Part 2:
Furniture in the Boulle Technique

Fig. 1. Cabinet, Johann Daniel Sommer, 1685, marquetry of tortoiseshell with red underlay, engraved tin, horn with finely painted underlay, mother-of-pearl, ivory, silver mounts. Sammlung Würth, Künzelsau.

The conservation of a cabinet by Johann Daniel Sommer

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One of the most fascinating ebonists in German-speaking Europe in the second half of the 17th century was Johann Daniel Sommer (1643–circa 1698).[1] He worked largely using materials such as horn, tortoiseshell and tin plate, which he employed in a variety of different shapes. Sommer's utilisation of sheets of horn atop painted designs is unique within European furniture making: he underlaid transparent pieces of horn with highly detailed and delicately painted motifs in bright colours (Figs. 1, 2, 3 and 4). In the case of this cabinet we look through pieces of inlaid horn onto painted figures, animals and flowers. No other contemporary ebonist in Europe could match his quality and no later cabinet-maker would ever equal it.

Johann Daniel Sommer was born in 1643 in Künzelsau (today in Baden-Württemberg) where he worked until the year 1679, before moving on to other still as yet unknown locations. Twelve works by J. D. Sommer, produced between 1666 and 1692, are currently known.[2] The cabinet addressed here was created in 1685 for the Prince-Bishop of Würzburg, Johann Gottfried von Gutenberg (1645–1698). The marquetry is made of hawksbill sea-turtle shell with red underlay, engraved tin, horn atop painted motifs, mother-of-pearl and ivory. Using archival sources the art historian Andrea Huber has been able to trace the location of the cabinet back to the year 1697.[3] She also discovered that the cabinet was once crowned by a crucifix. This stood in a central position on top and was ninety centimetres high. Today traces still remain of the fixing. By acquiring the piece in 2003, the Museum Würth in Künzelsau brought Sommer's cabinet home to the region in which Sommer was born and spent his early professional life.

The following explores two aspects of this cabinet's conservation: the conservation of the pieces of tin, and the tortoiseshell.

Sommer typically used a number of different tin profiles in his works – sometimes employing them next to one another (Fig. 5) – to structure the piece of furniture as well as to lend sophistication to its various surfaces. This cabinet displays 29 differently shaped pieces. Over 720 individual pieces have been worked out of bent ribbons of tin. Having become detached, 118 of these had been deposited in one of the drawers. Some 86 sections taking 14 different shapes were missing entirely. A large number had been inexpertly re-glued into place with copious amounts of polyvinyl acetate (PVAc) glue between 1998 and 2003 (Fig. 6).

Damage to the tin involving bulking or loss was manifest in four different ways (Fig. 7). These were:

1. The formation of bubbles with expansion;
2. The formation of veins with expansion;
3. Erosion from outside in;
4. The formation of cracks.

The question naturally arose as to whether or not the damage was to be associated with the use of different alloys. With the aim of clarifying this matter Dr Kilian Anheuser of the Musée d'art et d'histoire in Geneva analysed 14 samples of tin. Two readings were taken per specimen. No external funding for analysis was available in the context of this project. As no external funding for analysis was given all tests carried out were paid for personally and with the support of those people I thank at the end of this paper. Because only few measurements could be executed, the results should only be taken as suggestive. All results are thus to be interpreted as indications. All of the tin

Fig. 2. The cabinet door.

Fig. 3. Detail of a drawer with typical painting beneath clear horn.

Fig. 4. Detail from the lower middle drawer of painting beneath clear horn.

alloys, with the exception of the tin of the aerial roots, comprised 85–90 per cent tin with differing amounts of copper, lead, bismuth and mercury (Fig. 8). It was possible to identify three types of alloys. The thin strands of tin used for the marquetry, the flat sections and the ribbon-like veins – i.e., those pieces produced from the tin sheets – had approximately the same proportion of the other metals in the lower percentage bracket. There was a greater proportion of bismuth in the tin used for the sections. The tin used for the aerial roots contained approximately equal amounts of tin and lead and a higher proportion of mercury (the exact quantification of one to the other was not possible under the prevailing conditions of analysis).

The test results showed that three different tin alloys were employed according to the purpose for which they were intended – for the tin profiles, for bands of tin or for the fine tin threads. The results of these investigations did not aid the explanation of the evident damage. This appears to be the result of oxidation and other chemical reactions in the tin caused by external influences.

When it comes to damage of tin, the keyword tin pest always rears its head, the transformation of metallic tin (â-tin) into a differently crystallised modification (à-tin) at low temperatures, which in the end can lead to a powdery consistency that is thermodynamically more stable at lower temperatures. In fact, only a very small number

Fig. 5. Profile pieces of different forms.

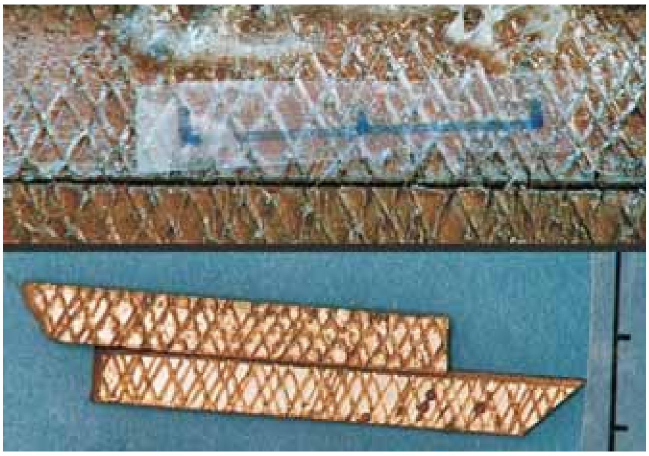

Fig. 6. PVAc on an original bed of glue,
rear sides of tin pieces.

of isolated cases of tin pest have been found in art objects to date and the disease can thus be excluded from consideration here.

The upper part cabinet's mirror conceals the jottings of various persons who have worked on this piece.[4] The most recent reads 'Andreas Schuberth Schreiner Meister von Schmeilsdorf den 18. Juli 1899'. I connect this note with what was probably the last comprehensive conservation of the object.

Lost pieces of tin have been renewed in places. These additions have been cut from thin sheets of tin and also strengthened with wood on the underside. The surfaces in these areas have, in part, been roughly smoothed (Fig. 9). These coarse object-inappropriate interventions lead one to suppose that the cleaning of the surface was also carried out using aggressive materials.

It was common to clean tin in the first half of the 20th century using a hydrochloric acid of 20–30 per cent. Objects were immersed in a bath of this acid and then rinsed in water. It is quite possible, then, that the tin of the cabinet was cleaned with concentrated hydrochloric acid in 1899. In doing so it was able to penetrate beneath those pieces of tin that were no longer firmly attached. In these places the hydrochloric acid has caused the tin to partially or completely disintegrate from behind. This explains the damage to the tin where it has been eaten away

Fig. 7. Fore and rear sides of the pieces of tin investigated.

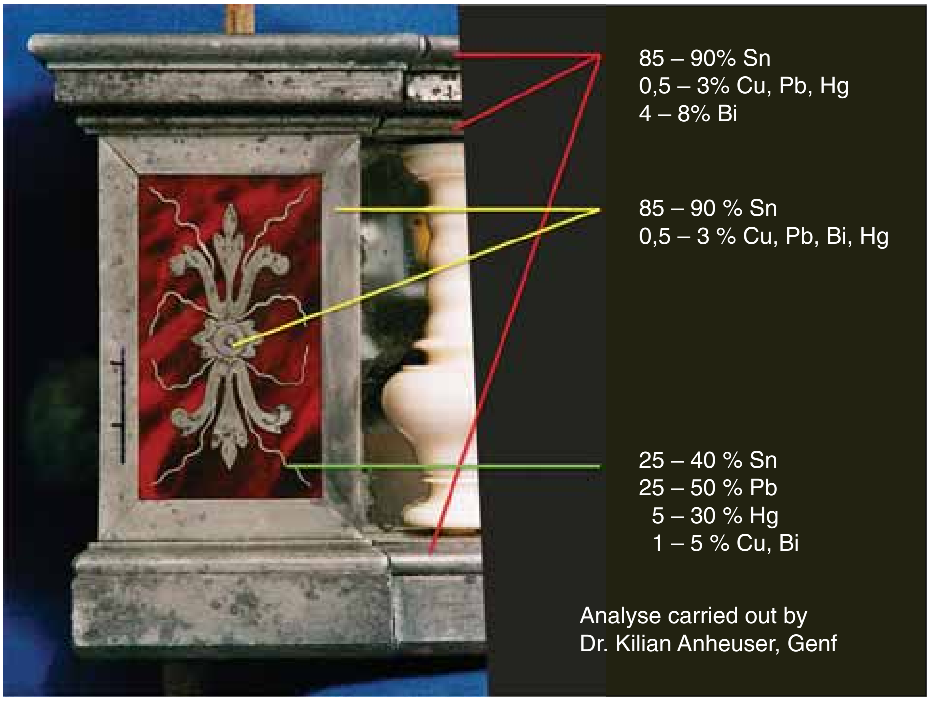

Fig. 8. Results of the tin analysis.

from the outside in, or has cracked. No analysis was made of the glue in the area of such damage in order to confirm this theory.

In the more than 200 places where the tin profiles had fallen off or been lost, a bed of glue remained, approximately 0.3–2 mm deep. This was imprinted with marks left behind by the tin profiles, the rear of which had been scratched with a diamond-like cross hatched grid (Fig. 6). Despite sometimes being as thick as 2 mm, these glued surfaces displayed no cracks due to shrinkage. An analysis of the adhesive by Dr Stefan Zumbühl at the Fachhochschule Berne using Fourier transform infrared spectroscopy (FTIR) identified animal glue of 5–25 per cent natural resin. No further characterisation of the resin was attempted.

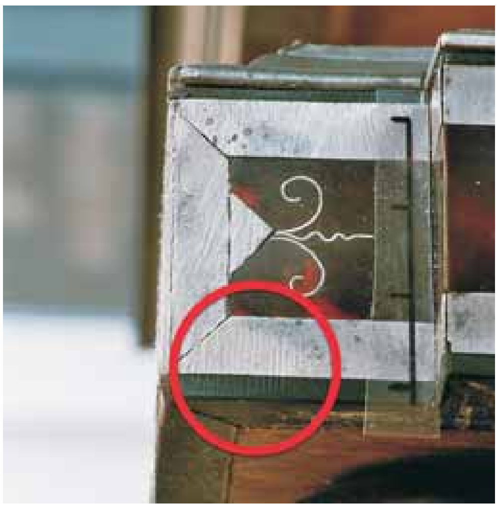

Fig. 9. Rough traces of polishing
where earlier additions of tin had been made.

During conservation it was important that all of the original glued surfaces whether thickly or thinly applied should be preserved so that the surviving pieces of tin could be re-applied with exactitude, creating accurately fitting mitred joints in the corners. To achieve this the old glue surfaces were dry-cleaned. The adhesive was then moistened using compresses on top of sheets of Goretex that caused the raised bars of glue to swell. The cleaned and gently warmed tin profiles were then re-adhered with some animal glue having been added. The removal of the tin pieces, which had been imprecisely applied with thick layers of PVAc glue and were also raised, was particularly time consuming. A scalpel was used to separate the layers and the PVAc glue was mechanically removed from the rear of the tin profiles as well as from the original glue. Thereupon the tin profiles were re-glued as described above.

In order to re-produce the eighty-six missing pieces, the fourteen different missing forms were copied using heat-resistant silicon. Casts were produced using an alloy comprising 80 per cent raw tin (97 per cent tin, 1.5 per cent copper, 1.5 per cent antimony) and 20 per cent Wood's metal (50 per cent bismuth, 25 per cent lead, 12.5 per cent cadmium, 12.5 per cent tin) and can thus also be clearly distinguished from the original pieces. The back of the cast

Fig. 10. Middle doors (detail).

Fig. 11. Left and right drawers of the central part.

pieces were engraved with parallel lines – the original pieces with a grid – and glued with animal glue.

Tortoiseshell

Threatened by extinction, turtles have been protected by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) since 1973. This means that their shells (traditionally called tortoiseshell, a usage which is also adhered to in this volume) cannot be bought or sold in any form, be it raw, semi-finished, or processed. As a result of this legislation all industries involved in the processing of tortoiseshell were forced to shift their production to other materials. Consequently traditional knowledge of how to work tortoiseshell has been slowly lost in the course of the last forty years, as has the ability to distinguish between the types and classify the colours. Sadly this artisanal knowledge was not recorded, and neither used nor advanced by the conservational sciences or art history it has thus entirely disappeared.

To this should be added that no low-cost, non-destructive methods of analysis for the differentiation of different types of shell have been discovered to date. What is more, conservational and art-historical publications from the last 30 years have added to the confusion, because these are contradictory, in part incomplete and include inaccuracies.[5] For this reason, I would like to focus briefly and generally on tortoiseshell as a material.

The shell from primarily three species of turtles has been being employed for European applied arts from the 17th century onwards:[6] the hawksbill sea turtle (*eretmochelys imbricata*), the loggerhead sea turtle (*caretta caretta*) and the green sea turtle (*chelonia mydas*).[7] All three species are at home in tropical and subtropical seas and are threatened by extinction. Yet it is only the shell of the hawksbill sea turtle which is truly exotic in Europe. In fact the loggerhead and green sea turtles can be considered to be both exotic and native, for these are still to be found in the Mediterranean today. In addition to these three natural types of tortoiseshell there is also tortoiseshell from

Fig. 12. Drawer, right of centre (detail).

Fig. 13. Socle (detail).

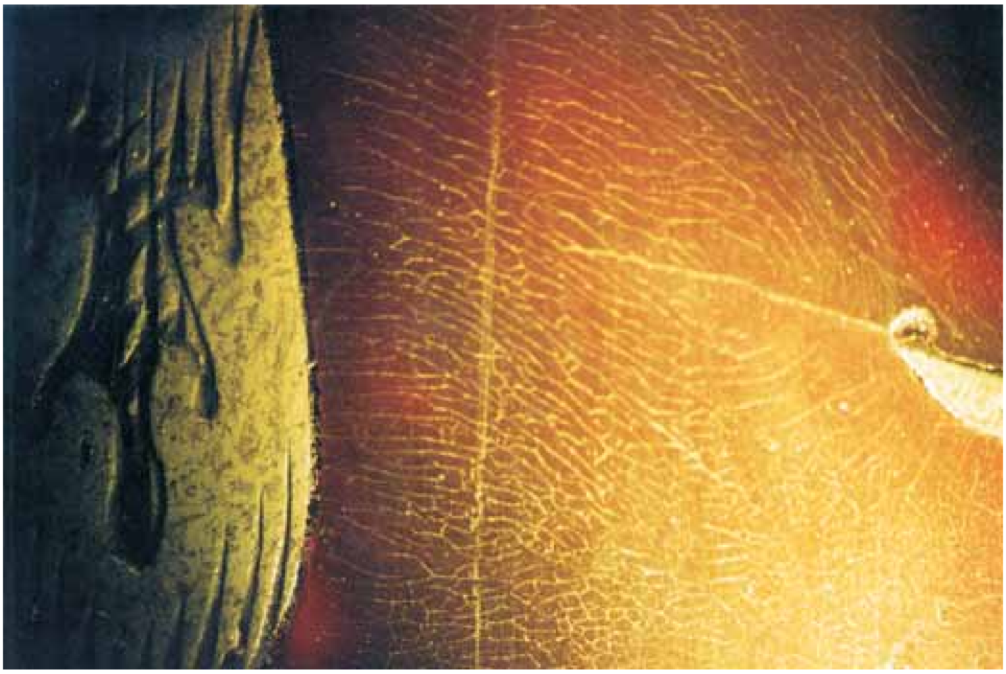

Fig. 14. Macro image of the tortoiseshell surface.

farmed green sea turtles, which has been available since the 1980s. Their shells are not the same as those of turtles living in the wild. The German custom's authority supplies tortoiseshell for educational establishments and the conservation of objects in public ownership. This means that farmed shell can often be found without its origin having been specifically declared.

All three natural types of tortoiseshell display a large variety in terms of colour and structure. Identifying one from another is made difficult by the fact that certain structures can be found in all three sorts. There are also many works of art in which two types can be found to have been used.[8] Technologically speaking, the three types differ in the fact that the shell of the hawksbill can be fused while this is not possible with the shell of the other two types in the long term.

Basing myself on the example of the cabinet, I would like to point out the common differentiations between types of shell in earlier periods. On the cabinet the shell of the hawksbill sea turtle was used in different colours. Conversations with dealers and workers of tortoiseshell in German-speaking Europe have revealed that it was common in the 20th century to classify shell according to its colour using the Roman numerals I to XII. The lowest denominators stood for dark tortoiseshell and the highest for very light, transparent shell. For shell with little structure (mottling) the add-on 'uni' was used.

In the middle of the central doors we find the use of the following colours (Fig. 10): in the centre a light tortoiseshell (XI uni), around this a darker variant (VII) and, beyond the two leafy boughs, a shell with mottling from the centre to the sides (XI). Differently aligned mottling was deliberately employed: on the four drawers to the left and right of the middle doors (Fig. 11) the long bands of mottling converge diagonally – on the left drawer in diagonal bands from the upper right to the lower left, and on the right drawer in loose diagonal stripes from the lower right to the upper left. Daniel Sommer clearly deliberately deployed pieces of different colours and with different mottled patterns.

One can further comprehend the techniques he employed by exploring how Sommer executed the transition from one sheet of tortoiseshell to the next where the surface was to be continuous. In areas of the same colour, Sommer mostly used sheets with a similar structure. The transition from one piece to the next is mostly made where there is horn or tin. In narrow straights (Fig. 12), where two sheets of tortoiseshell come up against directly one another, they are bluntly cut and abut directly with the result that the transition from one plate to the next is barely perceptible.

On the ¼ round ledge on the upper extreme of the socle, Sommer employed tortoiseshell fused lengthways (Fig. 13), which is to say pieces of tortoiseshell which run continuously between the silver mounts.

Between the tortoiseshell and the wooden support there is a layer of animal glue mixed with vermillion locked in by a layer of paper. Amazingly this layer comprises not only one sheet, but, in fact, two or six thin pieces of paper stuck together. The papers are glued to one another using an animal-based glue with filler, probably kaolin.

The surface of the tortoiseshell in this object is unusually soft when compared with the shell surfaces of many of the other objects I have treated to date. Only in a few places was the shell actually transparent. On looking through the microscope one can see a variety of damage to the surface – parallel and intertwining cracks as well as delamination (Fig. 14). These fine cracks on the surface of the shell give a mat and opaque appearance. These may also be due to the treatment of the piece with hydrochloric acid as described above. The fine cracks were closed by applying glue over them or warmly compressing them with animal glue containing two per cent ethanol, isinglass or both – both procedures brought about a good result but in different contexts. By doing this, the surfaces became more transparent.

The cabinet will be exhibited in the Bode Museum in Berlin until October 17, 2014.

I thank the following people for their assistance, support and the execution of analysis, as well as all those to whom I talked and who have helped:

- Kilian Anheuser, Musée d'art et d'histoire, Geneva
- Rolf-Dieter Blumer, Landesamt für Denkmalpflege, Esslingen
- Andres Huber, Mühltal
- Katharina Mansmann, Berne
- Elke Menzel, Hochschule der Künste, Berne
- Katharina Schmidt-Ott, Landesmuseum Zürich
- Werner Schoch, Langnau
- Julia Schultz, Hochschule für Angewandte Wissenschaft und Kunst, Hildesheim
- C. Sylvia Weber, Museum Würth, Künzelsau
- Stefan Zumbühl, Hochschule der Künste, Berne

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Notes

1 Kellermann 1988, 121–140.
2 Ibid.
3 Förderverein Künstlerfamilie Sommer E.V. 2004, 28–40.
4 Kellermann 1988, 35.
5 Cat. Frankfurt 2009, 114–119 in which only two types of tortoiseshell are listed, caretta caretta is missing. The illustration (p.114) does not show the shell of the hawksbill turtle, but rather that of the green sea turtle, i.e., the species chelonia mydas.
6 Obst 1985/1988, 25–40.
7 Tardy 1905, 117–118; Freyer 1993, 33–40; and Freyer 2007, 24–30.
8 Freyer 2011, 653–658.