

Unboxing the Secrets

Technical Study and Conservation of a Reliquary Casket from the Regensburg Cathedral Treasury

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This article presents the results of a study on the materials and techniques used in the manufacture of a reliquary casket from the Regensburg Cathedral Treasury. The casket was examined by means of stereomicroscopy, visible and fluorescent light microscopy, scanning electron microscopy with energy dispersive spectroscopy (SEM-EDS), X-ray fluorescence spectroscopy (XRF), X-ray computed tomography (CT) and radio-carbon dating. The wooden core is made of cypress and lined with a textile, the outer surface is decorated with openwork ivory panels, gilt leather, wood inlays, relief gilt silver foil, and a painted bottom in sgraffito. It was reworked at least once, partly using recycled elements. The wooden panels of its construction were dated to the 11th–12th century; the textile lining was produced in the 13th century. The casket shows elements of Byzantine and Islamic style and originates probably from Spain or Italy. It was originally probably designed as a writing or luxury box, and later reused as a reliquary casket.

Enthüllung der Kostbarkeiten

Kunsttechnische Untersuchung eines Reliquienkästchens aus dem Regensburger Domschatz

Die vorliegende Studie beleuchtet die vielfältigen Materialien und Techniken, die bei der Herstellung eines Reliquienkästchens aus dem Regensburger Domschatz verwendet wurden. Die eingesetzten Analysemethoden umfassen die stereomikroskopische Untersuchung am Objekt, lichtmikroskopische Untersuchung von Materialproben (Querschliffen), Rasterelektronenmikroskopie mit energiedispersiver Röntgenspektroskopie (REM-EDX), Röntgenfluoreszenzanalyse (RFA), Computertomografie (CT) und C14-Datierung. Das aus Zypressenholz gefertigte Kästchen ist innen mit einem Textil ausgeschlagen, das Äußere zeigt Einlagen aus durchbrochenen Elfenbeinplatten mit einer Rücklage aus Goldleder, kleinteilige Intarsien, gepresste Silberfolien und eine in Sgraffitotechnik bemalte Unterseite. Es wurde mindestens einmal umgearbeitet, wobei teils Elemente in Zweitverwendung zum Einsatz kamen. Das Holz des Kästchens lässt sich auf das 11.–12. Jahrhundert datieren, das Textil im Inneren auf das 13. Jahrhundert. Das Kästchen zeigt islamische und byzantinische Stilelemente und stammt vermutlich aus Spanien oder Italien. Es wurde wahrscheinlich ursprünglich als Schreib- oder Schmuckkästchen verwendet, bevor es zum Reliquienkästchen umgenutzt wurde.

Provenance of the casket

In 1873, four reliquary caskets containing human relics were discovered within a silver shrine in St Emmeram church in Regensburg. A few years after their discovery, the caskets were incorporated into the Regensburg Cathedral Treasury, where they are still kept today. The relics themselves were left inside the shrine in St Emmeram. Written sources reveal when the caskets were first placed inside the shrine¹: after a significant fire in 1641, which destroyed most of the St Emmeram church, a sarcophagus was discovered. The human remains within were thought to be those of St Emmeram, the patron of the church.² The bones from the sarcophagus were placed in four wooden caskets and enclosed in the silver shrine in 1659, where they remained until their rediscovery in 1873. The casket under study is notable due to its elaborate decoration, combining elements of Islamic and Byzantine style into an intriguing work of art (Fig. 1, 2, 8).³

The casket's elements

This study set out with the aim of shedding some light on the secrets the casket has kept since its discovery some 150

years ago and, for the first time, identifying the materials and techniques used for its creation as well as the changes it has undergone over time.

Construction of the casket and textile lining

The casket is constructed of wooden panels with the outer surface decorated with openwork ivory panels, wood inlays, glass inlays and relief gilt silver foil. It is fitted with metal mounts and has a painted bottom and a textile lining.

The wooden panels are joined with fine through-dovetails (Fig. 3). The use of dovetail joints has a long history dating back to fourth dynasty Egypt.⁴ In European furniture however, it only became popular from around the 14th century onwards, although there is also evidence of its use before the 12th century.⁵ The wood was identified as cypress (*Cupressus spec.*)⁶, which points in the direction of a Mediterranean origin. The casket has an internal compartment constructed of a lid and side wall, both of which are removable. The compartment's lid is decorated with gilt silver relief foils and the sidewall is lined with textile, gilt leather and silver relief foils (Fig. 6). The casket was once raised off the ground by metal feet, which were mounted into recesses cut into the dovetail joints of the casket's corners (Fig. 3). On the front of the casket, one can note the brass tour lock, which still has its arrow-



1
Regensburg reliquary casket, Domschatzmuseum Regensburg, acc. no. D 1974/65

shaped key. CT-scanning revealed the mechanism of the lock.⁷ It appears there had once been metal fittings around the corners just beneath the rim, evidenced by small holes in the wood. The lid is joined to the corpus with two hinges and can be lifted with a handle.

When opening the lid, the well-preserved textile lining of the casket is revealed (Fig. 2, 19). It is a semi-silk fabric in twill

weave and presents a yellow and red pattern of medallions enclosing oppositely arranged griffins and birds. It was produced either in Italy or Spain and can be dated to the 13th century.⁸

Ivory panels and wood inlays

Recesses were cut into the wood, where openwork panels made of polychromed ivory were placed (Fig. 4).⁹ The polychromy consists of a red coloured layer, possibly a bole, followed by gold leaf and painted black outlines (Fig. 5).¹⁰ The shapes cut into the ivory, are reminiscent of Arabic letters surrounded by arabesques.¹¹ Single shapes of these Arabic script motifs might be identified as letters – however, they do not make sense as a whole.¹² The reason for this could be that single Arabic letters were copied and arranged freely for a mere decorative purpose by a person who was not capable of reading and writing Arabic.¹³ Another possible expla-

2
Opened casket with textile lining



3
Dovetail joints and intarsia on the back of the casket





4
Visual compilation of the lateral
ivory panels (front, back, left
and right side of the casket)



5
Detail of the left quatrefoil ivory panel
with an incised circle above the eye of
the griffin

nation would be that the panels were originally wider and were cut down to match the casket's size, thus cutting off additional letters, which might have provided the required context to understand it. This hypothesis is clearly supported by the appearance of the panels, whose sides do indeed seem to have been cut off. Moreover, the panels on the front and back of the casket are mounted upside-down.¹⁴ Since the recesses in the wooden casket fit the ivory's shape perfectly, their current orientation was obviously intended and is not a result of later amendments. This again indicates that the person assembling the panels on the casket was not capable of reading Arabic letters.

The quatrefoil panels on the lid show figurative motifs of fighting animals, surrounded by foliage. A previous study has pointed out the resemblance of these to Fatimid wood and ivory carvings, though with considerable stylistic differences noted.¹⁵ The quatrefoil panels have also been linked to the Innsbruck enamel plate¹⁶, assumedly a Byzantine court production.¹⁷

As mentioned before, there are several indications that the ivory panels have been recycled from a previously different purpose: Besides the resizing of the lateral panels, the quatrefoil panels on the lid show several incised circles with a central dot spread over the surface of the ivory (Fig. 5). On

the middle panel, the dots form a curved line when connected. One explanation for this could be that the plates used for the quatrefoil panels were originally decorated with a circled dot motif, a pattern commonly found on many types of objects across different time-periods and cultures.¹⁸ The plates were possibly sanded down before being redecorated for a new purpose. All in all, these findings provide clear arguments for the ivory panels being reused from a different context.

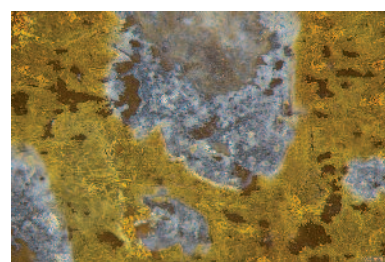
The golden colour glimpsing through the openwork ivory panels comes from pieces of gilt leather, placed behind the panels as a backdrop (Fig. 6).¹⁹ Gilt leather was usually produced by sizing the leather with animal glue, applying silver foil and subsequently covering it with gold lacquer (Fig. 7).²⁰ This technique is known to have been used for leather wall-hangings, which were especially popular in 16th to 18th century Europe.²¹ The technique is thought to have originated from a region in present-day Lybia and spread from there to the Iberian Peninsula and throughout Europe.²²

In addition to the ivory panels and gilt leather, delicately worked wood and bone inlays are placed on the lid, the front and back of the casket (Fig. 3, 8–9). The inlays were produced from different species of wood combined with natural and



6
Pieces of gilt leather and gilt silver foil ap-
plied on the sidewall of the internal com-
partment box

7
Detail of the gilt leather (photomicrograph)





8
Lid of the casket with quatrefoil panels and intarsia

dyed bone, which were arranged in a block, cut into slices and subsequently glued into recesses in the casket's panels and lid.²³ Similar works occur in Spain and Italy from the 14th throughout the 16th century.²⁴

Due to the loss of silver relief decor²⁵ on the lid, several characters written directly on the wood became visible. These marks might have given instructions on the placement of certain elements such as the quatrefoil panels or the inlays (Fig. 11). The script and meaning of these characters have not yet been determined.

Glass inlays

Adding to the splendour of the casket's decoration are glass rhomboids set into recesses in the lid (Fig. 12). The ornamental design was painted with gold and silver onto the glass before

reheating it to form a durable bond. The yellow and green hues, which can be observed around some of the silver lines, indicate the formation of silver stain where silver ions diffused into the blue glass surface (Fig. 13). The use of silver stain for decorating glass objects can be found on examples from Byzantium dating to the 10th century, and the technique has also been used for Islamic objects.²⁶ However, on the Regensburg casket, the formation of silver stain was probably not intended as it only occurs on two out of eight glass inlays. The CT-scans reveal that underneath the glass rhomboids, metal foils were placed to reflect the light and enhance the blue colour.²⁷

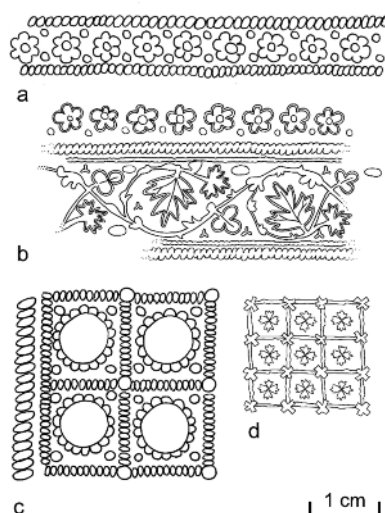
Silver relief decor

The space in between the ivory panels and wood inlays is filled with gilt silver foil, which shows motifs of flowers, circles

9
Visual compilation of the intarsia on the lid of the casket



10
Drawings of the
relief pattern impres-
sed in the gilt silver
foil



and leaves in relief (Fig. 10). The foil was likely produced similarly to part-gold (*Zwischgold*) using a technique which is referred to as “cold welding”, whereby gold and silver sheets are joined by hammering them together.²⁸ The relief was probably achieved by placing the sheet of gilt silver foil face down on a die and hammering it – probably with an intermediate layer of tow or a sheet of lead – until the design was impressed. This technique was already described by Theophilus Presbyter in the 11th century and recommended for the application on reliquary caskets and altar panels.²⁹ Examples can be found on numerous works of art.³⁰ The application of the gilt silver foils on the casket certainly aimed to imitate a goldsmith’s work. The foil is missing in many areas of the casket, but the motifs of the original applications can still be observed in the relief of the remaining adhesive used to fix the foils to the casket.³¹

Sgraffito

The elaborate decoration of the casket is not only limited to the readily visible areas, but also extends beyond. A geometric pattern was painted on the bottom of the casket, which combines three design elements arranged to form a double star pattern (Fig. 14). The painting technique used to create this motif is quite complex and can be described as *sgraffito*. To begin, tin foil was applied to a ground layer and sealed with a gold-coloured glaze.³² Then, black and white fields were painted onto the dried glaze and the lines of the design subsequently scraped out whilst the paint was still malleable, thus revealing gold-coloured ornamental lines (Fig. 15–16). The use of the *sgraffito* technique for surface decoration has for example been identified on early Italian artworks of the 13th century, in one case even over tin foil.³³

Modifications of the casket

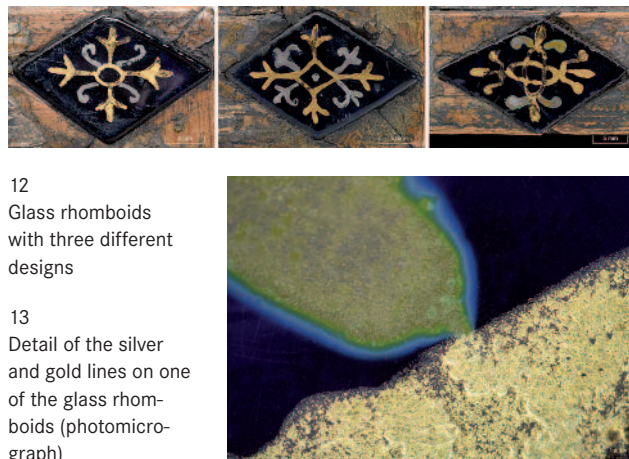
Observing all these different materials and stylistic elements combined on the casket, the question arises if it was originally

11
Characters written
onto the lid, original-
ly covered by the sil-
ver foil



12
Glass rhomboids
with three different
designs

13
Detail of the silver
and gold lines on one
of the glass rhom-
boids (photomicro-
graph)



designed that way or if it has undergone modifications over time. There are indeed indications of a redesign of the casket. For example, punches can be found along the rim of the wooden corpus (Fig. 17). These had been part of an earlier design and were covered up with gilt silver foil and textile when it was redecorated. Furthermore, the metal hinges are a later addition, too. The lid and corpus were originally connected by interlocking eyelets, which can be clearly seen from the back and in the CT-scans (Fig. 18). With the application of the metal hinges, the distance between lid and corpus was changed, thus making the eyelets unusable and redundant.

Considering all the clues given on the casket, it can be possibly assumed that the first design of the casket might at least have comprised punches along the rim, eyelets as hinges, herringbone wood inlays on the front and side of the lid and metal fittings on the corners before the gilt leather,

ivory panels, relief silver foil, textile and metal hinges were added. There is evidence that after the textile was added, the casket was in use for a period of time as the lid of the internal compartment was obviously used to support the casket's lid when it was left open, resulting in a faint worn line on the textile, suggesting an extended period of use (Fig. 2).

Origin and Dating

Thus far, previous studies on the casket have suggested an "oriental" or more specifically "arabic" origin³⁴, or placed its production in a western area with Islamic and Byzantine influence, such as Northern Italy.³⁵ Avinoam Shalem and Eva-Maria Troelenberg, who conducted the most recent study on the casket in preparation for the Munich exhibition "The Future of Tradition – The Tradition of Future" in 2010, point out the link between the wood inlays found on the casket and the works produced during the Nasrid period in Spain.³⁶ They therefore propose an origin in the Western Mediterranean region.³⁷ The suggested Mediterranean origin of the casket is also supported by this study's find of cypress wood for its construction. The stylistic and technical comparison of the casket's elements shows connections to both Spain and Italy as well as to Byzantium without giving a clear indication of either of these regions.³⁸

As to dating the casket, suggestions range from the 12th to the 14th century.³⁹ In order to determine a more precise date, a sample from the wooden corpus was analysed using radio-carbon dating. The result places the casket in an even earlier time period: its wood dates back to between 1021 and 1152 A.D.⁴⁰ The casket could therefore have been made in its first design phase around the 11th or beginning of the 12th century, although, in theory, the casket could also have been made at a later date using recycled wood.⁴¹

The same applies to the elements used for the redecoration of the casket. Analogous to the ivory plates, these could also have been applied to the casket in secondary uses, which again renders the dating of the casket's modification difficult.

14
Bottom of the casket with *sgraffito* design



However, the overall technical and stylistic comparison suggests that the modification of the casket was not conducted before the 13th century.⁴²

The casket was most likely originally designed as a luxury or writing box before being repurposed as a reliquary box in the 17th century at latest.⁴³ It can be assumed that it was already in its current appearance, when it was enclosed in the shrine in 1659.

Conservation

The casket's eventful history has left its traces and taken its toll on the condition of the art work. This is most apparent in the loss of the silver foils, which originally covered wide areas of the casket's surface. Examination of the remaining foils indicated that some areas were loose and at risk of detaching, requiring consolidation.

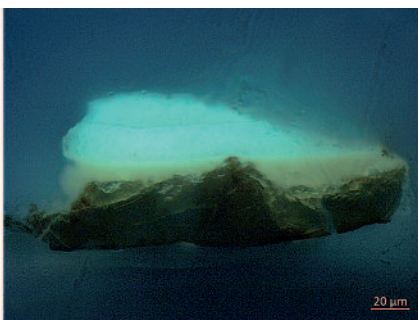
Wear and obvious previous cleaning attempts of the painted underside had resulted in significant surface scratches, disturbing the design. There were also several areas of flaking paint on the base, which needed to be secured. Furthermore, the casket was covered with dust, particularly on the lid, which not only obscured fine decorative details, but also has the potential to cause further damage. The more ingrained surface soiling however could be considered as a witness of

15
Details and drawings of the main design elements of the painted bottom





16
Cross section of the white paint layer from the bottom of the casket (ground layer is missing): corroded tin-foil (a), gold-coloured lacquer (b), white paint (c), varnish (d)



17
Detail of the punchmarks on the rim of the corpus



18
Detail of the back of the casket with one of the eyelocks, which used to join lid and corpus at an earlier stage

19
Detail of the textile lining



the history of the casket. It was therefore decided to only remove the dust from the casket's surface while respecting the traces of its history.

The surface of the casket was cleaned using a soft sable brush, followed by selective cleaning using a PVA sponge⁴⁴ which was very lightly dampened with de-ionised water and gently "dabbed" against the surface to remove the remaining fine dust. The casket's surface was immediately dried after contact.

The loose silver foil was re-adhered with sturgeon glue⁴⁵ applied using a fine-tipped brush. During drying, the foil was held down with gentle pressure by placing a layer of absorbent Evolon® fabric⁴⁶ over the treated area, onto which a soft Polyurethane sponge was positioned with a further thin metal weight on top. This ensured a good bond whilst not applying too much pressure on the sensitive silver foil. Likewise, the flaking paint on the bottom of the casket was consolidated using sturgeon glue.

Conclusions and future research

This study set out to shed some light on this exceptional object and to provide further clues for its dating, the various techniques employed for its production, its materiality and its changes over time. The most obvious finding to emerge from this study is that the casket's wooden core can be dated to the 11th to the 12th century. The casket combines precious materials with elaborate techniques and was most likely produced in Spain or Italy as a writing or luxury box in the first place, before being reused as a reliquary casket in Regensburg.

Further research is needed to investigate the Arabic script motifs regarding their origin and meaning. Likewise, the written symbols or characters underneath the adhesive on the lid might provide further clues for the casket's origin. Furthermore, comparison of style and technique of wood inlays of Italian and Spanish origin might narrow down whether they were produced in either of these regions. An analysis of the glass composition of the rhomboids might also provide more evidence on their origin and dating.

Although there are still questions to be answered, this study provides the first comprehensive assessment of the casket from a material's point of view, and establishes a starting point for future research to reveal some more of the casket's secrets.

Acknowledgements

The author would like to express her gratitude to Dr Maria Baumann, Dr Renate Eikermann, Ute Hack, Hans-Jörg Ranz, Dr Klaus Achterhold, Dr Matthias Weniger, Dr Regula Schorta, Dr Johannes Pietsch and the colleagues from the conservation department of the Bayerisches Nationalmuseum.

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Notes

- 1 HUBEL 1976, pp. 152–153
- 2 This assumption was only discarded some 200 years later, when the actual relics of the patron were found elsewhere in the church.
- 3 Domschatzmuseum Regensburg (Regensburg Cathedral Treasury), acc. no. D 1974/65, 41,8 × 21 × 12,7 cm
- 4 EDWARDS 2000, p. 111
- 5 EDWARDS 2000, p. 111; EAMES 1977, p. 228, note 111: A report of the opening of the burial of St Cuthbert in 1104 describes the use of dovetail joints for constructing the coffin. An early example for dovetail joints is a Byzantine casket in the Cleveland Museum of Art, 14th century, acc. no. 1999.229 a-b, personal communication from Martin Siennicki, 21.02.2018. A comparative example to the rather finely worked dovetail joints on the Regensburg casket is an object in the Museum of Applied Arts Vienna (MAK), casket from Northern Italy, 15th century, acc. no. H 794.
- 6 The identification of the wood species was carried out at the Chair of Wood Science (Technical University of Munich) by the author, Dr Michael Risse and Gabriele Ehmcke. The sample was examined with the aid of the reference collection of the Chair and wood identification databases: Intkey (<http://delta-intkey.com/www/programs.htm>) and InsideWood (<https://insidewood.lib.ncsu.edu>), both based on the IAWA criteria for wood identification, accessed 18.03.2020.
- 7 The X-ray computed tomography was conducted at the Munich School of Bioengineering (MSB, Technical University of Munich) by Dr Klaus Achterhold using a Phoenix v|tome|x CT system. A publication on the process of scanning and the presentation of results is in preparation.
- 8 Personal communication from Dr Regula Schorta, Abegg-Stiftung Riggisberg, Switzerland, 19.03.2018; the technical examination was conducted by Dagmar Drinkler and Beate Kneppel, both Bayerisches Nationalmuseum, textile conservation studio.
- 9 Visual examination suggested that the panels are made of elephant ivory, but no further analysis was conducted. Indications pointing towards elephant ivory are for example the size (the biggest panel measuring 24,5 cm × 6,5 cm) and the visibility of a faint Schreger pattern on the intersections of the openwork panels. For the identification of elephant ivory see for example LOCKE 2008 or BAKER ET AL. 2020
- 10 The decoration of ivory panels using gold and black colouring can be found in numerous examples, especially on so-called “Siculo-Arabic” ivory caskets, which are mainly dated to the 12th and 13th century, e.g. a casket from the Museo Sacro Vaticano, acc. no. 61902. For a comprehensive study on the topic of so-called “Siculo-Arabic” ivories see ARMANDO 2017.
- 11 For the lateral panel without Arabic script motif (Fig. 4, bottom left), comparable objects are reproduced in FERRANDIS 1940, plate LXI: a casket from the cathedral in Burgo de Osma and a casket from the Musée des Beaux Arts de Lyon, both published in FERRANDIS 1940, plate LXI.
- 12 SHALEM/TROELENBERG 2010a, p. 122; personal communication of Daniel Potthast, 04.06.2018
- 13 personal communication of Daniel Potthast, 04.06.2018
- 14 SHALEM/TROELENBERG 2010a, p. 122; personal communication of Daniel Potthast, 04.06.2018
- 15 SHALEM/TROELENBERG 2010a, p. 120
- 16 Tiroler Landesmuseum Ferdinandeum, Innsbruck, acc. no. K 1036. Byzantium or northern Mesopotamia, mid-12th century. SHALEM/TROELENBERG 2010b, p. 88; HUBEL 1976, p. 153
- 17 SHALEM/TROELENBERG 2010b, p. 88
- 18 The circled dot motif can for example be found on a comb from Egypt, Skulpturensammlung und Museum für Byzantinische Kunst, Staatliche Museen zu Berlin, 6th–7th century, acc. no. 19/83, on a chess piece from the Western Islamic Lands, Metropolitan Museum of Art, 11th–12th century, acc. no. 47.68, an offertory box from the Upper Rhine region, Bayerisches Nationalmuseum, around 1280, acc. no. MA 2936; and on an arrow-straightener from Canada (Eskimo-Aleut), British Museum, 19th century (?), acc. no. Am.St.770. For more examples and a discussion of the motif see ARMANDO 2017, pp. 116–120
- 19 XRF-analysis confirmed the use of silver for the production of the gilt leather. The analysis was conducted by Joachim Kreutner using a NITON XL3t-980 HE device.
The use of a gold coloured backdrop behind openwork panels can be observed on several objects, for example on a luxury casket from Attinghausen, Switzerland, Schweizerisches Nationalmuseum, around 1250, acc. no. LM-3405.34, on a casket from Konstanz (Germany), Schweizerisches Nationalmuseum, around 1320, acc. no. IN-6957.4 (gilt parchment), on a casket from the Alpine region, Kunsthistorisches Museum Wien, beginning of the 12th century, acc. no. KK_10006 and on a casket from Cuenca (Spain) Museo Arqueológico Nacional (MAN), 1049–1050, acc. no. 57371 (leather).
- 20 SCHULZE 2011, p. 39
- 21 SCHULZE 2011, p. 18
- 22 POSTHUMA DE BOER ET AL. 2016, p. 19 and SCHULZE 2011, pp. 19–20, Schulze mentions that there is documentary evidence of gold leather in the Christian parts of Spain as early as the 11th century. He points out that there also may well have been European precursors to this technique, which have not yet been further explored.
- 23 To prevent the pieces from falling apart during cutting, a paper support was often glued onto the surface. On the reliquary casket, a paper support is visible underneath one of the wood inlays: Fig. 9, top row second from right.
- 24 Shalem and Troelenberg point out the striking resemblance of the wood inlays to the inside of a door leaf from the Palacio de los Infantes in Granada, Nasrid period, 14th century, Museo Nacional de Arte Hispanomusulmán Granada, acc. no. 190 and to the inlays found on a writing box from the Museo Arqueológico Nacional Madrid, Nasrid period, 14th century, acc. no. 1972/105/3, SHALEM/TROELENBERG 2010a, p. 120. Similar inlays can also be found on a chess board from Venice, first half of the 14th century, Kunsthistorisches Museum Wien, acc. no. KK 168 or on a Venetian token casket, 15th century, Bayerisches Nationalmuseum München, acc. no. MA 2523.
- 25 See the following section.
- 26 Bracelet with Birds and Geometric Patterns, 1100–1400, Byzantine, Metropolitan Museum of Art, acc. no. 67.185; Fragment of a Glass Dish, 10th century, Byzantine, Metropolitan Museum of Art, acc. no. 30.95.34
- 27 This practice can be seen on numerous objects, for example on the Westminster retable, 1270/1280, where silver foil was placed underneath transparent, coloured glass. SAUERBERG 2009, p. 235
- 28 WU ET AL. 2018, p. 122
- 29 BREPOHL 1987, p. 230
- 30 One example with a striking similarity regarding the pattern of the silver foils is the Aschaffenburg board game, Italy, around 1300, Stiftsmuseum Aschaffenburg, acc. no. MSA Dep. KKPA 4/2009. Another example for the use of relief silver foils is the reverse of the Königsfelder diptych, Venice, 1270/1290, Historisches Museum Bern (Switzerland).
- 31 Unlike in other examples of applied relief, a specific fill material for supporting the relief could not be observed on the casket. However, in areas where the foil is lost, the remaining thick adhesive layer (probably animal glue) replicates the relief, indicating the adhesive could also have been intended as a stabilising fill material.
- 32 The tin was identified by Dr Catharina Blänsdorf using SEM-EDX
- 33 FOLDA/WRAPSON 2015, p. 252
- 34 HUBEL 1976, p. 153
- 35 COTT 1939, note 91; HUBEL 1976, p. 153
- 36 SHALEM/TROELENBERG 2010a, p. 120
- 37 SHALEM/TROELENBERG 2010a, p. 120
- 38 The selection of comparison examples is by no means exhaustive and can be expanded in future studies. The relief silver foil and the *sgraffito* seem closer to Italian examples, the wood inlays and gilt leather could point towards Spain. A Byzantine influence is possible on the ivory panels and glass inlays.
- 39 HUBEL 1976, p. 153 (suggests 13th century and cites literature suggesting 12th/13th century); SHALEM/TROELENBERG 2010a, p. 120 (14th century?)
- 40 FRIEDRICH 2018. This is the result for the 2-sigma calibration error (95,4 % probability).
- 41 The correspondence of the presence of rather finely worked dovetail joints and the dating to the 11th or 12th century could be re-examined

in future research, for example, by searching for further comparative examples from the regions of origin concerned. See note 5.

- 42 The textile lining (13th century) and the silver relief foil (comparative examples date to around 1300) were probably applied during the redesign of the casket (see the respective sections). Likewise, the metal fittings can possibly be assigned to the redesign but have not been investigated further during this study. It is not clear whether the wood inlays on the lid are part of the redesign or belonged to the original design. Comparative examples suggest that this type of wood inlays only became popular in the 14th century (see note 24).
- 43 HUBEL 1976, p. 153
- 44 Blitifix®. This product is chemically a Poly(vinyl formal) sponge, but generally referred to as Poly(vinyl alcohol) sponge in conservation. SEGURA ESCOBAR 2013, p. 274
- 45 5 % w/w concentration in deionised water; Sturgeon glue is generally referred to as having relatively good ageing properties, depending on its preparation and environmental conditions during ageing. It was observed that even century old animal glue reacted to exposure to water. It was hoped that with the use of sturgeon glue for consolidation, the assumed animal glue originally used to adhere the silver foils would be reactivated and therefore the amount of new consolidation material needed could be reduced. The decision in favour of sturgeon glue was also influenced by the thought of avoiding the introduction of a synthetic conservation material to the casket. SCHELLMANN 2007, p. 62–63
- 46 Non-woven fabric made from polyester and polyamide microfibers

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