Figs. 1 and 2: Imperial Chinese lacquer screen, front and reverse. Qianlong Period (1736–1796), created in the 1770s. Weltmuseum Wien, inv. no. 71.233.

The Conservation of an Imperial Chinese Lacquer Screen for the Reopening of the Weltmuseum Wien

Christiane Jordan, Silvia Miklin-Kniefacz, and Richard Miklin[1]

1. SHORT OBJECT DESCRIPTION

One of the most important objects in the collection of the Weltmuseum Wien is the three-part lacquer screen (inv. no. 71.233) from the era of the Chinese emperor Qianlong (r. 1736–1796), the fourth ruler of the Manchurian Qing Dynasty (1644–1911). It was created during the 1770s and, based on its depiction of the mythical birthday festivities of the Queen Mother of the West, Xiwangmu, could have been commissioned by Qianlong for the eightieth birthday of his mother.[2]

Already impressive for its dimensions of ca. 330 cm (H) × 260 cm (W) × 30 cm (D), the structural construction of the object is made of wood. A multi-layered, three-colour relief (red, green, yellow) is applied to the front, masterfully executed in the traditional carved lacquer technique; the reverse is primarily treated in black lacquer with gold decoration *(figs. 1 and 2)*.

Though connected, the three panels of the screen do not form a flat surface: the two narrow side panels project forward at obtuse angles to the middle panel. The arrangement is typical of Chinese screens placed behind thrones. The throne that obviously formed an ensemble with this screen is today in the Victoria and Albert Museum, London (inv. no. W.399:1, 2-1922; *fig. 3*).[3] Until 1900, both objects were located in the palace of the imperial hunting park of Nan hai-tze (Nanhaizi)[4] once south of Beijing and have great iconographic and stylistic similarities. This is especially evident when comparing the cloud-shaped top elements of the screen with the inner back of the throne. Both show at their centres the ascending, five-clawed dragon, the most significant symbol of the Chinese emperor.[5]

The screen can be divided horizontally into three sections: base, middle picture surface, and crowning top element.

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1 The authors dedicate this article to Burgl Baustädter, in loving memory.

2 See the catalogue entry by Bettina Zorn, *Thronstellschirm*, in: Christian Schicklgruber (ed.), *Weltmuseum Wien*, Vienna 2017, 282 f. The screen was most likely made in the imperial workshops in Beijing.

3 http://collections.vam.ac.uk/item/O18895/throne-unknown/ (last accessed: 15 October 2020). Like all imperial thrones, the ensemble surely also originally included a matching footrest.

4 Burgl Baustädter, *Der chinesische Rotlack-Wandschirm im Weltmuseum Wien*, in: Archiv für Völkerkunde 61/62, 2013, 133–149, here: 133.

5 Craig Clunas, *Whose Throne Is It Anyway? The Qianlong Throne in the T. T. Tsui Gallery*, in: Orientations 22/7, 1991, 44–50.

Fig. 3: Throne, originally forming an ensemble with the screen. London, Victoria and Albert Museum, inv. no. W.399:1, 2-1922. (© Victoria and Albert Museum, London.)

The picture surfaces of the screen show a depiction of the mythical Pantao feast that spans all three panels.[6] This takes place in the garden of the Jade Palace of Xiwangmu, the Queen Mother of the West, in the mythical Kunlun mountains. Xiwangmu is the goddess of immortality and one of the most important female gods in Taoism. The peach trees in her garden bloom every three thousand years and are only ripe after another three thousand. The feast of peaches then takes place, also the birthday festival of Xiwangmu, to which she invites all gods and immortals.[7] Surrounded by a crowd of servants she receives her guests, who arrive by water, land, and air. Xiwangmu is recognizable by the mythical bird, the phoenix, on her head, and is flanked by two girls who hold feather fans above her *(fig. 4)*. On the front of the terrace are assembled Shouxing, the god of longevity, recognizable by his oblong head, and the group of eight immortals – Zhongli Quan with the fan, Zhang Guolao with the bamboo, Lu Dongbin with the sword, Li Teiguai with the crutch, Han Xiangzi with the flute, Lan Caihe with the basket of flowers, Cao Guojiu with the castanets, and, as the only woman, He Xiangu

6 An iconographically comparable screen with a throne is in the Asian Art Museum (*Museum für Asiatische Kunst*), Berlin. This ensemble with the depiction of the Pantao feast is about a hundred years old, however, and its overall impression is dominated by the shimmering, splendid colour of thousands of mother-of-pearl inlays. See Beatrix von Ragué, *Ein chinesischer Kaiserthron. Die Pfirsiche der Unsterblichkeit* (Bilderhefte der Staatlichen Museen – Preußischer Kulturbesitz Berlin, vols. 40–41), Berlin 1982.

7 On the front of the screen are more than a hundred figures and – as on the reverse – a multitude of animals and plants with concrete meanings. Only a few of the most important are described in the following short description. On symbolism in Chinese art, see i.a. Wolfram Eberhard, *Lexikon chinesischer Symbole. Die Bildsprache der Chinesen*, Kreuzlingen – Munich 2004; Terese Tse Bartholomew, *Hidden Meanings in Chinese Art*, San Francisco 2006; Patricia Bjaaland Welch, *Chinese Art. A Guide to Motifs und Visual Imagery*, Tokyo – Rutland, Vermont – Singapore 2008.

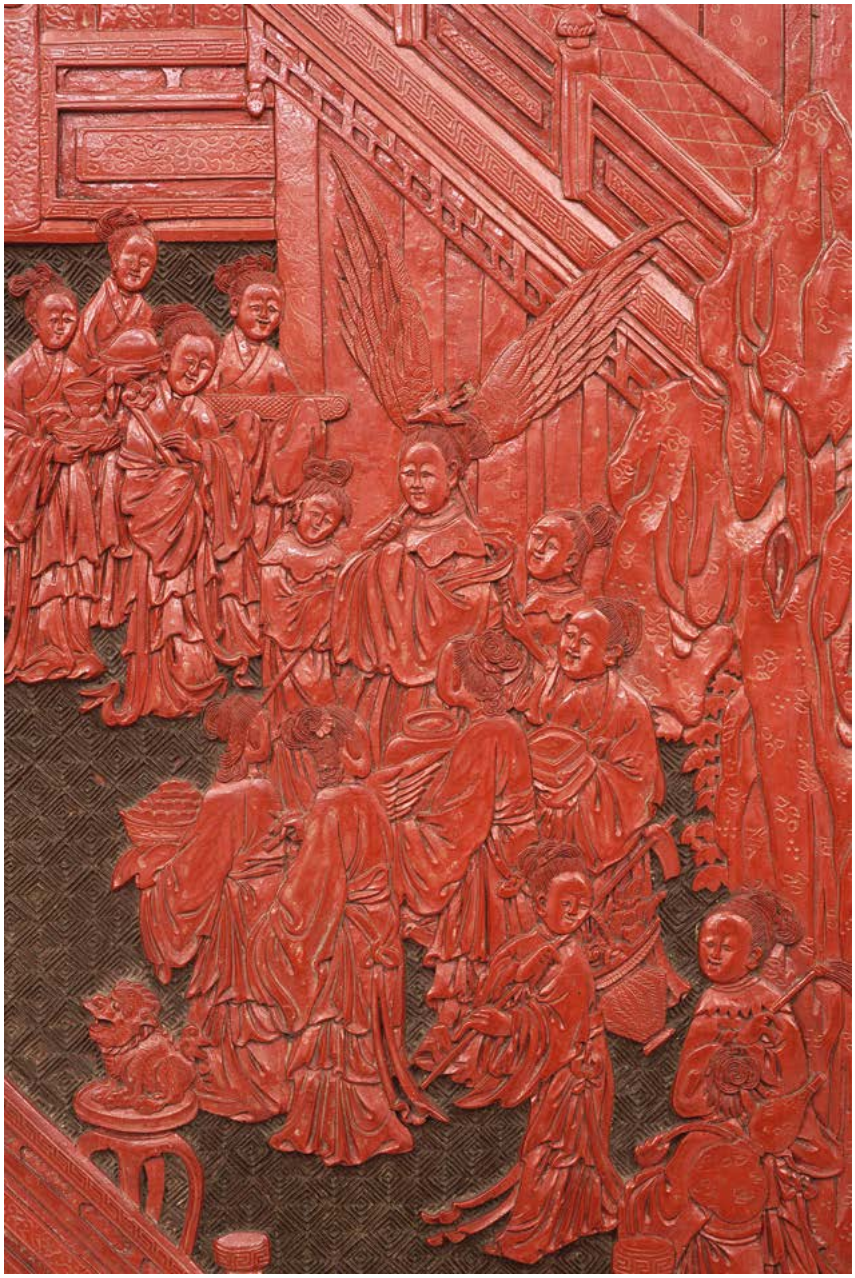

Fig. 4: Detail of the front of the screen: Xiwangmu, the Queen Mother of the West, surrounded by her servants.

Fig. 5: Detail of the front: Shouxing, the god of longevity, and the eight immortals on a terrace of the Jade Palace of Xiwangmu.

with the lotus flower *(fig. 5)* –, while ever more guests with gifts cross the bridge pictured at left. From the upper left, the moon goddess Chang'e with her female servants floats down from her palace, while from the waves the dragon kings of the four world oceans Ao Guang, Ao Qin, Ao Shun, and Ao Run offer their greetings to their host. Also visible in the lower part of the central panel are the immortal Liu Hai on a three-legged toad symbolizing wealth and longevity *(fig. 6)*[8], and Bo Luo Tuo She riding a tiger *(fig. 7)*[9]. In the middle of the left side panel, the three gods of happiness Shou Xing, Lu Xing, and Fu Xing cross the bridge, and in the lower half of the right panel Magu, the goddess of longevity, approaches accompanied by a doe. Various animals and plants are also depicted – including cranes and deer, pine and bamboo – considered symbols of long life in Taoism. All of the picture fields in the three panels are framed by multiple borders of different widths, in which meander-like and strictly geometric patterns alternate with flower and vine motifs *(fig. 8)*.

[8] According to Bruno J. Richtsfeld, the figure on the toad could also be the monk Shide, whose attribute is a broom. See Bruno J. Richtsfeld, *Onorato Martucci (1774–1846) und sein 'chinesisches Museum'*, in: Claudius Müller – Wolfgang Stein (eds.), *Exotische Welten. Aus den völkerkundlichen Sammlungen der Wittelsbacher 1806–1848*, Dettelbach 2007, 157–260, here: 191–194.

[9] To the originally sixteen younger Buddhas, called Arhat or Luohan, two were added in China, which were also assumed into the Taoist pantheon. Bo Luo Tuo She is the eighteenth Luohan, whose riding on a tiger symbolizes the triumph over evil. See Charles A. S. Williams, *Chinese Symbolism and Art Motifs*, 4th revised ed., Tokyo – Rutland, Vermont – Singapore 2006, 170–177.

Fig. 6: Detail of the front: the immortal Liu Hai (or the monk Shide) on a three-legged toad symbolising wealth and longevity.

Fig. 7: Detail of the front: the Luohan Bo Luo Tuo She, riding on a tiger, symbolizing victory over evil.

Fig. 8: Detail of the borders on the front: Meander-like and geometric patterns alternate with zones of flowers and vines.

Fig. 9: Detail of a border on the front: The endless knot is one of the eight Buddhist symbols incorporated into the flower and vine borders.

In the widest, outermost borders of each panel, the eight Buddhist symbols – victory banner, lotus flower, vase, pair of fish, endless knot *(fig. 9)*, dharma wheel, conch shell, and parasol – are included between the vines and flowers.[10] The stepped base is likewise divided into multiple borders. Meander-like bands with geometric patterns alternate with floral elements and occasional bats. The bat is considered a particularly lucky symbol because of the word's homophony with the character for luck (*fu*) *(fig. 10)*.

The opulent, cloud-shaped top elements of the screen are divided into multiple fields by borders with volute-like scrolled ends and blossom and vine patterns. The central field shows the aforementioned ascending five-clawed dragon with a flaming pearl in dense clouds, flanked by two further dragons seen from the side and bats. At the highest point of the screen above the head of the middle dragon is another flaming pearl, approached from both sides by dragons. Here, too, numerous bats are embedded in the dense cloud ornament.

The considerably simpler reverse of the screen is decorated with animals and plants. Five bats are depicted in the cloud-shaped top element, representing the five life wishes or virtues: prosperity, health, virtuousness, long life, and peaceful death. In the centre of the middle panel is a peach tree *(fig. 11)*, around which bats and cranes flutter *(fig. 12)*. A Chinese mahogany tree with two additional cranes is depicted on the left side panel, and on the right panel a wutong tree with a pair of deer *(fig. 13)*. Symbols for happiness and longevity likewise dominate the reverse of the screen.

On the upper corners of the base and the twelve feet are cast and fire-gilded brass or bronze hardware. While the hardware of the base continues the meander ornament of the carved lacquer, that on the feet is decorated with cloud shapes.

[10] Since the early seventeenth century, these Buddhist symbols were incorporated into Taoist symbolism. Here they also represent a long life. See Bartholomew 2006 (cit. n. 7), 185.

Fig. 10: Detail of the front: Appearing countless times on the front and reverse of the screen, the bat is a particular symbol of luck because of its homophony with the character for luck (*fu*).

Fig. 11: Detail of the reverse: A peach tree at the centre with ripe fruits, symbols of immortality, continues the subject matter from the front.

Fig. 12: Detail of the reverse: The crane is one of many Chinese symbols of longevity.

Fig. 13: Detail of the reverse: The two deer likewise represent longevity in this context.

The entire iconographic programme of the screen serves the glorification of the Chinese emperor as 'son of heaven'. When he took his place on the throne, he became a kind of guest of Xiwangmu and was thus assumed into the circle of immortals. The numerous symbols for happiness and long life on all parts of the screen additionally sought to support and promote the health and wellbeing of the emperor.

1.1 OBJECT HISTORY 1900–2004

In October 1900, during the violent clashes of the so-called Boxer Rebellion, the Austrian navy appropriated the screen in the palace of the imperial hunting park Nanhaizi near Beijing. The valuable asset was first stored in the former residence of the city prefect. There in April 1901, the Austrian Rear Admiral Count Rudolf Montecuccoli-Polinago carried out an inspection of multiple pieces of booty, among them a 'large red lacquer wall [*grossen Roth-Lackwand*]'. The transfer of the screen to Taku and its temporary safekeeping in the maritime museum in Santa Pola followed. In December 1902, the Imperial Royal Natural History Court Museum accepted the crate containing the object. After temporary storage in the library of the ethnographic department, the screen was presented from 1903 in the anthropological-ethnographic collection of the Imperial Royal Natural History Court Museum in a glass case in Hall XIV *(fig. 14)*.[11]
After its transfer from the Imperial Royal Natural History Court Museum to the *corps de logis* of the Neue Burg, the screen was installed there in 'Chinese Hall I', on the raised ground floor, in 1927. The festive opening of the Museum of Ethnology took place on 25 May 1928. The lacquer screen was continuously on view thereafter, as one of the most significant objects in the permanent collection.[12] In preparation for the major refurbishment of the Museum of Ethnology (today Weltmuseum Wien), in 2004 the object was disassembled and put in storage.

2. CHINESE CARVED LACQUER

2.1 HISTORY

The adhesive, protective, and simultaneously decorative functions of Asian lacquer, called *qi* in Chinese (*urushi* in Japanese), have been known in China for over eight thousand years. The oldest known archaeological lacquer object in China is a lacquered bow from the Neolithic period.[13]
Because of the protective and especially the water repellent and acid and base resistant qualities of the *qi* lacquer, food and drinking vessels, musical instruments, and furniture, as well as weapons and sarcophagi, were coated with it. Early lacquer objects were usually simply decorated with black and red lacquer, but over the course of the centuries numerous decorative techniques were developed, among them the multi-layered carved lacquer.

[11] For a more detailed object history of the screen, see Baustädter 2013 (cit. n. 4).
[12] The question of whether the screen was presented in a showcase or freestanding from 1927 to 1988 could thus far not be satisfactorily answered. Norbert Kirchner, M.A., the conservator in the former Museum of Ethnology, reported that in the late 1970s, the lacquer screen was located in a 'niche' on the mezzanine of the Ringstrasse side and from there transferred to the raised ground floor for the Japan/China reinstallation in 1987/88. The curator for East Asia, Dr. Bettina Zorn, informed the authors that the screen was displayed from 1988 to 2004 without a showcase.
[13] This is in the Kuahuqiao Relics Museum, Hangzhou. See Julie S. C. Chang, *A Cross-Disciplinary Approach to Chinese Lacquer Technology*, unpublished dissertation, University College London 2019, 25.

Fig. 14: Image of the lacquer screen from 1903 or 1904. Weltmuseum Wien, Photograph Collection, inv. no. 6.514. (Photo: Josef Szombathy, Curator of the Prehistoric Collections of the Imperial and Royal Natural History Court Museum.)

Asian lacquer is a natural sap harvested from trees of the sumac family (*Anacardiaceae*). It was long assumed that Chinese lacquer came exclusively from the species *Toxicodendron vernicifluum*. Recent investigations at the Getty Conservation Institute in Los Angeles[14], however, have shown that many Chinese lacquer objects – not only those for export – contain lacquer from *Toxicodendron succedaneum* (also called Vietnamese or laccol lacquer), along with numerous organic and inorganic additions.

The harvesting of the lacquer is very labour intensive and demands considerable experience. It can also only be done by persons not allergic to the lacquer. The yield is very slight: today a ten- to fifteen-year-old tree delivers ca. 200 g of lacquer in one season; previously the cultivation was less intense, allowing the tree to survive.[15] This made Asian lacquer a very precious material.

[14] See https://www.getty.edu/conservation/our_projects/education/radical (last accessed: 15 October 2020).

[15] In the modern tapping method, the tree is completely depleted and dies after the tapping season.

The special technique of carved lacquer has a long tradition. According to the famous treatise *Xiushilu* by Huang Cheng from the sixteenth century[16], the earliest historic text referring to lacquer production, the technique can be traced to the Tang period (618–907), although the oldest preserved carved lacquer objects date from the Song period (960–1279). The technique reached highpoints in the Yuan (1271–1368) and Ming (1368–1644) periods, after which courtly production decreased. Only in the Qianlong period did the tradition of carved lacquer arts in the imperial workshops see a renewed and final major flowering.[17]

Vessels and containers made from carved lacquer were of little practical use and were an extreme luxury because of their precious material and extremely time-consuming production. They were specially made for courtly use and highly prized as diplomatic gifts. Furniture and screens were seldom produced in this technique. Likewise seldom were combinations of carved lacquer with lacquer painting and other lacquer techniques.

2.2 TECHNIQUE

Carved lacquer is built up from numerous, sometimes up to hundreds of individual lacquer layers, into which figures and patterns are only cut or engraved after all of the layers have hardened. The different carved lacquer techniques have their own terms in Chinese: carved lacquer generally is called *diaoqi*, that consisting exclusively of red lacquer layers is called *tihong*, and carved lacquer with layers in different colours is called *ticai*.[18]

2.2.1 SUPPORT

Due to its good adhesion to almost all materials, the supports for East Asian lacquer vary, from paper and leather to woven bamboo and rattan to ivory, ceramic, and bronze. Traditionally, however, wood is most commonly used.

2.2.2 GROUND

The wood support is usually pre-treated with lacquer, animal glue, starch, or blood.

To level knotholes and irregularities and smooth the surface, nearly all lacquer works receive a multi-layered ground applied with spatulas. Textile or wood fibres or paper are usually embedded in this. The ground forms a levelling layer between the support and the lacquer and secures connections, joints and corners.

[16] The following information from the *Xiushilu* was taken from the dissertation Chang 2019 (cit. n. 13), itself based on the edition of the text in Shixiang Wang, *Xiu shi lu jie shuo: Zhongguo chuan tong qi gong yi yan jiu*, Beijing 1983.

[17] See Patricia Frick, *Schnitzlack*, in: Monika Kopplin (ed.), *Im Zeichen des Drachen. Von der Schönheit chinesischer Lacke*, Munich 2006, 92–95.

[18] Early carved lacquers with different coloured layers (usually red and black) and regular ornaments (double volutes) are called *tixi* (a synonym for the Japanese *guri*).

The materials and techniques of the ground differ according to period, quality, and location. According to the *Xiushilu*, the highest quality ground is filled with ground staghorn or pulverized porcelain, somewhat poorer categories with bone ash and pulverized oyster shells, the lowest quality with brick dust and clay. All powders were sieved into three grades of fineness.
For high-quality lacquer objects, lacquer was already used as a binding medium in the ground layer. In the commentary to *Xiushilu*, however, thick starch paste, pig blood, 'lotus paste', and glue are all also listed as lower-quality substitutes for lacquer – lower quality because of their weaker binding properties. Local traditions were also decisive for the choice of the materials, however. Thus, in northern China usually lacquer was used in the ground, in southern China blood and animal glues.

2.2.3 LACQUER LAYERS

After the ground, the lacquer layers follow. Various pigments can be mixed into the lacquer, but not all are compatible with Chinese lacquer: some turn it black and some delay the hardening. Thus, primarily, compatible red and black pigments have always been used (alongside the less common colours yellow, green, and blue).
The application of the lacquer layers was normally done with a brush, in three layers for normal lacquer works, for carved lacquer hundreds of very thin lacquer layers with each layer ca. 0.03–0.04 mm thick. Various oils are added to the lacquer to render the layers easier to carve. Each individual layer hardens within one to three days; the conditions for ideal polymerization are a temperature of 20–30°C and a relative humidity of 70–80%. Ideal working conditions also demand absolute freedom from dust.
After the hardening of a lacquer layer, an intermediate sanding takes place using abrasive stones or various plants (e.g. horsetail) before the next layer is applied. The process is repeated until the desired thickness is achieved. Independent of the size of the object, the buildup of the lacquer layers alone can take one to two years, before the decorative process of carving can begin.
The surface is polished after the carving, while the cut surfaces usually remain matte.

Fig. 15: Mortise and tenon connection of two parts of the base.

Fig. 16: Dovetail connection visible on the bottom of the base beneath the lacquer coating.

Fig. 17: Bamboo dowel between the inset panel and frame.

3. TECHNOLOGICAL FINDINGS

3.1 PRODUCTION TECHNIQUES

The three-part screen consists of two narrow side sections and a large middle panel. The three panels stand with pegs inserted into a likewise three-part base and are crowned with separate cloud-shaped top elements. Added carved elements are present at the outer edges on both sides.

All individual parts of the screen are made from wood and connected with simple mortise and tenon joints. The base elements have recesses into which tenons from the panels are inserted; likewise at the upper edges, the panels have channels into which tenons from the top elements are slotted. The parts are joined in the same way laterally: the middle parts have recesses that taper diagonally downward, into which tenons on the sides are inserted and slid downward into place *(fig. 15)*.

The individual wood elements are made from different wood profiles, which are connected and glued with invisible wood joints and bamboo dowels. The base shows a dovetail construction, for instance (connecting the sides to the bottom; *fig. 16*), and tenons in the middle. Because of the lacquer

Fig. 18: Iron nail on the reverse.

Fig. 19: Iron nails on the carved lacquer side.

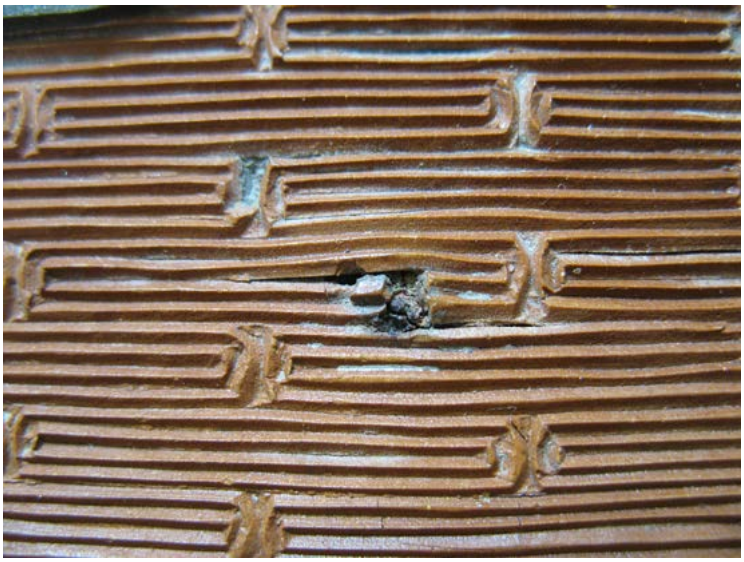

Fig. 20: Iron nail on the carved lacquer side (area of the patterned sky).

coating, however, it is not possible to precisely determine the wood construction with the naked eye.

The panels and top elements employ a rail and stile construction, although the number of planks from which the inset panels are made is not clear (only the long crack in the middle panel suggests a joint). The frame is connected to the inset panel with bamboo dowels *(fig. 17)*, and further small moulding strips are attached with glue and dowels. Numerous iron nails, the function of which could only partly be explained, were identified in the panels using magnets *(figs. 18 to 20)*. In the top elements, these could be related to the attachment of the ornamental profile on the reverse. All other nails, especially those recognizable on the front, are distributed over the entire surface, independent of the construction. Perhaps multiple planks were attached to the entire front surface to strengthen the panel *(figs. 21 and 22)*.

In losses to the coating, a woven textile is visible immediately above the wooden support, followed by a ground layer with embedded textile fibres, then another, coarse-grained grey ground layer. The fronts and all exterior

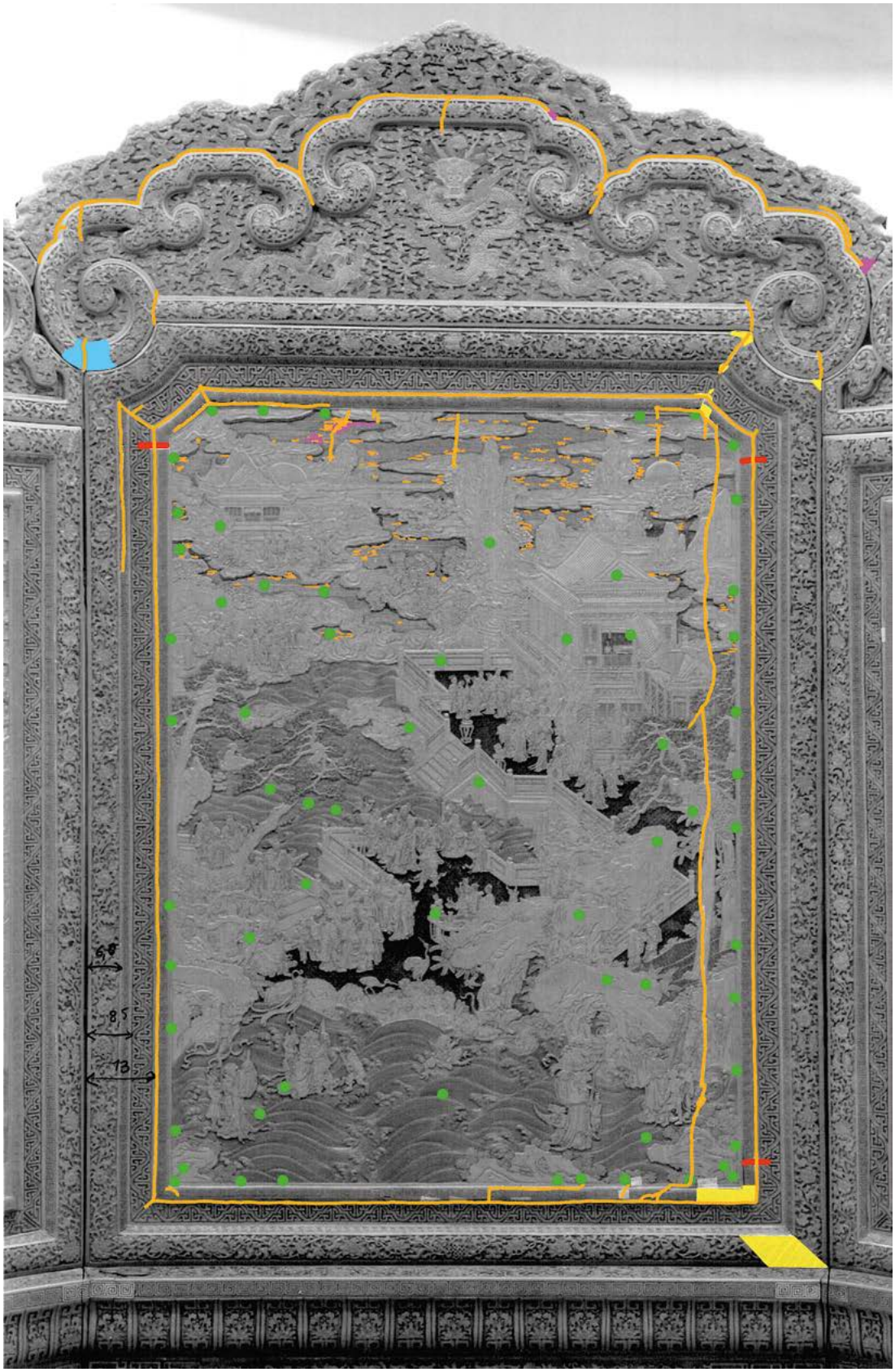

Fig. 21: Diagram of the front of the middle panel (the iron nails are shown enlarged for better legibility).

- Cracks, open joints, loose areas
- Nails
- Bamboo dowels
- Losses
- Wood repairs
- Overpaint

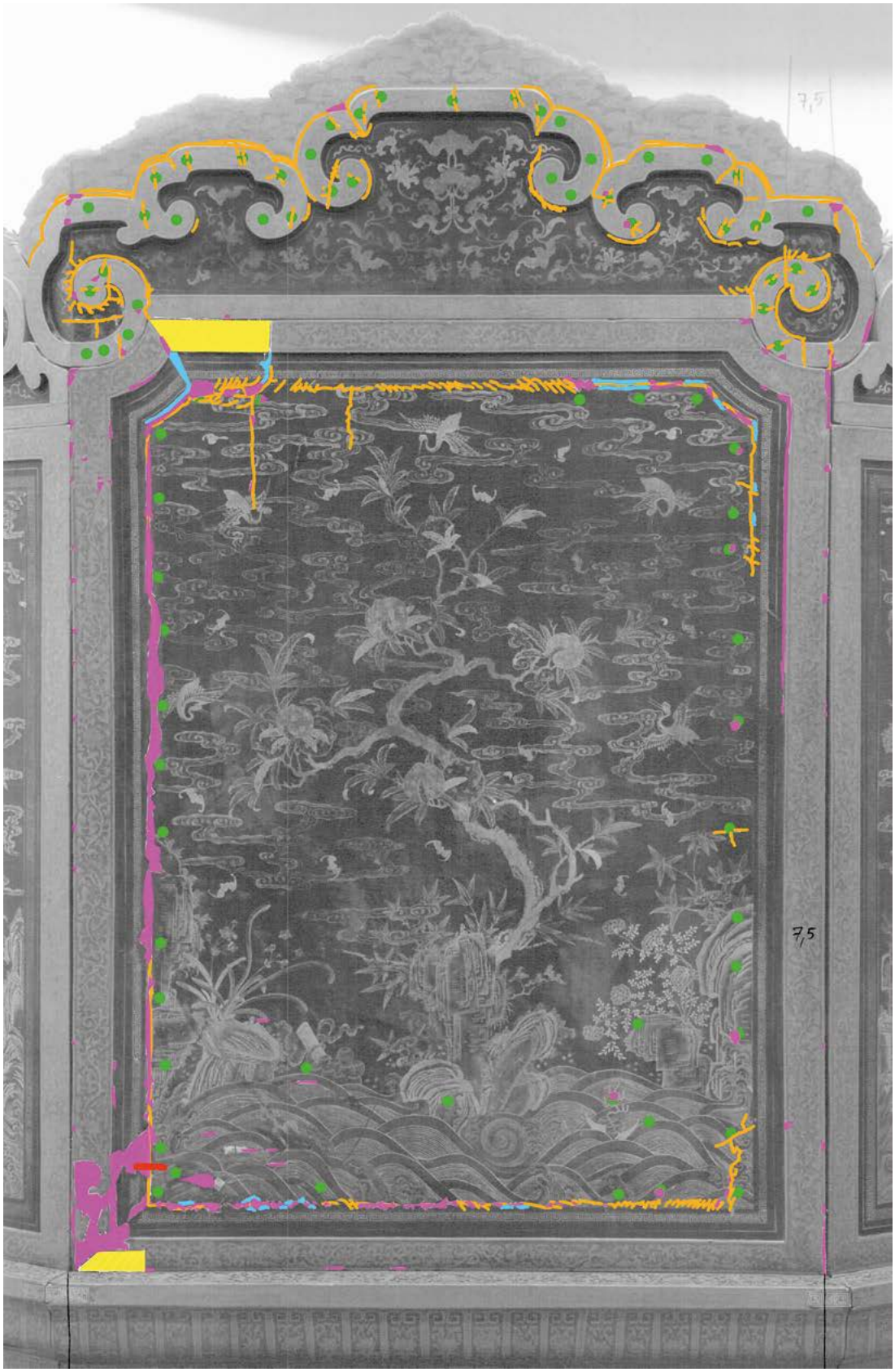

Fig. 22: Diagram of the reverse of the middle panel (iron nails enlarged).

- Cracks, open joints, loose areas
- Nails
- Bamboo dowels
- Losses
- Wood repairs
- Overpaint

Fig. 23: Loss on the edge of the base at the front: Through abrasion of the uppermost dirt and oxidation layers, the original colour is visible.

and horizontal surfaces are adorned with very fine, three-colour carved lacquer decoration. Above the ground on these surfaces is a sequence of lacquer layers, first yellow, then green, and finally red *(fig. 23)*.[19]
The woven textile – natural coloured on the base *(fig. 24)* and blue on the panels *(fig. 25)* – was presumably glued over the entire surface before the ground was applied to secure the wooden support against distortion and movement of the joints.
Aside from the small lateral additions, the reverses show no carved lacquer. The inset panels and top elements are lacquered black and decorated with three-coloured gold decoration and a grey border strip of metal powder (apparently tin), the rails and stiles of the reverse and the base reverse are red lacquer with lacquer painting in black and yellow (ochre paint), the inner sides of the panels and base are simply lacquered in red.

3.2 INVESTIGATIONS

3.2.1 METHODS

To gain an overview of the techniques and materials used in the lacquer screen, the following analytical methods were employed at the Conservation Science Department of the KHM-Museumsverband and the Getty Conservation Institute[20]: non-destructive investigation using x-ray fluorescence analysis (XRF) for the identification of pigments and metals; preparation of sample material as cross-sections and investigation using light microscopy; histochemical staining of the cross-sections for medium analysis; scanning electron microscopy with energy-dispersive x-ray spectroscopy (SEM/EDX)

[19] On *ticai*, see section 2.2 Technique.
[20] The analyses of the red and black lacquers were executed by Michael R. Schilling and Julie Chang using THM-Py-GC-MS; see the internal report *Chinese carved lacquer screen*, Getty Conservation Institute, June 2013.

Fig. 24: A natural-coloured woven textile is evident above the wooden support at losses on the base.

Fig. 25: At losses on the screen panels, a blue woven textile is visible below the ground.

for the analysis of inorganic components and their distribution; gas chromatography-mass spectrometry (GC-MS) for the detection of fats, resins, and proteinaceous binding media; and pyrolysis-gas chromatography-mass spectrometry using tetramethylammonium hydroxide (TMAH) for thermally assisted hydrolysis and methylation (THM-Py-GC-MS) for the identification of the lacquer.[21] The identification of blood was done at the Department of Biochemistry and Microbiology, University of Chemistry and Technology in Prague[22] using nanoscale liquid chromatography coupled to tandem mass spectrometry (nano LC-MS/MS).

By these means, the structure and components of all ground and lacquer layers were to be investigated and the textile fibres of the ground and the metal particles used in the gold decoration of the reverse determined. The extensive investigations also sought to clarify the relationship between inherent and external factors in the development of damages to the object.

[21] A comprehensive list of all investigations appears in Václav Pitthard et al., *The technical investigation of an eighteenth-century Chinese imperial carved lacquer screen and its role in developing an appropriate conservation treatment*, in: Studies in Conservation 61/3, 97–108.

[22] Analyses by Štěpánka Hrdličková Kučková.

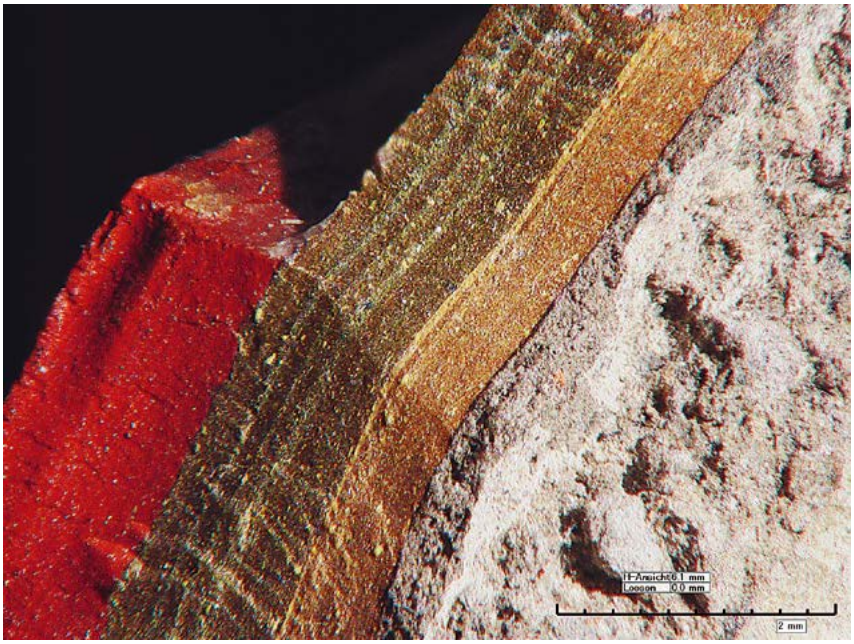

Fig. 26: The multi-layered lacquer application is visible in a fragment sample (Hirox 3D microscope, 50x).

Fig. 27: Cross-section of a sample taken from the front (visible light, 100x, assembled from multiple images because of the thickness of the layers).

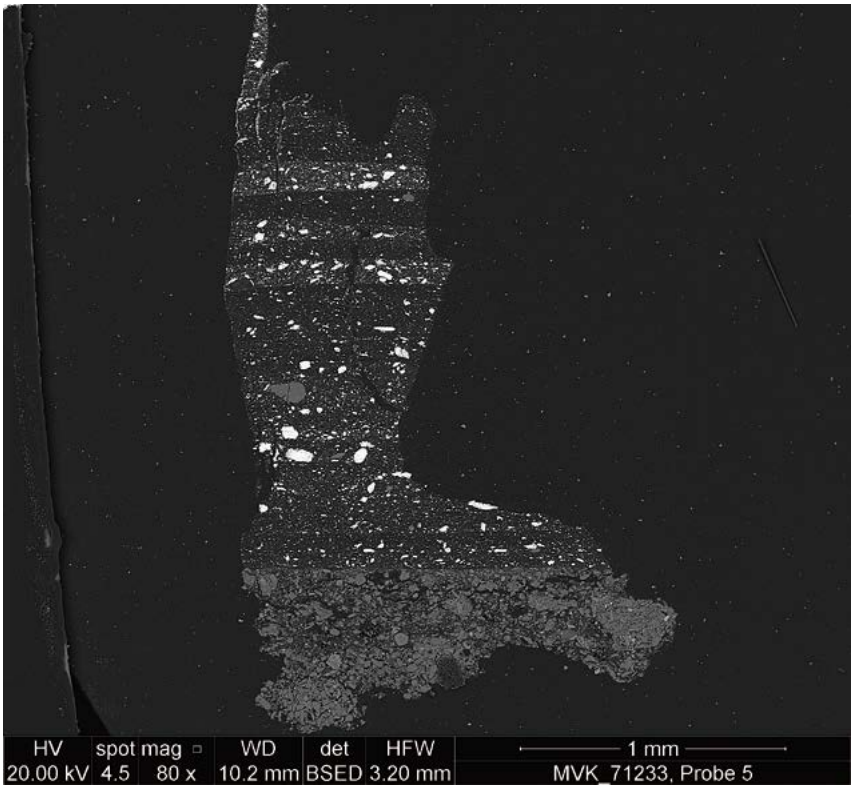

Fig. 28: Cross-section of a sample from the front (SEM/BSE, 80x).

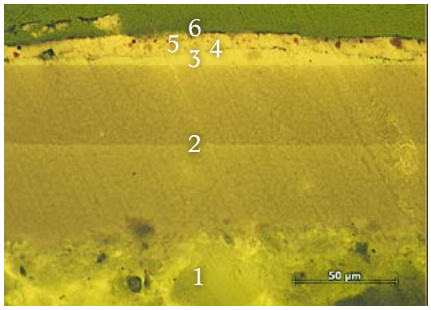

Fig. 29: Cross-section of a sample from the black lacquer with gilding on the reverse (UV, 500x):
1. green ground, 2. two layers of lacquer, 3. mordant layer, 4. thin layer of metal powder (silver–gold alloy), 5. thin red layer, 6. gold powder, compressed.

3.2.2 CROSS-SECTIONS/STRATIGRAPHIC INVESTIGATIONS

The layer structure could be revealed using the HIROX 3D microscope and light and electron microscopic investigations of cross-sections *(fig. 26)*: thick layers filled with granular grey material form the ground, into which the textile fibres were embedded. The carved fronts of the screen appear as three-colour reliefs, consisting of ca. 50–60 individual layers: the lowest ca. 15–20 layers are light brown lacquer (originally yellow), above are ca. 15–20 layers of dark brown (originally green), ca. 20 layers of red-pigmented lacquer are uppermost *(figs. 27 and 28)*.
On the reverse, the inset panels and the top elements were created using the black lacquer technique: atop the ground, two separate layers of black pigmented lacquer (with intermediate sanding) were applied and polished to a high gloss *(figs. 29 and 30)*. The decoration was painted freehand on the polished surface (lines with iron oxide red lacquer, surfaces with unpigmented lacquer) and gold powder of various alloys sprinkled onto the still-wet lacquer or gold leaf applied to a thin layer of lacquer mordant. Unlike in Japanese *maki-e*, no additional lacquer was applied to the scattered gold, which lends the Chinese gold lacquer its particular allure: the contrast between the glossy lacquer surface and matte gold decoration. A number of areas are decorated in gold leaf, recognizable for its smoother, shinier surface – also a conscious decorative accent *(fig. 31)*.

Fig. 30: Sample site for the cross-section in *fig. 29*.

Fig. 31: Gilding tones: 1. light gold ('blue gold' powder, gold–silver alloy), 2. 'true gold' (nearly pure gold powder), 3. silver (powder), 4. gold leaf (pure gold).

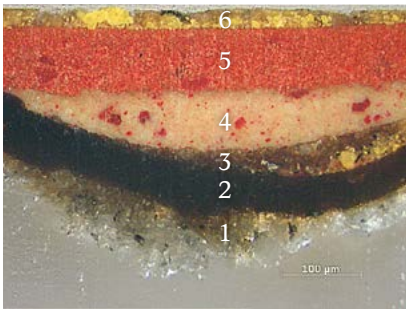

Fig. 32: Cross-section of a sample from the reverse (frame/red edge with yellow lines, visible light, 200x):
1. coarse ground, 2. lacquer, 3. two grey-brown layers with orpiment and ochre, 4. light red layer with cinnabar and lead white, 5. pure cinnabar layer, 6. ochre-coloured layer (orpiment with ochre).

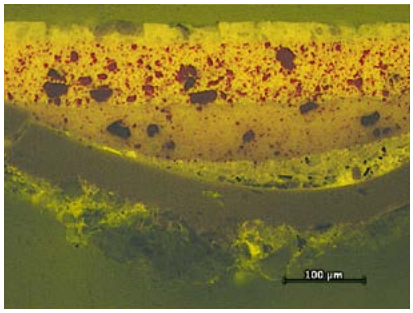

Fig. 33: Cross-section of a sample from the reverse (frame/red edge with yellow lines, UV, 200x).

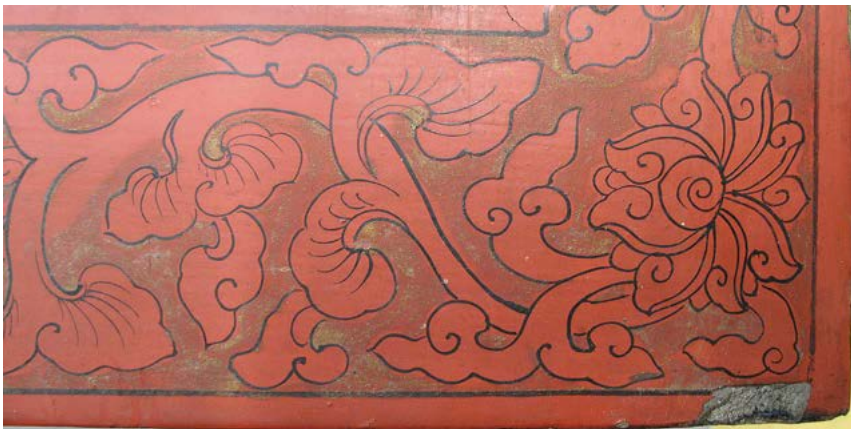

Fig. 34: Detail of the frame on the reverse: decoration with black lines and yellow fields.

Fig. 35: Detail of the back of the base: yellow lines.

On all other areas of the reverse (frame, base), above the ground was applied and polished first black lacquer (one layer) followed by red lacquer (two layers) *(figs. 32 and 33)*; these surfaces were subsequently decorated with black lines, yellow fields *(fig. 34)*, and yellow lines (meander, lower base; *fig. 35*).

3.2.3 BINDING MEDIA OF THE COATINGS, LACQUER, AND GROUND LAYERS

Before the analysis of the lacquer and ground layers, it was necessary for conservation reasons to determine if, and if so, what coatings are present.
In three samples, the whitish coatings on the carved lacquer side could be identified with GC-MS as ibota wax, an Asian insect wax. Through comparison with a reference sample of the Japanese ibota wax ibota-ro,[23] which is used in certain polishing processes in the lacquer technique, the results of the analysis could be verified. The coating, which was visible under UV illumination, was likewise identified using GC-MS: colophony with traces of shellac and a drying oil were found. This also corresponded with the THM-Py-GC-MS investigations performed at the Getty Conservation Institute (Michael Schilling, Julie Chang): In a sample from the red carved lacquer side, in addition to the lacquer components, colophony (pine resin) with traces of shellac and cedar oil were found. The results suggest that the iboda wax is attributable to historical care in China (as it was not common here) while the colophony coating belongs to the later history of care in Vienna.
Asian lacquers cannot be directly analysed by GC-MS as they are insoluble. The red lacquer of the front and black lacquer of the reverse were thus investigated in the Conservation Science Department of the Kunsthistorisches Museum using THM-Py-GC-MS.
The black lacquer contains urushiol (this was determined from the pyrolysis products of the aged lacquer) and drying oils (possibly a mixture of perilla and linseed oils). The red lacquer shows the same pyrolysis products, hence the same binding media composition, but additionally contains cedar oil.
For comparison, samples were investigated at the Getty Conservation Institute by the same method (THM-Py-GC-MS): The red lacquer of the front shows a very high proportion of an oil, heat bodied tung oil, and *urushi* (Chinese: *daqi*, *Toxicodendron vernicifluum*) as well as mercury sulphide (from its pigmentation with cinnabar). In the black lacquer, perilla oil with *urushi* was determined (Chinese: *daqi*).

[23] Ibota-ro, from the Watanabe company, http://www.urushi-watanabe.net (last accessed: 15 October 2020).

All of the lacquer layers thus contain urushiol[24] and can be assigned to the tree type *Toxicodendron vernicifluum*, native to China, Japan, and Korea.[25] To improve handling and achieve the desired level of gloss, various oils were added to the lacquer[26]: cedar and tung oil in the red layers, perilla oil[27] in the black layers.

The investigation of the binding medium of the ground proved unexpectedly difficult. In the THM-Py-GC-MS investigation at the Getty Conservation Institute, proteins associated with the ground could be determined, suggesting an animal glue as the binding medium. The historical source mentioned above, however, indicates that animal blood was commonly used in the grounds of lacquer works. The GC-MS investigation at the Kunsthistorisches Museum showed the presence of amino acids, suggesting the use of blood, but animal blood could not be unequivocally identified. Only using nano LC-MS/MS was the binding medium clearly identified as pig blood based on the peptide sequences found *(Table 1)*.[28]

Table 1: List of the peptides/proteins determined by nanoLC-MS/MS (taken from the investigation report from the Department of Biochemistry and Microbiology, University of Chemistry and Technology, Prague).

Accession	**Protein**	**#Peptides**
HBB_PIG	Hemoglobin subunit beta	5
HBA_PIG	Hemoglobin subunit alpha	4
TRYP_PIG	Trypsin	2
HBB_TARBA	Hemoglobin subunit beta	2

[24] Urushiols, derivatives of catechol, are the main component in tree saps from Eastern and Southeast Asian lacquer trees, at about 60–65%; other components are: 20–30% water, 5–7% plant gums, 2–5% glycoproteins and <1% enzymes. See Nanke Schellmann, *Über die Reinigung ostasiatischer (Urushi-)Lacke*, in: Paul-Bernhard Eipper (ed.), *Handbuch der Oberflächenreinigung*, Munich 2017, 338–460, here: 338.

[25] In Asia, depending on the country and region, different lacquer trees of the family *Anacardiaceae* are used for the production of lacquer. Urushiol is the main component of the tree type *Toxicodendron vernicifluum* (synonym: *Rhus verniciflua Stokes*) used in China, Japan, and Korea. In lacquers from Vietnam (tree type *Rhus succedanea*), laccol is the main component, while in the lacquers of Cambodia, Thailand, and Burma (tree type *Melanorrhoea usitata*) it is thitsi-ol; see Marianne Webb, *Lacquer. Technology and Conservation*, Oxford 2000, 3–8.

[26] The lacquer master Tatsuya Matsumoto described the advantages of this tradition in a 2005 interview: 'Urushi will harden more slowly and the urushi layer will become thicker so that it feels like carving rubber. And the carved part will become a little lustrous, so there's no need to polish […]. It [the lacquer] will be soft when carving, but then it will harden.' Tatsuya Matsumoto, *History of Choshitsu and Its Terminology*, in: U*rushi 2005. International Course on Conservation of Japanese Lacquer*, Tokyo 2005, 28–33.

[27] Perilla oil, also called egoma oil, is won from the seeds of the perilla plant (*Perilla frutescens*), also called wild sesame or black nettle.

[28] See Silvia Miklin-Kniefacz – Václav Pitthard – Walther Parson – Cordula Berger – Sabine Stanek – Martina Griesser – Štěpánka Hrdličková Kučková, *Searching for Blood in Chinese Lacquerware: ZHŪ XIĚ HUĪ* 豬 血 灰, in: Studies in Conservation 61/3, 45–51.

3.2.4 PIGMENTS OF THE LACQUER AND GROUND LAYERS

The investigation of the pigments using SEM/EDX and XRF revealed the presence of orpiment for the yellow lacquer layers; the greens were coloured using orpiment and indigo, the red with cinnabar, and the black lacquer layers with carbon black.[29]
The thin yellow drawing on the reverse of the screen frame was executed with orpiment and ochre.
Only earth pigments were determined in the ground layers (not pigmenting proper, rather the natural components of the earths used).

3.2.5 METAL PARTICLES AND TEXTILE FIBRES OF THE LACQUER AND GROUND LAYERS

The metal powders and leaves used in the lacquer painting of the reverse were also identified using XRF: depending on the 'gold tone', silver, gold, and silver-gold alloys were detected. For instance, in a cross-section *(see fig. 30)*, over a sprinkling of a fine powder of a silver–gold alloy, a line with red lacquer (cinnabar with some earth pigment) is detectable, onto which very pure gold (only traces of silver and copper detectable) was again sprinkled.
The textile fibres and textiles in both the ground and the overall covering were investigated in Textile Conservation using microscopic investigation. In all samples, ramie-like[30] stem fibres were determined.[31]

[29] Marianne Webb lists orpiment, cinnabar, and carbon black as the pigments historically most commonly used to colour lacquer layers, before the introduction of synthetic pigments; see Webb (cit. n. 25), 8.

[30] Ramie, also called China grass, China plant, or Chinese nettle, is obtained from the inner bark of the stem of the ramie plant. The natural fibre is a bast fibre. See https://en.wikipedia.org/wiki/Ramie (last accessed: 20 November 2020).

[31] Thanks to our colleagues Barbara Pönighaus-Matuella and Lisa Metatla.

Fig. 36: Crack in the middle panel with an adjacent crust of glue over the carved lacquer.

Fig. 37: Glue crust filling the finely carved lacquer relief.

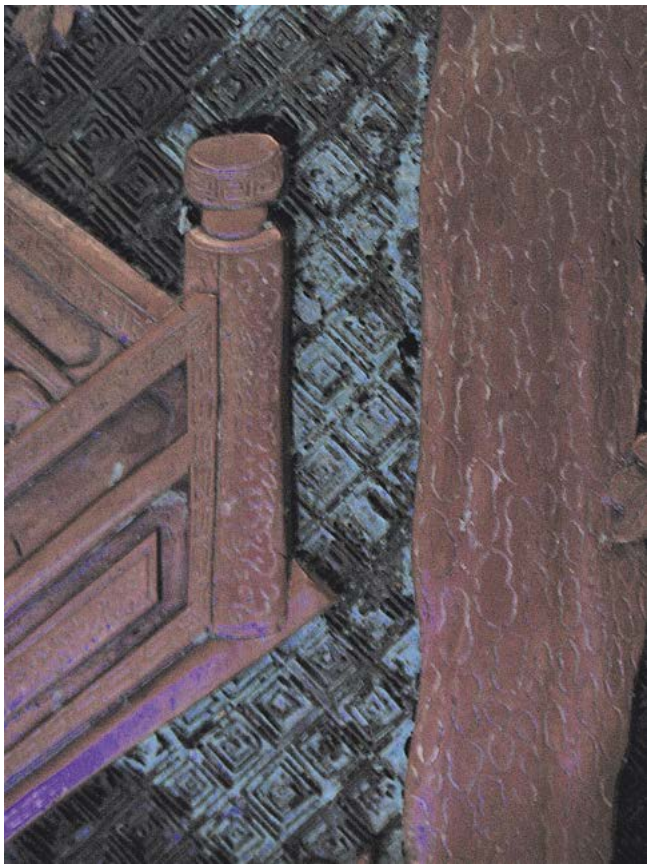

Fig. 38: Glue crust in UV light.

Fig. 39: Secondary coating in UV light, with traces of wiping from the front to the reverse.

Fig. 40: Secondary coating in UV light, with drips.

4. CONDITION AND REASONS FOR CONSERVATION

In preparation for the planned reinstallation of the lacquer screen in the reopened Weltmuseum Wien, the Conservation Department carried out a first evaluation of the object's state of preservation in late 2010. This revealed numerous deep structural cracks in the wood on both the front and the reverse, which had already led to large areas of loss to the ground and lacquer layers (compare the diagram in section 3. Technological Findings).

A vertical crack in the wood of the middle panel displayed traces of old repair with an animal glue that had flooded the surrounding, finely carved lacquer areas, covering and clogging the decoration *(figs. 36 to 38)*.

What was already evident on close observation with the naked eye was clearly visible under UV light: The entire red carved lacquer surface of the front is coated with a non-original, very glossy varnish[32] (see section 3.2.3 on the binding medium analysis), which had partly flowed over the edges to the unvarnished reverse of the object *(figs. 39 and 40)*. Under the varnish on the front, numerous accumulations of a white waxy substance could be observed, which – as already described – were identified as ibota wax and thus probably attributable to maintenance measures at the location of origin.

The reverse also showed tented deformations of large lacquer areas, severe local abrasion, and further superficial damage to the black lacquer layer. Retouching extending far over the original and 'temporary' facings and considerable surface soiling also contributed to the abject appearance of the once splendid object.

This condition suggested that the damages already documented at the beginning of the twentieth century before the shipment to Austria and on cataloguing in the Imperial and Royal Natural History Court Museum had

[32] The coating lies over dirt and other accumulations in the depths.

never been wholly rectified.[33] A lack of written documentation of possible earlier restorations supports this supposition.[34] The decades-long, unprotected exhibition of the humidity- and light-sensitive object in the permanent display of the Museum of Ethnology had doubtless also left clear traces on the lacquer screen.[35]

4.1 SECONDARY COATING

The secondary or really tertiary coating does not appear disturbing on first glance. On closer observation and in comparison with untreated carved lacquers, it is evident, however, that it both falsifies the original, subtle sheen of the carved lacquer surface and includes particles of i.a. dirt. On a number of test cleaning areas, the difference between the glossy, resinous colophony coating and the matte, aged surface of the carved lacquer is evident. Also recognizable are the dirt particles in the cracks and interstices, which are embedded in the coating, as well as the whitish masses in the interstices and at the edges *(fig. 41)*.
The coating was only applied to the fronts, the lateral surfaces at the top of the base, and the backs of the two small lower elements. As already mentioned, the ibota wax was presumably used for care in China, as it is not common in Europe.

4.2 CRACKS, GAPS AND DEFORMATIONS, LOOSE AREAS AND LIFTING LACQUER

In addition to the historically documented vertical crack in the middle panel, there are multiple, sometimes gaping shrinkage cracks between the inset panels and their rail-and-stile frames and at other construction-related joints of the other pieces on the front and the back. These are associated with numerous loose areas and losses on both sides, especially in the yellow carved lacquer (in the sky; *figs. 42 to 44*).

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[33] Already in 1901, Count Montecuccoli described a 'large break' in the middle screen element in a dispatch to the Imperial and Royal Imperial War Ministry. During the cataloguing of the screen in 1903 in the Imperial and Royal Natural History Court Museum, damage to the base and a number of cracks in the lacquer were noted. See Baustädter 2013 (cit. n. 4).

[34] According to verbal communication with Norbert Kirchner, M.A., former conservator at the Museum of Ethnology, the folding screen, especially the horizontal surfaces (base), were locally cleaned with rapeseed oil for reinstallation in the Japan/China Hall. Kirchner further confirmed the likelihood of a shellac coating, which he also found on many other objects in the collection, dating from the early years in the Museum of Ethnology. Verbal communication between Silvia Miklin-Kniefacz and Norbert Kirchner, March 2011.

[35] Baustädter documents that during its time in the Imperial and Royal Natural History Court Museum, the screen was presented in various (glass) cabinets; see Baustädter 2013 (cit. n. 4), 141 f. It can be assumed, however, that from its move to the Museum of Ethnology in 1928 until the closure of the permanent collection, the lacquer screen was no longer exhibited in a showcase and was thus exposed over a prolonged period to climatic variations and damage by museum visitors. As already mentioned, Norbert Kirchner, M.A., reported that in the late 1970s the lacquer screen was located in a 'niche' on the mezzanine of the building's Ringstrasse side, and from there was transferred to the raised ground floor for the Japan/China reinstallation in 1987–88.

Fig. 41: Test removal of the coating. The exposed area is lighter and more matte; lower-lying dirt and (whitish) wax remains in the depths.

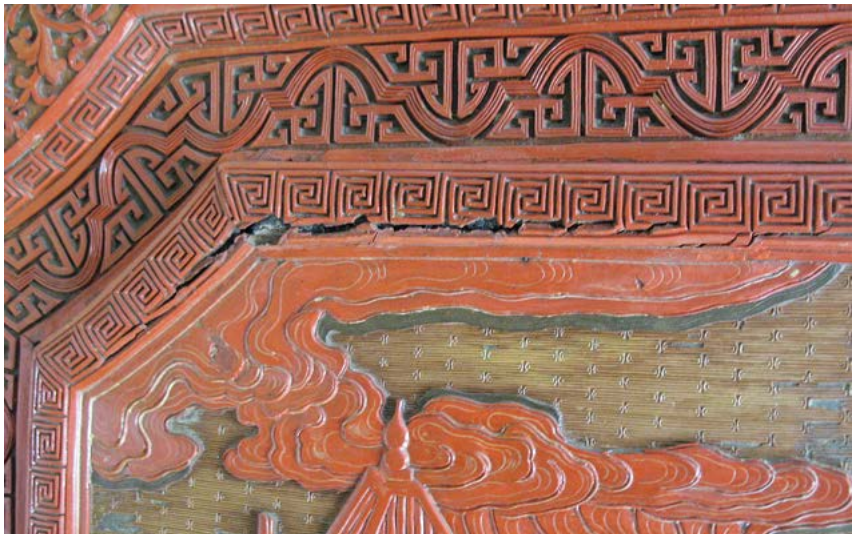

Fig. 42: Cracked joint between the frame and inset panel, front.

Fig. 43: Crack in the carved lacquer extending from a split joint in the support, front.

Fig. 44: Lifting lacquer along a joint in the support, reverse.

Fig. 45: Drips of glue running perpendicular to the vertical crack in the middle panel, UV light.

Fig. 46: Detail of a drip, running horizontally.

Fig. 47: Matte black spots on the surface, reverse.

Fig. 48: Red material transfer on the surface, reverse.

Fig. 49: Scratch in the gold decoration.

4.3 OLD GLUING AND GLUE DRIPS

Along the continuous vertical crack in the middle panel on both the front and the reverse, drips of glue running horizontally are evident, particularly under UV light *(figs. 45 and 46)*. At other early attempts at gluing (e.g. the upper join of the middle panel on the reverse), adhesive likewise usually extends far beyond the area to be secured.

4.4 MATTE, PATCHY REVERSE, SCRATCHES

The originally highly polished black lacquer of the reverse shows a matte, uneven surface. A number of black retouchings and red accretions of colour (probably caused by rubbing against another red object or part of the screen) likewise disturb the appearance of the surface *(figs. 47 to 49)*.

Fig. 50: Loss in the pattern of the sky.

Fig. 51: Large loss on the frame, reverse.

4.5 LOSSES

On the edges of all parts, but particularly at the corners and edges of the base, are numerous mechanical damages and losses, in part reaching to the wood core.
In the area of the sky on the carved lacquer side (brown area), many small relief passages have detached from the ground. The carved lacquer layer is thinnest here, the carving sometimes reaches to the ground, and the tension in the narrow lines of relief is very high. Numerous overpaints and unpigmented wax fills attest to attempts to resolve the persistent problem *(fig. 50)*.
An especially large loss on the reverse, at the lower bottom corner of the frame, is also notable: The lacquer and ground have flaked away, and multiple textile layers and the lower ground remain.
Contiguous to this on the reverse panel and along the long vertical crack, numerous lacquer flakes have been lost that the cracking caused to detach from the lower layers *(fig. 51)*.

4.6 OLD COMPENSATION IN WOOD AND WAX

Loss compensation is found in the form of chalk fills, old wax fills (light red, dark red, light brown, and black; *figs. 52 and 53*) that are partially overpainted (in the sky), and repairs in wood with crude, dark red retouching on the base (back exterior corner and the entire outer/lower meander strip). A number of coarse wood inserts with dark, crude retouching are also found in the carved lacquer area, frame, and top element.

Fig. 52: Old wax fill, black.

Fig. 53: Old wax fill with dark red wax.

Fig. 54: Overpaint of a light wax fill in the pattern of the sky.

Fig. 55: Red-painted wood insert, partially cleaned.

4.7 OVERPAINT

Fills were overpainted, especially old wax fills (brown overpaint for light wax fills in the pattern of the sky, black overpaint for wax fills on the reverse) and wood inserts (dark red) *(figs. 54 to 56)*.

4.8 MISSING HARDWARE AND MISMATCHED REPLACEMENTS

Gilded brass or bronze hardware is present at the twelve feet (replaced with a softwood) and at the upper corners of the base. The originals are cast and the surfaces worked or engraved with chisels and gravers and fire gilded. Four different hardware types are present on the feet of the three bases: on the reverse, five brackets with an engraved cloud pattern (chisel engraved) as well as a later replacement with graver engraving, on the front and sides are six brackets with a relief cloud pattern (cast); six additional areas have cardboard replacements with bronze paint and pencil drawing.
On each of the outer feet of the side panel bases, two brackets were soldered to form one corner: two relief pieces at the front corners and at the back, one relief plate (side) with one engraved plate (back).
Based on the relief hardware present (one left and one right), casts could be produced and the cardboard replacements replaced *(figs. 57 and 58)*.

Fig. 56: Black overpaint on a loss.

Fig. 57: Original cast hardware.

Fig. 58: Softwood foot with cardboard replacement hardware.

Fig. 59: Cleaning of the carved lacquer.

Fig. 60: Cleaning of the back of the base.

5. CONSERVATION TREATMENT

In preparation for the planned reopening of the Weltmuseum Wien, the initial investigations for the cleaning began in January 2011; conservation measures continued with interruptions until February 2015.
The primary goals of the conservation treatment were the stabilization of the construction, cracks, and lacquer layers and the cleaning of the lacquer surfaces, preserving the secondary coatings.

5.1 SURFACE CLEANING

Because to the great effort required and the expected minimal visible impact, it was decided to preserve both the wax accretions (as a historic document) and the later resin coating; only very disturbing drips in transition areas were reduced.

Fig. 61: Cleaning of the black lacquer of the reverse with petroleum spirits (b.p. 140–200°C).

After multiple tests with gels, films, and mouldable pastes, the carved lacquer areas were ultimately carefully cleaned with a mixture of deionized water and isopropanol (8:1): Each application, using cotton swabs or brushes, was limited to a manageable area (5–10 cm^2) and after a short dwell time was blotted with a lint-free cellulose cloth before proceeding to the next location.
The red lacquered reverses (frame and base) could be cleaned with the same method, as the red lacquer of the reverse displayed an astonishing resistance to aqueous cleaning *(figs. 59 and 60)*.
The black lacquered areas (inset panels) of the reverses, however, which also lack secondary coatings, required wholly different measures. From aging, especially through the effects of UV light, these areas show heavy superficial micro-cracking and are thus matte and very water sensitive. They were cleaned with petroleum spirit (boiling point range 140–200°C) *(fig. 61)*. Later paint and old retouching partly had to be removed with acetone and a scalpel. Excess glue residue was softened with locally applied agar-agar compresses and removed with horn spatulas.

5.2 SURFACE CONSOLIDATION OF THE REVERSE: *URUSHIGATAME*

Although the cleaning of the black lacquer areas achieved an improvement in their visual appearance, in order to secure the light damaged surface and the gold decoration it seemed sensible to stabilize the micro-cracks in the longer term. This is traditionally effected for lacquer by rubbing raw lacquer into the damaged surfaces. The colour and gloss of the gold decoration, however, can greatly change as a result.
A method recently developed in Japan – *urushigatame* – seeks to achieve penetration of the lacquer only in the interstices of the cracks, leaving nothing on the surface. Here *urushi* (Chinese: *daqi*), thinned with a slow-evaporating solvent, is introduced into the micro-cracks and carefully removed from the surface using a more quickly evaporating solvent, until no residues are evident on the cloth. Through the mixture of specific lacquer types, hardening and transparency can be optimally adjusted, which is particularly important for the gold decoration.

Fig. 62: Application of the thinned *urushi* mixture in sections.

In the black lacquer areas of the reverse, *urushigatame* was carried out with a 1:1 mixture of *nashiji-urushi*[36] and *kijomi-urushi*[37] diluted with Shellsol A (2 parts). The surface was cleaned first with a dry cloth; after about 15 minutes the remaining *urushi* was removed from the surface with naphtha (petroleum spirits, boiling point range 80–120°C). The hardening took place at ca. 65% RH, for which the humidity in the workroom was slowly increased with humidifiers.

Initial tests showed that this treatment altered neither the matte gilding nor the colour tones of the gold. The process was repeated once after the curing.

For particularly absorptive and matte areas in the black, during the second application the *urushi* was not removed with solvents but only polished clean (this procedure is called *suri-urushi*); in this way, partial differences in the surface gloss could be evened out. Very matte areas were also partially polished with Micro-Mesh cloths before the application of *urushi*.

The alternative to this (admittedly) non-reversible surface treatment would be *no* treatment and an absolute protection from light! Any other coating – even if reversible – would remain in the microcracks and result in unknown changes *(figs. 62 to 68)*.

[36] Very light, transparent *urushi* coloured yellowish with gamboge; minimal adhesive strength.

[37] High-grade raw lacquer with good curing and adhesion properties, darker than *nashiji-urushi*.

Fig. 63: Surface after the *urushigatame* treatment.

Fig. 64: Detail before cleaning and before *urushigatame*.

Fig. 65: Detail after cleaning and *urushigatame*.

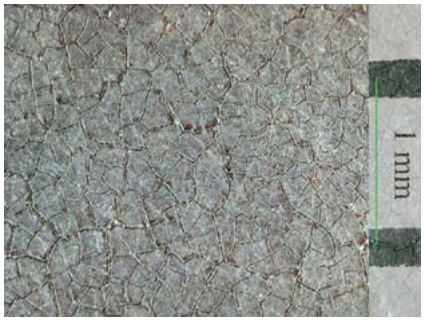

Fig. 66: The micro-cracks before cleaning (USB digital microscope camera eScope DP-M07, 250x imaging magnification).

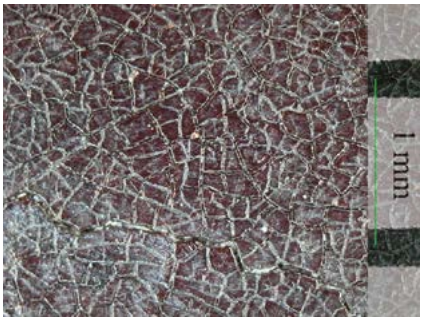

Fig. 67: The micro-cracks after cleaning (USB digital microscope camera eScope DP-M07, 250x imaging magnification).

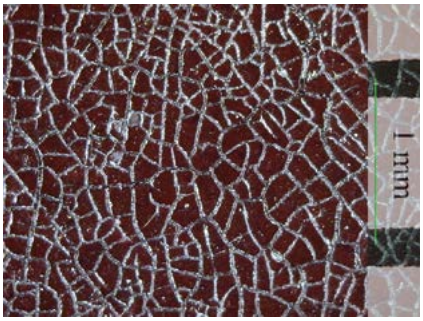

Fig. 68: The micro-cracks after the *urushigatame* treatment (USB digital microscope camera eScope DP-M07, 250x imaging magnification).

5.3 CONSOLIDATION

The consolidation method for the lifting lacquer areas on the black lacquer reverse also differed from that of the carved lacquer front.
Due to the water sensitivity of the reverse, proteinaceous glues and aqueous emulsions had to be avoided. A similarly traditional gluing technique with *mugi-urushi* was chosen: Wheat flour kneaded with water is mixed with raw lacquer (1:1), resulting in a thick mass with high adhesive strength usually used for joining pieces of wood, textile, ceramic, etc. The adhesive mixture must be thinned to introduce it underneath the cupped lacquer, for which e.g. petroleum spirit (boiling point range 80–120°C) works well. The thinned *mugi-urushi* is fed under the flakes with brushes or thin spring steel spatulas and must then be pressed for several days.
For this, a so-called *shinbari* construction was used: Rods of knot-free beech were spanned against a corresponding frame, allowing pressure to be exerted at precisely the desired location. Depending on the hardness required, different sequences of mylar film and small plexiglass, silicon, and PVC plates served as interlayers *(fig. 69)*.
In the carved lacquer areas, a flexible adhesive was necessary, but due to the coating there was no danger of damage from aqueous adhesives. A mixture of Plextol D 360[38] (3 parts) and Plextol D 498[39] (2 parts) was deemed appropriate as it offered both the necessary adhesive strength and a high flexibility. This was subsequently also used as a binding medium, mixed with ground cork and phenolic resin microballoons, to stabilize and fill (below level) larger cracks in the construction *(fig. 70)*.
In a few areas, detached profiles on the carved lacquer side were reattached with cattle hide glue[40] *(fig. 71)*.

[38] Plextol D 360: a very soft acrylic dispersion based on butyl acrylate and methyl methacrylate, with excellent aging properties and chemical stability.
[39] Plextol D 498: harder than Plextol D 360; an acrylic dispersion based on butyl acrylate and methyl methacrylate, with excellent aging properties and chemical stability.
[40] Cattle hide glue Topaz II, Tanex (CZ), bloom grade 223.

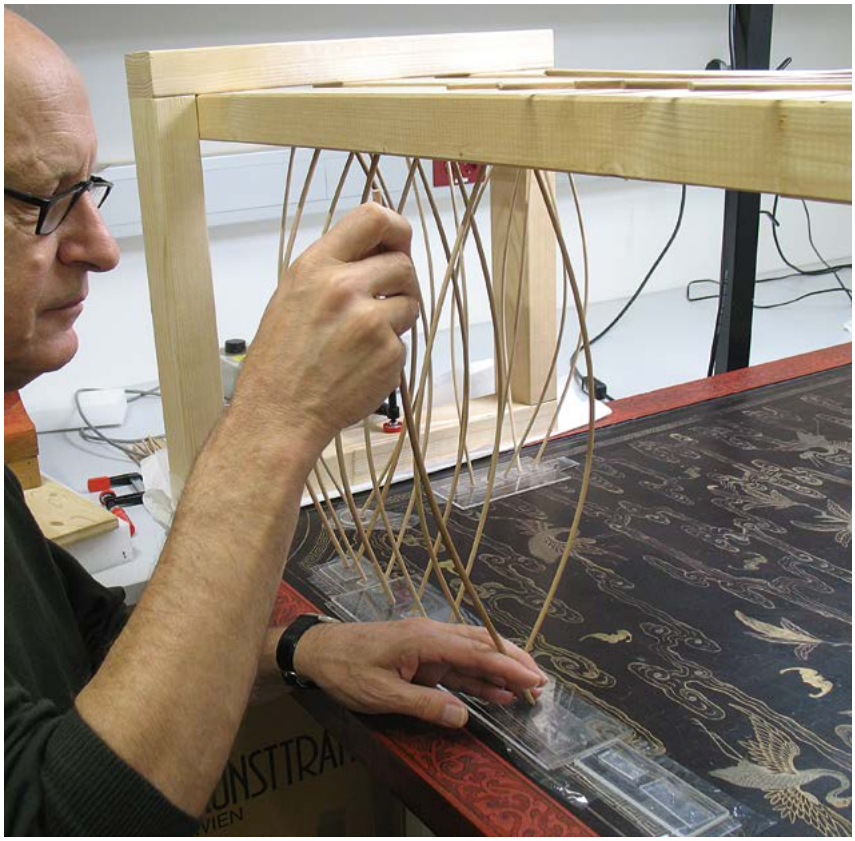

Fig. 69: To apply pressure on the lifting lacquer flakes, a *shinbari* frame with spanned beech dowels was used.

Fig. 70: Filling of larger gaps with ground cork and Plextol dispersion.

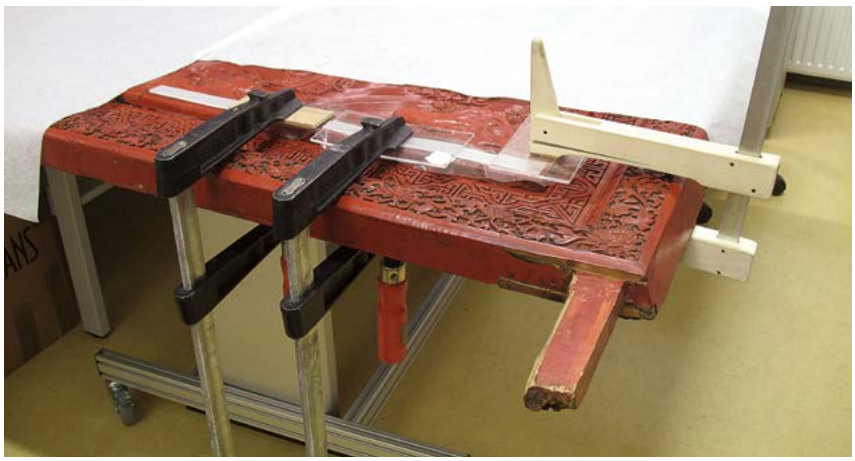

Fig. 71: Gluing of detached wood mouldings with cattle hide glue.

Fig. 72: Loss at the lower right corner of the base (compensation has already begun for the lower meander and brown layer, c.f. *fig. 24*).

Fig. 73: Compensation in the corner with red and brown pigmented microcrystalline wax.

5.4 LOSS COMPENSATION AND RETOUCHING

Very disturbing losses in the carved lacquer were filled with pigmented microcrystalline wax (TeCero 30222/TeCero 30201, 1:1).[41] For this, mixtures were prepared in six different red tones, pigmented with English red, iron oxide red, and ochre in various proportions. After the application of a Plextol separation layer on the lacquer surface or the gaps stabilized with Plextol and cork, the matching wax mixture was applied with a heated spatula, shaped with warmed bamboo skewers and carved and polished on cooling; cold working was sometimes also achieved using a cloth or cotton swabs moistened with petroleum spirits or acetone, with final polishing done using a dry cotton cloth *(figs. 72 and 73)*.

Losses in the brown ('yellow') lacquer of the patterned sky of the background were filled in a similar manner: After the removal of overpainting and old wax fills and consolidation of lifting lacquer layers with the above-mentioned Plextol mixture, the losses were filled with brown-pigmented wax (ochre, sienna, umber). The wax was warmed and kneaded with the hand and then pressed into the loss and formed with small bamboo and steel spatulas. Sometimes a final acrylic glaze (Golden Fluid Acrylics) was applied *(figs. 74 and 75)*.

Plextol inserts were applied to two large losses in the sky area. The carved pattern was cast from an intact area with kneadable silicon, a mixture of Plextol and phenolic resin microballoons and pigments (ochre and others) cast in the mould, and the positives thus produced were trimmed to fit the losses. Reversible attachment was achieved using Canadian fish glue; transitions and air bubbles were smoothed with a brown-pigmented wax mixture; final retouching was carried out with acrylics (Golden Fluid Acrylics) *(figs. 76 to 78)*.

[41] TeCero 30201 microcrystalline wax is obtained from heavy fractions of petroleum, solidification point 70–75°C, drop point 76–80°C, Tromm (acquired from Deffner & Johann, DE); TeCero 30222, microcrystalline wax, solidification point: 80–85°C, hard, good ability to be polished, gloss similar to lacquer.

Fig. 74: Loss to the carved lacquer pattern of the sky.

Fig. 75: Compensation of the missing carved lacquer with modelled, brown-pigmented wax.

Fig. 76: Large old fills with overpainting in the sky.

Fig. 77: Inserts made by moulding and casting with a Plextol mixture.

Fig. 78: Inserts adhered and further filled with wax, with retouching.

Fig. 79: Old wood insert, loss at the edge (reverse framing).

Fig. 80: Filling of losses at the edge with red pigmented wax, smoothing of the wood insert with acrylic spackle and retouching with acrylic paints.

Fig. 81: Old wood insert with old retouching.

Fig. 82: Retouching removed and adjustment of the wood insert.

Fig. 83: Retouching in acrylics.

Fig. 84: Compensation with microcrystalline wax, with *urushi* application on the right side.

Fig. 85: Compensation in wax with the hardened *urushi* coating (*suri-urushi*).

Losses to the edges and corners of the red frame on the reverse were likewise filled with red wax; losses to the surface, however, were closed with an acrylic spackle (Ecofiller[42]) and multiple layers of acrylic glazing (Golden Fluid Acrylics[43]). To match the surface gloss, the acrylic layers underwent intermediate and final polishing with Micro-Mesh 2400.

The black and yellow lines of the decoration were realized on both the wax and the acrylic fills with acrylic paints *(figs. 79 and 80)*.

Nearly all of the old wood fills had to be adjusted: Darkened old retouching was removed (usually with acetone), mismatched forms were levelled with a scalpel and sandpaper and filled with acrylic spackle if necessary; retouching was done with acrylic paints *(figs. 81 to 83)*.

Losses to the black lacquer on the reverse were filled with black-pigmented microcrystalline wax (ivory black, Indian red). After consolidation of loose areas, the application of the wax was done with a heated spatula, and the wax fills were then smoothed with bamboo and horn spatulas or with cork, cotton cloths, or petroleum spirits and finally dry polished to achieve the desired gloss.

The wax fills were partly isolated with raw lacquer (*ki-urushi*), and only thereafter was *urushigatame* performed on the entire surface. No problems were found with the adhesion or hardening of the *urushi* on the wax *(figs. 84 and 85)*.

[42] Ecofiller water-based acrylic wood filler, Borma Wachs (available in wood colours from Neuber's Enkel, Vienna).

[43] Golden Fluid Acrylics consist of an acrylic polymer binding medium and concentrated, high-quality pigments, with no fillers. They are lightfast, permanent, and flexible. Golden Fluid Acrylics have a low viscosity, which allows a smooth application while maintaining colour intensity.

Fig. 86: Application of linseed oil mordant over a wax fill.

Fig. 87: Reduced (blotted) application of the oil mordant.

Fig. 88: Dusting with gold powder (*aokin*, 'blue gold').

Fig. 89: Scratched gold decoration.

Fig. 90: Retouching with thinly applied and reduced oil mordant and dusting with gold powder (*kin*, 'pure' gold).

5.5 GOLD RETOUCHING

The bulk of the gold retouching was carried out imitating the original technique, however using the reversible and easier to use (with respect to humidity) 3-hour linseed oil mordant instead of Chinese lacquer.[44]
The abraded or missing decoration was applied in the unpigmented linseed oil mordant using a brush and carefully blotted; after a short drying time (5–10 minutes), gold (*keshifun kin* and *aokin*[45]), silver, or tin powder was dusted on with a dry brush. The metal powder adheres only on the areas pre-drawn with the mordant *(figs. 86 to 90)*.
Smaller losses could i.a. also be closed with pearlescent watercolours (Kremer[46]).

5.6 HARDWARE

All of the hardware described in section 4.8 is mounted with brass brads. The foot hardware was removed for cleaning and casting. Cleaning was done with fine brass brushes and more serious corrosion pustules were reduced with a scalpel. Green copper corrosion on the backs was reduced with radial brass brushes.
The missing metal hardware was cast using the spin casting process.[47] One left and one right original piece was cast and two casts produced of each respectively; one of each side was soldered together to form a corner bracket.

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44 Oil mordant (mixtion) is a mordant for gold leaf and metal powder based on linseed oil; 3-hour mordant dries in about three hours, depending on the thickness of the application, ambient temperature, surface, etc.

45 Finest Japanese gold powder in different alloys: *kin*, gold (97.6%); *aokin*, 'blue gold' (80% gold, 20% silver). http://www.urushi-watanabe.net/en/index.html (last accessed: 15 October 2020).

46 Kremer watercolour palette for gold retouching.

47 Johannes Ghezzi, M.A., Teesdorf/Baden bei Wien.

Fig. 91: Top: two pieces of original hardware; below, two reproductions (untreated).

Fig. 92: Top: two pieces original hardware; lower right: polished reproduction; lower left: polished and gilded reproduction.

The casts were partly galvanically gold plated on the fronts, hand polished, and abraded with fine brass brushes to match the surfaces of the aged originals.
All of the hardware was remounted using the historic brass nails; missing nails were replaced and the nail heads partially galvanically gold plated.
In order that the screen not rest on the hardware and cause this to exert pressure on the lacquer layers immediately above, all feet were underlaid with 3 mm thick oak shims *(figs. 91 and 92)*.

Fig. 93: Assembly of the multi-part lacquer screen in the new, environmentally controlled showcase.

6. REDISPLAY IN THE WELTMUSEUM WIEN

Since the reopening of the Weltmuseum Wien in October 2017, the lacquer screen, in its own protective showcase, is again presented in the China Hall on the mezzanine. The freestanding case, constructed of steel with the imposing dimensions of 4 m (W) × 3.5 m (H) × 1.2 m (D), is equipped with two large Prosorb drawers to stabilize the environment of the interior and an additional air diffusion system (without a fan). The glazing is 8 mm, 2-layer laminated glass. The showcase can be opened by two large doors on the front. The illumination of the object is achieved with LED lights positioned outside of the case *(figs. 93 and 94)*.

Fig. 94: New presentation of the lacquer screen in the Weltmuseum Wien.

7. THANKS

The successful completion of this major project would not have been possible without the help of many colleagues. The authors extend their heartfelt thanks to all those employees of the Weltmuseum Wien and the KHM-Museumsverband who were involved, whether briefly or for longer periods, in the research and conservation of the screen. Our particular thanks also go to our external colleagues and advisors Julie Chang, Norbert Kirchner, Štěpánka Hrdličková Kučková, and Michael R. Schilling.

SUMMARY

The technical study and conservation treatment of the imperial Chinese carved lacquer screen from the Qianlong Period (1736–1796), created in the 1770s, was one of the largest projects undertaken as part of the reopening of the Weltmuseum Wien in 2017. Imposing and of great artistic value, the screen was removed in 1900 by Austrian troops during the so-called Boxer Rebellion from the imperial hunting park Nan hai-tze (Nanhaizi) near Beijing and transported via Pula to Vienna where – after its presentation in the Imperial and Royal Natural History Court Museum – it was continuously exhibited in the Museum of Ethnology from its opening in 1928 until 2004. The depiction, spanning all three panels of the screen, shows the mythical Pantao Feast, the birthday festivities of Xiwangmu, the Queen Mother of the West. The reverse, executed in gold lacquer and gold painting, also relates to this.

The cracks and losses in the carved lacquer were consolidated and secured with Plextol D 360 and Plextol D 498 (3:2), with the addition of ground cork and organic phenolic resin microballoons for large gaps. Lifting lacquer on the reverse was set down traditionally using *mugi-urushi*, for which a so-called *shimbari* construction was also frequently employed. The secondary colophony coating on the reverse was retained, as was the presumably historic protective layer containing ibota wax. The carved lacquer surface was cleaned with a mixture of deionised water and isopropanol; the reverse largely with petroleum spirits. Losses in the carved lacquer areas and on the reverse were filled with pigmented microcrystalline wax. For the final surface consolidation on the reverse, the *urushigatame* method, developed in Japan, was applied. Nearly all old wood inserts had to be adjusted, and old retouching and overpaint was removed. New gold retouching on the reverse was achieved using a linseed oil mordant and gold powder. Missing metal hardware was cast and gilded galvanically.

Protected in an environmentally controlled glass showcase, the restored lacquer screen has been a centrepiece in the redisplayed collection of the Weltmuseum Wien since autumn of 2017.

ZUSAMMENFASSUNG

Die Erforschung und Restaurierung des kaiserlichen chinesischen Schnitzlackstellschirms aus der Qianlong-Zeit (1736–1796), entstanden in den 1770er Jahren, war eines der größten Projekte im Zuge der Neueröffnung des Weltmuseums Wien im Jahr 2017. Der imposante und künstlerisch hochwertige Stellschirm war im Zuge des sogenannten »Boxeraufstands« 1900 von österreichischen Truppen aus dem kaiserlichen Jagdpark Nan hai-tze (Nanhaizi) bei Peking entwendet und über Pula nach Wien transportiert worden, wo er – nach seiner Präsentation im k. u. k. Naturhistorischen Hofmuseum – im Museum für Völkerkunde von dessen Eröffnung 1928 bis 2004 durchgehend ausgestellt war. Die alle drei Tafeln des Paravents übergreifende Darstellung zeigt das mythische Pan-Tao-Fest, die Geburtstagsfeier von Xi Wangmu, der Königinmutter des Westens. Auch die mit Schwarzlack und Goldbemalung ausgeführte Rückseite nimmt darauf Bezug.

In Vorbereitung der Restaurierung wurden sowohl Aufbau und Zusammensetzung aller Grundierungs- und Lackschichten als auch die textilen Fasern der Grundierung und die verwendeten Metallpartikel des Golddekors der Rückseite untersucht. Der schon historisch belegte senkrecht verlaufende Riss in der Mitteltafel sowie mehrere teils klaffende Schwundrisse hatten zu zahlreichen losen Stellen und Fehlstellen im Lack auf der Vorder- und Rückseite geführt.

Die Risse und Fehlstellen im Schnitzlack wurden mit Plextol D 360 und Plextol D 498 (3:2) gefestigt und gesichert, bei großen Fugen unter Zusatz von Korkgranulat und organischen Phenolharzkügelchen. Die auf der Rückseite aufstehenden Lackschollen wurden in traditioneller Weise mit *mugi-urushi* niedergelegt, wobei vielfach auch eine sogenannte *shimbari*-Konstruktion Verwendung fand. Der sekundäre Kolophoniumüberzug auf der Vorderseite wurde belassen, ebenso die vermutlich historische Pflegeschicht mit Ibotawachs. Die Schnitzlackoberfläche wurde mit einer Mischung aus deionisiertem Wasser und Isopropanol gereinigt; die Rückseiten großteils mit Siedegrenzbenzin. Alle Fehlstellen im Schnitzlackbereich und auch auf der Rückseite wurden mit pigmentiertem, mikrokristallinem Wachs gefüllt. Für die abschließende Oberflächenkonsolidierung der Rückseite wurde die in Japan entwickelte *urushigatame*-Methode angewendet. Fast alle alten Holzergänzungen mussten angepasst sowie alte Retuschen und Übermalungen entfernt werden. Neue Goldretuschen auf der Rückseite erfolgten mit Leinöl-Mixtion und Goldpulver. Fehlende Metallbeschläge wurden nachgegossen und galvanisch vergoldet.

Geschützt von einer klimatisierten Glasvitrine, stellt der restaurierte Lackschirm seit Herbst 2017 ein Prunkstück in der neuen Schausammlung des Weltmuseums Wien dar.