchased by southern Europeans, especially by the Jesuits and other religious orders, between the late sixteenth and early seventeenth centuries in Japan never used the application of gold leaf but instead employed *maki-e* decoration, the sprinkled dust of gold or gold alloys (Impey & Jörg, 2005, pp. 77–83; Frade & Körber, 2011; Yamashita & Lencz, 2014). As a result, the leaves on the branches are always depicted in at least two different tones in *Nanban* decorations and not with a homogeneous gold tone as on the Luso-Asian artifacts. *Nanban* decorations also use multiple decorative friezes filled with geometrical and stylized floral patterns, never one or two single lines. The latter is, however, commonly found on Chinese lacquerware. The *Nanban* coatings that have been examined used *urushi*, or *thitsi* lacquer for intermediate layers and, moreover, were based on ground layers with very distinctive compositions.

The small amount of remaining sample material from these trays was analyzed alongside samples from a group of other Luso-Asian furniture from Portuguese and other European collections whose lacquer coatings were analyzed for the first time at the Getty Conservation Institute (GCI) with the objective of answering specific questions about the composition of ground and lacquer layers and the origin of the protein present in ground layers, complementing and expanding our knowledge of layer compositions and creating a broader basis for comparison (Körber, forthcoming).

Materials and methods³

Optical microscopy

Cross-sections of the lacquer samples were prepared for optical microscopy and analysis. During the study at the LJF-DGPC, the samples were mounted in epoxy resin and polished. New mounted samples were embedded in Technovit 2000 LC methacrylate cast resin and polished manually using Micro-Mesh sheets up to 12 000 grit. Optical microscopy was carried out under visible and ultraviolet light (UV) using an Olympus BX51 optical microscope coupled to an Olympus E.330 digital camera; the same cross-sections were again observed at the GCI using a Leitz microscope equipped with visible and ultraviolet sources and with an excitation filter cube (I3) for blue light illumination (wavelength 450–495 nm).

SEM-EDX

To visualize the distribution of inorganic materials and for elemental analysis, energy-dispersive X-ray analysis in a scanning electron microscope (SEM-EDX)

²Unless otherwise indicated the images were taken by the author within the scope of a research project undertaken at the furniture section of the conservation department of the LJF-DGPC in Lisbon during the conservation treatment of trays 1 and 2 in 2009–2012, and guided by Margarida Cavaco. Analyses were conducted by: José Carlos Frade (Py-GC-MS, FTIR); Ana Mesquita e Carmo (XRD); Maria José Oliveira (XRD); Lília Esteves (wood analyses); and Figs. 1 and 5 were provided by Luis Piorro.

³The analyses were undertaken by: Michael Schilling (THM-Py-GC-MS); Ulrike Körber (separation of individual layers, preparation of cross-sections, microscopy and staining); Julie Chang (staining); Herant Khanjian (FTIR); David Carson (SEM-EDX on the scraping from tray 2); and Luis Dias (SEM-EDX).

was carried out on a Hitachi S-3700N with an accelerating voltage of 20 kV and a chamber pressure of 40 Pa. Chemical microanalysis was performed with a Bruker XFlash 5010 Silicon Drift Detector with a resolution of 129 eV at Mn K α . A sample scraped from the gilded lines on top of the mother-of-pearl inlay on tray 2 was analyzed at the GCI using a Philips-FEI XL30 ESEM-FEG equipped with an Oxford X-Max 80 elemental detector running with Aztec software. The experiment was performed in low vacuum mode at *c.* 100 Pa.

Separation of individual layers through micro-excavation

To prepare the sample material for analysis using pyrolysis-gas chromatography-mass spectrometry with thermally assisted hydrolysis and methylation (THM-Py-GC-MS), individual layers were scraped from loose lacquer flakes with a microchisel under the microscope under either visible or ultraviolet light. Photomicrographs of the cross-sections were consulted frequently during sampling and the light source was changed as necessary to ensure that the scraped material originated from the desired layer. The scrapings were carefully removed and placed in the well of a single-depression microscope slide. To avoid possible contamination, scraping was stopped as soon as the underlying layer became visible. In some cases lacquer layer separation was not possible due to the reduced thickness or small size of the sample material.

THM-Py-GC-MS

For THM-Py-GC-MS, tetramethylammonium hydroxide (TMAH) was added to the samples prior to analysis to convert any carboxylic acids, alcohols, phenols, and catechols to more volatile products. A Frontier Lab PY-2020D double-shot pyrolyzer system was used for pyrolysis, with the interface maintained at 320°C. The pyrolyzer was attached to an Agilent Technologies 5975C inert MSD/7890A gas chromatograph/mass spectrometer. The split injector was set to 320°C with a split ratio of 20:1 and no solvent delay. An Agilent J&W Ultra-inert DB-5MS capillary column was used for the separation (30 m \times 0.25 mm \times 0.25 μ m, but because the column was attached to a Frontier vent-free adaptor, the equivalent column length was 40 m). The helium carrier gas rate was set to 1 ml min⁻¹. The oven of the GC was held at 40°C for two minutes then ramped to 320°C at 20°C min⁻¹, followed by a nine-minute isothermal hold (for some samples, the oven heating rate was 6°C min⁻¹). The MS transfer line was maintained at 320°C, the source at 230°C, and the MS quad at 150°C. The mass spectrometer was scanned from 10 to 600 amu at a rate of 2.59 scans per second. Samples were placed into a 50 μ l stainless steel Eco-cup registered trade mark symbol,

and three microliters of a 25% methanolic solution of TMAH were introduced for derivatization. After three minutes, the cup was fitted with an Eco-stick registered trade mark symbol and then placed into the pyrolyzer where it was purged with helium for three minutes. Samples were pyrolyzed using a single-shot method at 550°C for six seconds.

Results

The identification of the specific materials present in the ground and lacquer layers is based on the parameters and database developed by Michael Schilling at the GCI, which are described in detail in the present volume (Schilling *et al.*, 2016).

The two trays from the MNAA had previously undergone conservation treatments that introduced wax into the objects. The presence of the wax interfered with the identification of the drying oils in ground and lacquer layers during the analyses by raising the palmitate to stearate (P/S) ratios, which are indicators of specific drying oils (Tables 1–3).

Wooden structure

Although it was not possible to collect adequate samples from the wooden substrates to permit the identification of specific species of trees, macroscopic examination showed that in all three cases tropical hardwood had been used. In trays 1 and 2, where the wooden structure is exposed on the rear surface, teak wood (*Tectona grandis*) or a macroscopically similar species could have been used.

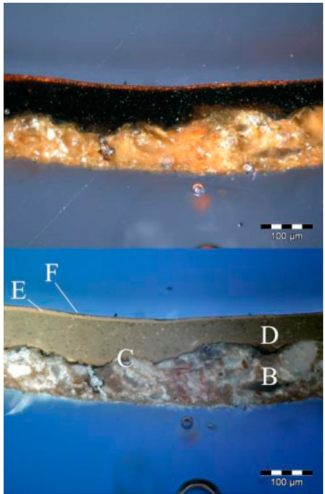
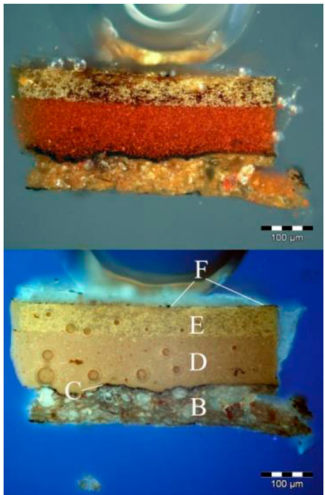
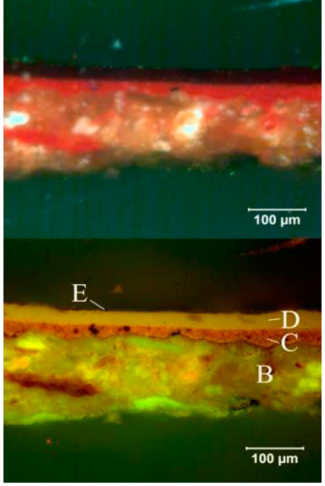
General layer structure and composition

On all three trays, a single ground layer was applied onto the wooden structure. The ground comprised of drying oil, protein, and sometimes starch, to which earth pigments had been added to give an overall light color that varied between beige and reddish-beige. All three trays were coated with laccol lacquer, derived from the sap of *Toxicodendron succedanea* L. species. Drying oil was added to both the ground and lacquer layers and, for the colored lacquer layers, pigments such as orpiment, red iron oxide, and carbon black (in the form of soot or charcoal) were identified. As can be seen from Tables 1–3, the stratigraphy within each of the trays varies according to the type of decorative technique used.

Gilded motifs and combination with mother-of-pearl inlay

In all three trays a thin, black-pigmented intermediate layer was applied onto the single ground layer. It was only possible to sample this layer in tray 2, where it proved possible to detect a mixture of slightly heat-bodied perilla oil with charcoal. For trays 1 and 3, it is most likely that charcoal or soot were used in the thin intermediate layers as no elements with a higher

Table 1 Tray 1, stratigraphies and composition of individual layers.

			Cross-sections V: vis light, U: UV light, B: blue light	
Stratigraphy	Identified materials			
I Top surface	Gold decoration	F: Silver leaf (Ag, S) E: Bole: Lacquer pigmented with red soil or iron oxide (Fe, Al, Si, Ca)**	V	
	Lacquer	D: Laccol (arlenic acid, C17), perilla oil (glycerol, A/P 0.50, P/S 1.91), protein (pyrrole, protein markers), soot (soot marker)		
	Pigmented intermediate layer	C: Layer of unknown composition with charcoal** (same as II-C?)	U	
	Ground layer	B: Earth material (Al, Si, Ti, Fe, K, Ca) in drying oil* (dicarboxylic fatty acid), protein (pyrrole), pine resin (pinaceae markers) and trace laccol (anacard markers) from layer above?, beeswax (A/P 0.05, P/S 10.65)		
II Gilded carvings	Gold decoration	F: Gold leaf (Au)	V	
	Lacquer	E: Brownish translucent lacquer layer: Laccol (arlenic acid, C17), tung oil (glycerol, A/P 1.09, P/S 1.57)		
	Lacquer	D: Red-brown layer: Laccol (arlenic acid, C17), tung oil (A/P 1.2, P/S 1.04), soot (soot markers), pigmented with red iron oxide (Fe)		
	Pigmented intermediate layer	C: Black-pigmented layer: Laccol (arlenic acid, C17), drying oil* (dicarboxylic fatty acid), starch (schellmannose), blood (phosphate, pyrrole, protein and blood markers), pine resin (pinaceae marker), soot (soot markers), caffeine (caffeine markers), beeswax (A/P 0.16, P/S 4.6)	U	
III Rear side	Ground layer	B: same as I-B		
	Decoration	E: Silver leaf (Ag, Cl)	V	
	Lacquer	C+D: Red and brown layer*** Laccol (arlenic acid, C17), slightly bodied tung oil (glycerol, A/P 1.71, P/S 1.05), trace protein (pyrrole)		
	Lacquer	D: Transparent layer serves as bole layer for the silver leaf in the area of the decorative band C: Lacquer layer pigmented with red iron oxide (Fe)	B	
	Ground layer	B: same as I-B		


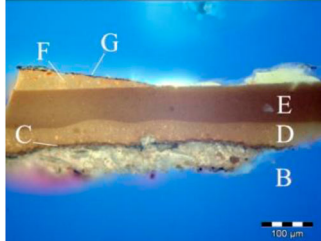
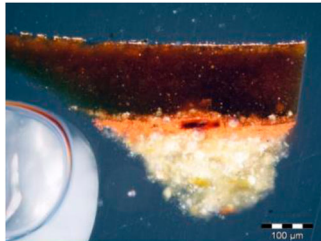
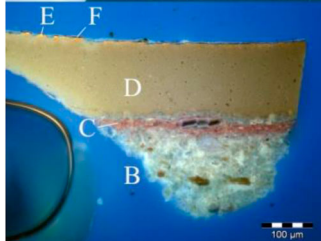
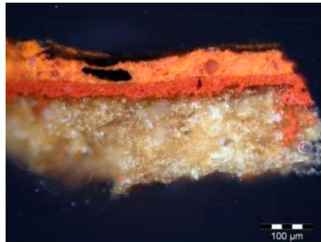
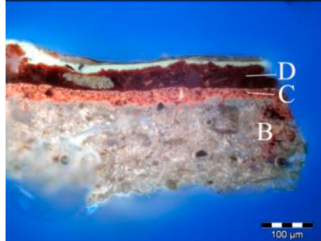
*The presence of beeswax resulting from conservation treatments interfered with the oil identification.

**Only analysed by SEM-EDX.

***THM-Py-GC-MS performed on both layers because of a tiny sample amount.

****SEM-EDX on one sample performed by David Carson, GCI.

Table 2 Tray 2, stratigraphies and composition of individual layers

Stratigraphy		Identified materials	Cross-sections (V: vis light, U: UV light)	
I Top surface	Gold decoration	G: Gold leaf (Au) F: Bole: Lacquer pigmented with orpiment (As, S), ** above MOP with red iron oxide (Fe)****	V	
	Lacquer layers	D+E: Laccol (arlenic acid, C17), tallow tree oil (glycerol, A/P 0.43, P/S 3.54), protein (pyrrole)***		
	Pigmented intermediate layer	C: Slightly heat-bodied perilla oil (A/P 2.38, P/S 2.19), trace pine resin (<i>pinaceae</i> markers), charcoal	U	
	Ground layer	B: Earth material (Al, Si, Ca, Fe, K) in drying oil* (dicarboxylic fatty acid), blood (phosphate, protein, blood markers), trace pine resin (<i>pinaceae</i> markers) and bitumen (bitumen markers), beeswax (A/P 0.28, P/S 4.9)		
II Gilded carvings	Gold decoration	F: Gold leaf (Au)	V	
	Lacquer	E: Bole: Thin lacquer layer pigmented with aluminum silicates and red iron oxide (Al, Si, Fe)		
	Lacquer	D: Laccol, slightly bodied perilla oil (A/P 0.92, P/S 2.3), protein (pyrrole)		
	Pigmented intermediate layer	C: Red pigmented layer: Slightly bodied perilla oil (glycerol, A/P 1.1, P/S 2.2), blood (pyrrole, trace phosphate, trace sterols), starch (schellmannose), red iron oxide or red earth (Fe, Al, Si), calcium (Ca)	U	
	Ground layer	B: same as I-B		
III Rear side	Decoration	–	V	
	Lacquer	D: Western coatings (drying oil, ambar, copal, sandarac, larch turpentine, traces of starch and protein, soot), beeswax (A/P 0.2, P/S 4.0), Pigments: Red lead, red earth or iron oxide, soot, barite (Ba, Pb, Fe, Al, Si, K, Ca)		
	Lacquer	C: Lacquer of unknown composition, pigmented with red iron oxide (Fe). Same composition as II-C?	U	
	Ground layer	B: same as I-B		

*The presence of beeswax resulting from conservation treatments interfered with the oil identification.

**Only analysed with SEM-EDX.

***THM-Py-GC-MS performed on both layers because of a tiny sample amount.

****SEM-EDX on one sample performed by David Carson, GCI.

atomic number were detected by SEM-EDX. The absence of phosphorus and calcium eliminated bone-based pigments as possible components.

The overlying lacquer layers have distinctly different compositions; trays 1 and 3 show two lacquer layers, whereas tray 2 has a single lacquer layer. The gilding technique also differs as in trays 1 and 2; the metal leaf was attached to a pigmented layer based on either orpiment (tray 1) or an iron oxide (tray 2), while the gold leaf on tray 3 was applied directly on to the transparent second lacquer layer. Initially, it was assumed that the gilded motifs of birds and peonies of tray 1 were also made with gold leaf as these appeared to be made of the same material (Fig. 2), but SEM-EDX revealed the presence of silver leaf.

In tray 2, thin golden lines have been applied to the shell pieces to make them appear as leaves or flower buds. Where the mother of pearl is gilded, the gold is applied to a red iron oxide (bole) layer (Table 2, I layer Fa; Figs. 10 and 11), in contrast to the use of an orpiment pigmented layer in the remaining motifs (Table 2, I layer Fb). Thus, although all the gilded areas at first appear to have been applied in a single operation, it is evident that the gilded motifs on black lacquer and the gold applied onto the mother-of-pearl inlay were produced in separate steps using different materials.

Gilded carvings

Due to the good condition of the carved rim of tray 3, it was not possible to collect a sample from that particular area (which is why there is no section II in Table 3). There are two different stratigraphies on trays 1 and 2, but they yielded similar results. In tray 1, a thin intermediate layer of lacquer mixed with a drying oil, starch, blood, and charcoal was applied onto the ground layer followed by a red-brown lacquer layer mixed with tung oil to which red iron

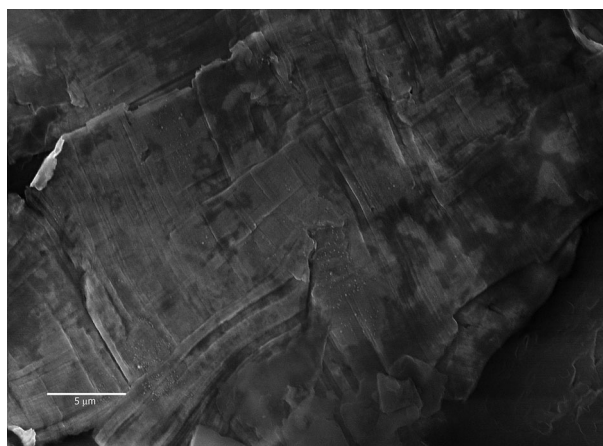


Figure 10 Tray 2, sample from the gilded lines over the mother-of-pearl inlay. The SEM image shows gold leaf. ©David Carson, GCI.

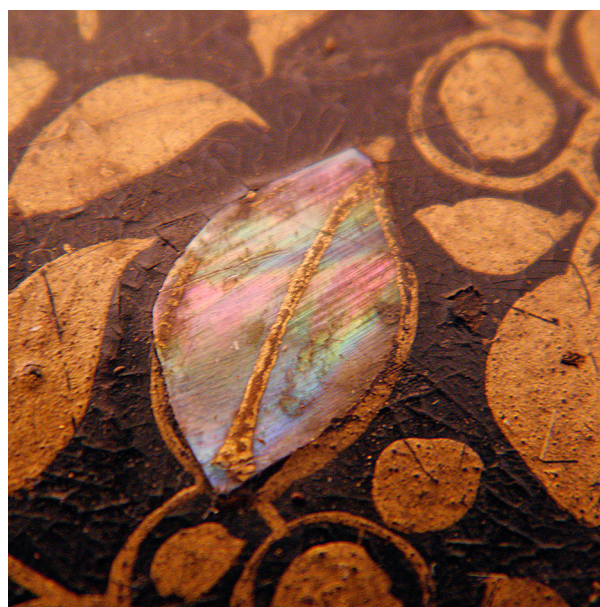


Figure 11 Tray 2, showing gilded lines on the shell pieces with the exposed red bole layer.

oxide and soot were added. No pigmented bole layer was used. Instead, gold leaf was applied to a transparent brownish lacquer layer mixed with tung oil.

On tray 2, a thin intermediate layer of lacquer mixed with slightly heat-bodied perilla oil, blood, and starch mixed with a red earth pigment, was applied onto the ground layer followed by a transparent brownish layer of lacquer mixed with slightly heat-bodied perilla oil. The gold leaf was attached to a very thin red lacquer layer of unknown composition.

Outer sides

In all three trays, the original lacquer coatings consist of a single lacquer layer pigmented with red iron oxide that sits upon a single ground layer. For tray 1, SEM-EDX analyses of a cross-section of a sample from the floral border on the outer surface of the sloping sides revealed that the decorative effect was achieved by inlaying silver leaf (Fig. 4). Over time, the silver has become tarnished through conversion to silver sulfide, which is why it had not been identified before. SEM-EDX also detected chlorine in the silver corrosion products. The silver leaf was applied to a transparent, brownish lacquer layer. It is not known whether the silver leaf was meant originally to imitate gold leaf.

Discussion

The results were compared with references found in two historic accounts of Chinese lacquer art. The first is the late Ming treatise *Xiushi lu* (records of lacquering) written by Huang Cheng from Xinan, a famous lacquer artist in the Longqing era (1567–1572), with a preface and some comments added by Yang Ming from Jiaying in 1625. This treatise is the

only existing pre-modern Chinese account on lacquer art. Its structure is based on Chinese cosmology and is divided into two parts, the first of which deals with the tools and materials involved, while the second makes reference to the many decorative techniques and diverse lacquer compositions used on objects destined for a range of purposes, from domestic use to sophisticated luxury goods. Rather than serving as a manual with technical details for artisans and craftsmen, the *Xiushi lu* is a book for the educated and prosperous classes, providing them with information to acquaint them with finished lacquer artifacts (Clunas, 1997; Wang, 2012; Jixing, 2013, p. 199; Frick, 2013). Nevertheless, its references to materials and decorative techniques found on Chinese lacquerware of that era make it an important source for this study.

A second important source is the more recent memoirs of the French Jesuit priest Pierre d'Incarville (1706–1757) who stayed at the Qing court in Peking for 17 years and sent a long description of lacquer art to the Academy of Sciences in Paris. First published in 1760, his memoirs describe the lacquering procedures used for the production of goods at the emperor's court (Sabin, 1904, pp. 146–79).

Wooden structure

Carvings of diamond and flower motifs were widely used in Goan civil and religious architecture or furniture (Carvalho, 2001, p. 151). Given their wooden structure and carvings the trays are undoubtedly of South Asian origin and can be compared to sixteenth and seventeenth century wooden fittings in Catholic churches or in Portuguese households in India, or to carvings on other Indo-Portuguese furniture (Pereira & Pal, 2001; Pinto, 2003; Dias, 2008a).

Lacquer type

The tree *Toxicodendron succedaneum* L., known as the principal source for Vietnamese lacquer, also grows in southern China, Indochina, and Japan, where it is known as *Haze* or wax tree (Daniels & Menzies, 1996, p. 19). A study of lacquer trees from the southern Chinese province of Guangxi identified them as belonging to the same species (Wan et al., 2007). In addition, Garner states that the sap of *Toxicodendron succedanea* L. species was possibly used for lacquerware in southern China (Garner, 1979, p. 20). There are other species of tree that contain laccol as their main ingredient, such as *Toxicodendron ambigua* Lavall ex Dipp. (also known as *Rhus orientalis*, which in Japan yields *tsuta urushi*) or *Semecarpus vernicifera* (Daniels & Menzies, 1996, p. 20).

Analyses performed on lacquer samples from Chinese export lacquerware produced in Canton dating from the eighteenth and nineteenth centuries

again identified laccol lacquer, in addition to some *urushi* lacquer layers from *Toxicodendron vernicifera* in the outermost layers (Petisca et al., 2011).⁴

Both lacquer types are also found on lacquered Luso-Asian objects, although *Toxicodendron vernicifera* appears only in the finishing layers of a few objects.

Another study on French furniture that incorporates Chinese export lacquer panels and of an eighteenth-century Ryukyuan inkstand from the J. Paul Getty Museum also detected laccol lacquer, cf. Heginbotham et al. (2016).

A study of six Ryukyuan objects with gold leaf décor from the collection of the Urasoe Art Museum in Okinawa, Japan, revealed that two were made with laccol lacquer — a red lacquered plate from the sixteenth to seventeenth century and a black and red lacquered box from the seventeenth to eighteenth century (Lu et al., 2007). Unfortunately, this study did not identify any further ingredients that might allow for further comparison.

Conversely, analyses performed on the so-called Ryukyu bowl from the Ambras Castle collection in Innsbruck, Austria, (Trnek and Silva, 2001, p. 227), which was also mentioned in the 1596 state inventory of Archduke Ferdinand II, revealed an *urushi* coating. Due to the tiny amount of sample, which did not allow the layers to be separated for individual testing, the whole sample was pyrolyzed. Nevertheless, perilla oil, starch, and blood were also detected within the sample (Körber, forthcoming). These results illustrate that laccol lacquer was used in Chinese lacquerware as well on objects produced in the Ryukyu Islands and was by no means limited to Vietnamese lacquer art.

Ground layers

Although the materials identified, as well as the structure and composition of ground and lacquer layers, are very different from those described in the *Xiushi lu* (which mentions differences in quality) they indicate that the coatings are of Chinese origin.

As Yang Ming noted (in part II, chapter 17, entry 175), ‘the body, the foundation and intermediate layers must be strong as they constitute a lacquerware’s bones and flesh’ (Wang, 2012). Huang Cheng mentioned that powdered porcelain or horn was the best material to add to lacquer sap to form foundation layers. Second-rate materials included bone and clam shell powders, while ground brick, unfired clay, or whetstone powder were cited as inferior materials. The structure of the ground was described as

⁴The same methodology applied to the study of the Luso-Asian lacquer samples has been applied to the study of the Cantonese lacquer samples at the LJF-DGPC. In both cases drying oils were not detected in the ground layers.

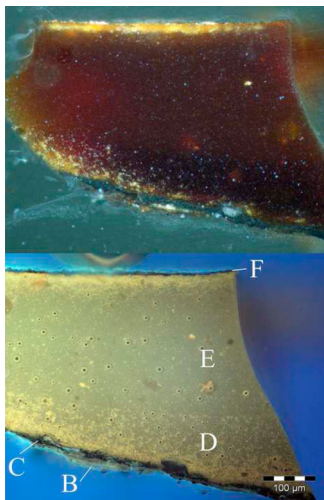
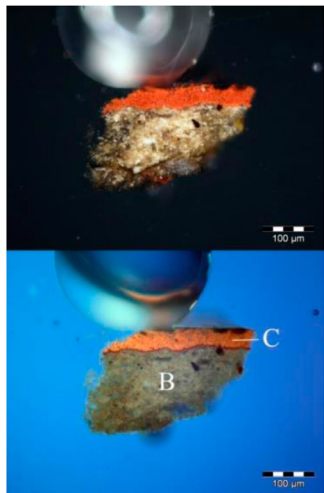
comprising three layers, each with a distinct composition. The powdered additives were sieved and sorted by particle size into coarse, medium and fine for inclusion in these three layers. Yang Ming added (part II, chapter 17, entry 180): ‘nowadays petty craftsmen use unbaked clay and charcoal powder mixed with thick paste, pig’s blood, lotus root starch paste, or glue to build foundation layers. How could this practice make wares durable? A better material in use is a paste of powder mixed with cooked tung oil’ (Wang, 2012). Analysis of the ground layers of the trays and other related objects shows that they correspond to these inferior versions.

According to the *Xiushi lu*, the wooden core was first sealed with lacquer to which a cloth layer was attached, followed by coarse, medium, and fine layers of ground. An intermediate lacquer coating

was then applied to the ground, followed by a raw lacquer layer and an intermediate coating of processed lacquer. The finish lacquer coating applied on top frequently consisted of more than one lacquer layer (Wang, 2012). Thus, the whole structure comprised a minimum of 10 different layers, which contrasts to the simple layer structure observed on the three trays.

For his part, d’Incarville described techniques used at the Imperial Workshop in Beijing 200 years later. He stated that the core was prepared by brushing the surface with an aqueous solution of gum mixed with chalk. Next, a layer of paper or silk was glued onto the surface with pure lacquer. The ground consisted of a light coat of sieved brick dust, tung oil, and pig’s blood (previously prepared with lime water), followed by a blend of lacquer and a type of earth (Sabin, 1904, pp. 155–8). Despite the mixture for the ground,

Table 3 Tray 3, stratigraphies and composition of individual layers

Stratigraphy		Identified materials	Cross-sections (V: vis light, U: UV light)	
I Top surface	Gold decoration	F: Gold leaf (Au) No pigmented bole layer	V	
	Lacquer layers	D+E: Laccol (arlenic acid, C17), tung or perilla oil (glycerol, A/P 1.08, P/S 1.33), protein (pyrrole, protein markers)*** (organic particles visible in both layers)		
	Pigmented intermediate layer	C: Layer pigmented with charcoal or soot**	U	
	Ground layer	B: Traces of wooden substrate and earth material (Al, Si, Fe, Ca, K)		
II Gilded Carvings		No sample		
III Rear side	Decoration	–	V	
	Lacquer	C: Bodied tung or perilla oil (glycerol, A/P 0.45, P/S 1.55), trace laccol (Anacard carbohydrates), pine resin (<i>pinaceae</i>), pigmented with red iron oxide (Fe) (thin red line from sunken pigments?)	U	
	Ground layer	B: Earth material (Al, Si, K, Fe, Ca) in perilla oil (A/P 0.27, P/S 2.18), protein (protein markers), starch (schellmannose)		

*The presence of beeswax resulting from conservation treatments interfered with the oil identification.

**Only analysed with SEM-EDX.

***THM-Py-GC-MS performed on both layers because of a tiny sample amount.

****SEM-EDX on one sample performed by David Carson, GCI.

the layer sequence described by d’Incarville is more consistent with the analyses of the Cantonese export lacquer samples mentioned earlier, which identified a mixture of different iron-containing clays, other silicates and minerals in a protein-containing binder in the majority of ground layers. Only three of 12 objects had lacquer-containing ground layers that comprised two layers and an intermediate layer of organic fibers (Petisca *et al.*, 2011). Other analyses of Chinese export lacquerware from the eighteenth and nineteenth centuries also identified drying oils in the ground layers (Schellmann, 2012), and the ground layer of the Ryukyu bowl mentioned above also contained lacquer.

Investigations of the proteinaceous materials found in the ground or lacquer layers confirmed the presence of blood in five cases (Table 3, III layer B; Table 2, I layer B and II layer C; Table 1, I layer B and II layer C). To determine the specific animal species of the blood, DNA analysis would be necessary, cf. Miklin-Kniefacz *et al.* (2016). In the other instances, it proved impossible to identify blood unambiguously, perhaps because of the tiny amount of sample available or since the protein derived from a different source, such as animal glue.

Composition of lacquer layers

The addition of a number of organic compounds to lacquer layers for different purposes has already been identified. In particular, drying oils have been found in numerous lacquers applied to Chinese objects cf. (Petisca *et al.*, 2011; Moore, 2011, p. 192; Schellmann, 2012; Heginbotham *et al.*, 2016).

The *Xiushi lu* stated that the addition of tung oil (obtained by pressing the seeds of the nuts of the tung tree *Vernicia fordii* or *Vernicia montana*) improved the color of all types of lacquer except black and that it might also improve the curing properties of the sap (Garner, 1979, p. 21; Frick, 2015, personal communication). D’Incarville mentioned that up to half of a lacquer mixture might be made up of tung oil or Chinese tea oil (*Camelia sinensis*) depending on its purpose (Sabin, 1904, p. 149). A variety of drying oils was used in Chinese lacquer art, including those identified in this study, which were tung, perilla, and tallow tree oil (Mills & White, 1994, p. 36; Daniels & Menzies, 1996, p. 8; Chang & Schilling, 2013; Yamashita & Lencz, 2014; Chang, 2015, personal communication). Mixtures of different types of drying oils were also mentioned in certain recipes (Chang, 2015, personal communication).

Top surface gilded motifs

It was a mystery why the silver leaf in tray 1 appears to be gold leaf as there was no evidence either for the application of a yellow layer over the silver or a transparent sealing layer, either with the naked eye or in the cross-section (Table 1, I); only a layer of wax is visible (Fig. 12).

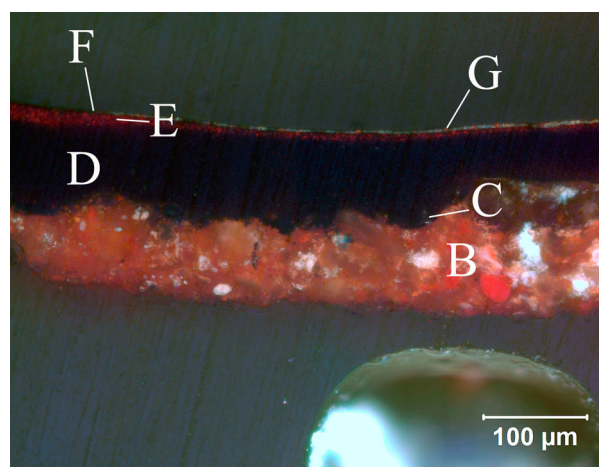


Figure 12 Tray 1, top surface, cross-section of the ‘gold’ decoration with the layer of wax (G) rendered visible under crossed polarizers.

D’Incarville mentioned that the Chinese used three types of gold: *ta-tchi* — ordinary gold, *tien-tchi* — pale gold, and *hium-tchi* — which was made of silver leaf to which they gave a golden color by exposing it to sulfur vapor. D’Incarville also stated that *hium-tchi* was not much used, only at the edges of dishes and sometimes for unusual pale shades (Sabin, 1904, p. 162). With d’Incarville’s comments in mind, the SEM-EDX results were re-examined and the presence of some sulfur was indeed confirmed. However, as silver usually tarnishes through the reaction with reduced sulfur gases in the atmosphere, the detection of sulfur by SEM-EDX may simply result from such corrosion.

The patination of silver by exposure to reduced sulfur vapors was a well-known technique among European gilders. During patination the color changes from a light-gold tone, through a middle-gold to dark-gold then copper, blue, green, brown, and finally black. Once the desired shade is reached, the surface is protected by an isolating layer, for instance a varnish such as glue or shellac (Kellner, 1989, pp. 133–5), to prevent further reaction with atmospheric gases. It has, however, been pointed out that the practical implementation of this process is difficult to manage, particularly in terms of achieving a uniform patination of the surface (Freitag, 2015, personal communication; Mittlböck-Jungwirth, 2015, personal communication).

An alternative method of producing a gold finish would be the application of a colored coating over the silver leaf, but the question remains why, if it is present, this layer is not visible in UV light. It also seems unlikely that an organic layer of this type would have survived over the centuries. Unfortunately, it was not possible to solve this mystery. The remarkable gold appearance of these motifs on the tray astonished the metal restorers when the tray was re-examined under the microscope at the LJF-DGPC in March 2015.

No specific mention of the application of gold leaf in Chinese lacquer art was found in the sources that were consulted, which is reflected in the fact that few objects exist that date to this period and make exclusive use of gold leaf décor. In Western literature, gilded decoration is frequently referred to as ‘gold painting’ or ‘gold lacquer’ without specifying the form of gold used.

When writing about ‘painting in gold’, D’Incarville mentioned only shell gold, which was produced from gold leaf (Sabin, 1904, p. 164). The same material is referred to in the *Xiushi lu* as *ni jin* as ‘mud gold’ (Arakawa, 1996, p. 199; Frick, 2015, personal communication) and mention as also made of a variety of materials used for gilded decoration, including this mud gold, as well as small gold fragments, gold dust, gold foil, gold flakes and gold wire. In addition, the *Xiushi lu* described techniques such as ‘gold lacquer’, ‘gilded lacquer’, ‘lacquer decorated with gold dust’ or ‘gold painting’, and diverse combinations with other techniques, but it did not explain which form of gold was used. Only once, in part II, entry 82, was the use of gold foil mentioned and this is in the context of a technique called ‘gold lacquer’: ‘Gold lacquer produced with mud gold does not have a high gloss. For newly produced objects the bole layer should be of a yellow color.’ Entry 108, on the technique described as ‘lacquerware with decoration in relief and gold painting’, which means lacquer decorated with either gold dust or mud gold, referred to drawing within inlaid elements as consisting of incised lines. This type of decoration was described as more attractive than simple ‘gold painting’ (Frick, 2015, personal communication), and the gold motifs on trays 1 and 3 feature such incised lines.

Garner mentioned gold painting as being applied with a brush or gold inlaid into incised lines (*ch’iang chin*), but did not mention the use of metal leaf. Although no other sixteenth-century gold painted lacquerware is known — apart from some wardrobes from the Wan-li period — he stated that a large number of less important objects with designs in gold might possibly have been made for everyday use (Garner, 1979, p. 202). He further stated that the technique of applying gold leaf was developed in China for porcelain during the Jiajing period (1522–1566). Porcelain bowls decorated in this technique survive in Renaissance collections in Europe (Trnek & Silva, 2001, cat. nos. 89–92). Garner speculated that this technique was also applied to lacquerware for a short period, but there might be no surviving examples (Garner, 1979, p. 203).

This technique of gold decoration is typical for sixteenth and seventeenth century Ryukyuan lacquerware, with the earliest *haku-e* pieces dating from the fifteenth century. Interestingly, some Ryukyuan objects display decorative elements that are similar to those found on

Luso-Asian lacquerware. Arakawa described the *haku-e* (from the Japanese *haku* for gold or silver foil) method as a technique where gold or silver leaf is applied to previously lacquered motifs before the lacquer has completely polymerized. After complete polymerization of the lacquer the excess metal leaf is wiped off with cotton (Arakawa, 1996).

In the Ryukyu Kingdom, the art of lacquerware production was highly influenced by Ming China from where it had been introduced, largely due to the strong tributary and commercial relations that were especially strong with the Chinese province of Fujian and its merchants. The Ryukyu Kingdom had very privileged trade concessions with Ming China that allowed them to buy highly prized Chinese goods once or twice a year in the southern ports of first Quanzhou and later Fuzhou. In this, they acted as intermediaries in intra-Asian trade, supplying all the coastal regions with Chinese goods from the late fourteenth century to the end of the sixteenth century (Takara, 1996, pp. 48–49; Ptak, 2003).

All three trays, and further trays in the MNAA or other Portuguese collections, were examined by Arakawa and classified as possible Ryukyuan lacquerware, especially given their gold leaf décor in combination with mother-of-pearl inlays (Arakawa, 1996, pp. 207–17).

In contrast to this technique, the gilded decorations on eighteenth or nineteenth century Chinese export lacquerware were made by applying gold powder or mixtures of gold and silver powder using a technique similar to the Japanese *maki-e* technique, in which gold dust or alloys with silver are sprinkled onto the area that has previously been coated in the shape of the motif that it is intended to gild. In China, the powder or dust was not sprinkled but applied using a piece of silk or cotton that had already been covered with metal dust.

Pigmented bole layers to attach the gold leaf

D’Incarville reported that when lacquer was to be employed as a mordant for applying gold, more than half of it was composed of tung oil (Sabin, 1904, pp. 151–2). This lacquer would also serve for mixing colors, and to make it more fluid some previously treated camphor was added. Orpiment was often added to the lacquer mix when it was intended as a mordant layer for gilding, but where the gold was intended to have a brighter color, vermilion was substituted (Sabin, 1904, pp. 161–3). In the case of the three trays, the mordant layers were pigmented with either orpiment or red iron oxide as described above.

Mother-of-pearl inlay

Examination of the trays makes it clear that the shells used in the mother-of-pearl inlays on trays 2 and 3

came from similar sources. In both cases the shell pieces were glued to the wooden core before the lacquer was applied. Some lost shell pieces on tray 2 had been substituted and retouched, but on both trays there are still traces of gilded outlines on the edges and of the inner drawing.

The use of very thin shell pieces became popular in the Ming and Qing dynasties and is also typical for 15th and 16th century Ryukyuan mother-of-pearl inlay on cinnabar lacquer. Chinese mother-of-pearl inlays used various shell sources, for example *Turbo marmoratus* or *cornutus*, or Chinese abalone, applying pieces of variable thickness that had been boiled and peeled previously (Garner, 1979, p. 211; Brandt, 1988, p. 32).

The *Xiushi lu* mentioned the technique of ‘gold painting and mother-of-pearl inlay’. Yang Ming commented that the edges of the inlaid mother-of-pearl pieces each have two lines painted in gold. Another entry mentioned that fields decorated with ‘gold painting’ were outlined in black and that the fields decorated with gold dust or mother-of-pearl inlay were outlined in gold. Another mention of golden outlines appeared in the entry ‘decoration with mother-of-pearl and outlines in gold’ (Frick, 2015, personal communication).

Conclusions

Lacquering tradition and procedures

The comparison of the results of the analysis with historical descriptions of Chinese lacquer techniques in the sixteenth century and later shows that the processes used on the three trays were part of the diverse range of decorative methods applied to Chinese lacquerware during that period and are clearly based on traditional Chinese materials.

As the application of Asian lacquer requires experience and craftsmanship there can be no doubt that these coatings were produced by skilled lacquer workers, even if simplified procedures may have been used. Consequently, an Indian origin for these lacquer decorations can definitely be ruled out.

The pared down structure of the preparatory layers, the lacquerware’s so-called ‘bones and flesh’, is marked by the absence of cloth applied to the support, fewer than normal ground layers (each with a simplified composition) and the lack of an intermediate fiber-containing layer. The structure also shows a reduced number of lacquer layers, without the intermediate layers that were described in the *Xiushi lu*, again indicative of this simplified process. Moreover, the use of stained silver leaf instead of gold leaf was mentioned by d’Incarville as a process applied to inferior objects. Compared to procedures applied to Cantonese lacquerware from the earliest known organized Chinese export lacquer production, the coatings

applied to Luso-Asian objects seem to be even simpler (Breidenstein, 2000; Moore, 2011; Petisca *et al.*, 2011; Schellmann, 2012). The question arises whether the lacquer coatings on Luso-Asian objects are those to which Huang Cheng referred when he mentioned compositions that were used by ‘petty craftsmen’ and whether these were also the faster and simpler methods used for everyday domestic objects in various Chinese production centers.

Gold leaf and stained silver leaf were used in China in addition to other forms of gold, but there is no mention of objects using exclusively gold leaf for gilded decorations. Moreover, few objects survive from the period that exhibit this type of decoration. This lack of objects, combined with the fact that similar gold leaf decorations are present on contemporary Ryukyuan objects, led initially to the suggestion that the decorations on Luso-Asian objects may have been produced in the Ryukyu Kingdom (Frade & Körber, 2011; Körber *et al.*, 2011; Körber, 2013). One possibility is that the gold leaf technique seen on Luso-Asian objects was derived from a technique used for decorating porcelain that is mentioned by Garner (1979, p. 203).

The Luso-Asian decorations are very unusual for both Chinese and Ryukyuan lacquer art. The surfaces are almost completely covered with gilded motifs in a style that is reminiscent of *horror vacui*, and that is also characteristic of Indo-Portuguese and *Nanban* works of art (Pinto, 2003, p. 33). This is not surprising given that the decorations were commissioned by foreigners who had formed their own particular taste in exotic objects as they explored the Asian shoreline during the previous century, which has led to the creation of a completely new style.

Question of attribution

As mentioned above, there are many Ryukyuan objects decorated using the same techniques. The same decorative motifs and decorative bands with spirals or wave borders as those on other lacquered Luso-Asian items appear on sixteenth and seventeenth century Ryukyuan lacquerware. It is well known that Ryukyuan lacquer craftsmen used Chinese techniques and adopted Chinese styles, although in a unique manner that displays combinations of techniques characteristic of Ryukyu production. This practice is rooted in the longstanding relationships between the Ryukyu Kingdom and Ming China, especially with merchants and craftsmen from the southern province of Fujian (Arakawa, 1996; Takara, 1996; Ptak, 2003; Körber, forthcoming).

There is no evidence of direct relationships and trade between Ryukyuan and the Portuguese ports in India or Southern China, probably because goods that emerged from occasional private orders, as there are

many among related lacquered Luso-Asian objects, were widely exchanged through unofficial private trade. Additionally, many documents that might shed light on these exchanges have been lost over the centuries, particularly during the 1755 earthquake in Lisbon, but also during the Satsuma invasion in 1609 and (in the case of Ryukyuan documents) in battles in Okinawa toward the close of World War II. Technical and stylistic similarities may indeed result from the close relationship and the impact of Chinese art and culture on the Ryukyu Kingdom and from the close relationships between the Ryukyu Kingdom and private Chinese merchants in Fujian and other southern Chinese provinces (Takara, 1996, pp. 47–52; Ptak, 2003).

Canton, Macao and southern Chinese centers as a possible origin for the lacquer decorations

Canton in Guangdong and Fuzhou in Fujian were both important port cities during the Ming dynasty and were recognized centers of lacquer production. They had their own trading communities that maintained direct relationships with Portuguese merchants. In his report (*Treatise of China*) first published in 1570 in Évora, the Portuguese friar Gaspar da Cruz (1520–1570) described the trading center of Canton as a place where ‘there are many and perfect workmen, and great abundance of things of every trade, and very perfect’. He mentioned lacquered objects such as boxes ‘with a very fair varnish’, as well as bedsteads, different types of chair, little gilt boxes, platters, baskets, writing desks and tables, as well as silver gilt objects (Boxer, 1953, p. 125, 1959, p. 181; Carvalho, 2000, p. 14; Loureiro, 2015). Chinese merchandise was shipped from Canton to Macao and was distributed from there through international trading channels (Loureiro, 2015, p. 79). It was only from 1760 onwards that the Qing dynasty permitted the port city of Canton to become a trading center for international merchants, who were supervised by the guild known as the Hong merchants (Cheong, 1997; Perkins, 1999).

Macao was situated close to Canton and connected with it via trade routes, while also being linked to the South China Sea network. The peninsula was ceded by the Ming to the Portuguese in the mid-sixteenth century at the time that the Jesuits established their mission there. Toward the end of the century Macao increasingly became a commercial and religious center. There are no records referring to established local lacquer production, even in connection with the religious orders although a production of mixed influence is possible and proofed by the existence of works of art, having in mind that after the expulsion of Christians from Japan many converted Japanese immigrated to Macao (Curvelo, 2007). Since the early days of Portuguese activity in Asia, Catholic missions had been closely linked to the activities of official and private merchants who would have been

able to provide them with lacquerware (Silva, 2000; Correia, 2011). From the establishment of the first Jesuit residence in 1562, and particularly after the foundation of the Diocese of Macao in 1576, the need for religious items and utensils for the Catholic missions in China grew, as did the number of Catholic churches in the region.

That some religious works of art of Goan manufacture survive in churches in Macao and that other works of art show the influence of Goan artifacts, suggests that — at least initially — the newly established churches in Macao must have been supplied with works from India to satisfy the demand. These Indo-Portuguese religious artifacts also presumably served as a source of inspiration for local craftsmen (Silva, 2000, pp. 88–90). The existing network of trade routes would have allowed this circulation of goods and it seems likely, therefore, that small wooden objects destined for liturgical use were shipped or brought by members of religious orders from Goa to Macao and were lacquered in Canton or another southern port city that had a lacquer production center.

Given the materials and techniques used, artisans or buyers who were familiar with the more popular *Nanban* lacquers in the context of the Catholic mission may have been responsible for these lacquer decorations that originated somewhere along the Chinese shoreline or within the area of the South China Sea, where there was already a tradition of using gold leaf decorations combined with mother-of-pearl inlay (as several records in the *Xiushi lu* confirm). Consequently, it seems possible that these objects were coated in areas linked to trade and to the religious centers in which missionaries operated throughout Portuguese India. The same techniques and decorations are manifest on a number of other liturgical objects in Portuguese museum, private, and moreover in ecclesiastical collections, namely oratories or mass book lectern that figure emblems of religious orders (Körber, forthcoming).

Indeed, the religious provenance and symbolic value of the objects suggest that Jesuits and other religious orders that were familiar with *Nanban* lacquerware commissioned the trays to which ‘*Nanban*-style’ lacquer decorations were added (trays 2 and 3), using techniques that certainly belonged to the Chinese tradition.

It may be assumed that these artifacts are among the first Chinese lacquered objects commissioned in higher number by Europeans (Körber, forthcoming). Their monastic origin leads to the conclusion that these objects were first purchased in Asia being used in missions in China before being brought to Portugal by their former owners, or were given as presents. In addition to the official trade run by the Portuguese Royal Enterprise via the Cape of Good Hope route and within Asia, southern Europeans conducted private trade with Chinese merchant communities

overseas and in southern China. Furthermore, the close relationship between religious orders and merchants, as well as the special trade privileges held by the religious orders that were mentioned earlier, offer a number of possible explanations of how these items could have been relocated and acquired by the missionaries.

In terms of their shape and decoration, the whole group of Luso-Asian objects decorated with east-Asian lacquer comprises highly unusual or unique items. This might indicate that these objects were made to order as a result of commissions for individual artifacts or small groups of objects. It is also conceivable that this production had an impact on the creation of an organized market for export to Europe and the United States in the following centuries by establishing the Canton System to respond to the growing demand for Chinese lacquerware. Following this closer examination of their lacquer coatings and compositions, these artifacts may now be designated more precisely as Luso-Indo-Chinese objects, although in a wider context, the designation Luso-Asian still seems appropriate.

To enable a more specific classification of these lacquer coatings it would be necessary to conduct a comparison of the compositions and techniques used for objects of southern Chinese and Ryukyuan origin that date to the same period and that are decorated in the same manner. These data, collected from the whole group of lacquered objects, would be useful for comparative purposes in the international research project on Asian lacquer coatings that has been initiated by the GCI and J. Paul Getty Museum, especially in terms of the compositions of the lacquer coatings and the practices used in Chinese lacquer art destined for foreign consumers. At the same time, such data are crucial in the development of appropriate methods for the restoration of the objects and in determining the most suitable environment for their future preservation.

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