

THE CONSERVATION OF SIX AMBER OBJECTS FROM THE COLLECTIONS OF THE ROYAL PALACE IN STOCKHOLM - TWO BOXES, THREE GOBLETS AND ONE TANKARD

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The Royal Collections at the Royal Palace contacted the conservation department at the National Heritage Board in December 1999 about six amber objects of art, which had been seriously damaged through accident. A colleague of mine, Ingrid Hall Roth and I were invited to look at the objects and assess the extent of the damage. After a thorough examination of the objects we decided to make an attempt to restore them.

Description of objects (before accident)

LARGE BOX (Fig. 1) No. 139. Early 18th century
Height 270 mm

This large rectangular box, is made up of thin amber pieces attached to a wooden framework, a technique called incrustation. By using amber pieces of various shades and shapes a striking mosaic has been created.

The feet are made of ivory with a carved acanthus motif.

At the very bottom of the front is a part hanging down with a female head in white amber, surrounded by shells and dolphins (Bérain-cartouche).

Views over harbours and castles delicately carved in white amber and mounted on top of shimmering brass foil are inset beneath transparent cover plates on each side of the box.

The lid is crowned by an ivory group composed of Poseidon seated in a shell drawn by two sea horses. In his left hand he holds an oval female

portrait, depicting Ulrika Eleonora the Younger, married to king Fredrik I of Sweden.

SMALL BOX (Fig. 2) No. 131. 17th century
Height 250 mm

The box has been ascribed to Georg Schreiber and once belonged to the queen dowager Hedvig Eleonora (1636- 1715) of Sweden.

It is rectangular in shape and stands on eight spherical amber feet, attached to the bottom of the box with metal pins. It consists of three storeys - a base, middle and an upper storey.

The base storey, with three small drawers next to each other, is composed of a wooden framework with thin amber pieces of various shapes and colours attached to it.

In the centre of each short side and the back long side is an inset relief in white amber mounted on black-painted mica foil and covered with a transparent amber plate.

The two upper storeys, on the other hand, are made up of pieces of amber, which have been notched together without any wooden framework.

The middle storey is decorated with small and large relief panels showing the four seasons, the four continents, antique divinities, women dressed in 17th century clothes, hunting scenes, etc. The relief panels are flanked by female herms (twelve in total, four on each long side and two on each short side).

In the bottom of the middle storey, covered by a transparent amber plate, is an inset relief carved in white amber and mounted on a black background, depicting the death of Thisbe.

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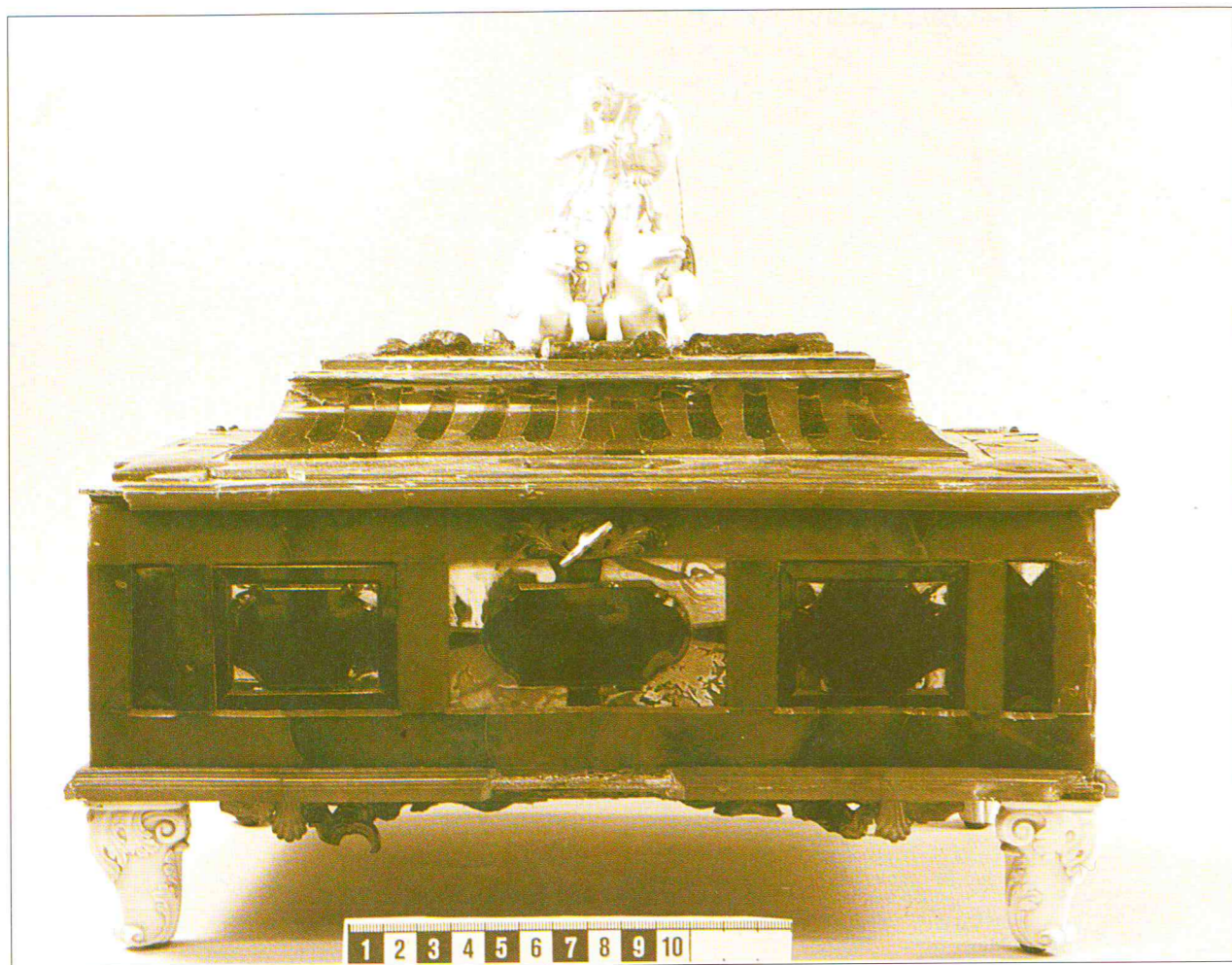


Fig.1

The base of the considerably smaller upper storey is inset in the lid of the middle storey. On the top is a crowning group of light amber, consisting of a triton seated on the back of a dolphin. All four sides are provided with relief panels, those on the long sides being flanked by putti playing different instruments. At the bottom of the upper storey is an inset relief, carved in white amber, depicting Orfeus playing music for the animals.

Both the middle and the upper storey were once lockable, but today only the fittings and the key to the upper storey remain.

GOBLET WITH LID (Fig. 3) No. 126. 17th century
Height 270 mm

Practically the whole goblet is made in dark reddish-brown amber. The upper part of the base is, however, made in yellowish-brown amber. Apart from the plates

covering the portrait relieves, the amber is opaque.

The node of the stem is folded and has the shape of an urn. Furthermore the node is decorated with small inset roundels and stars, covered by transparent amber plates. Above the node runs the inscription: VULNERE. VIRTUS. VIRESKIT. The upper part of the cup has a horizontal row of carved lion heads in various shades of yellowish-brown amber. The lower part of the cup is vertically folded. In each fold is inset a male or a female half-length portrait, carved in relief in white amber and mounted on copper foil. The portraits are covered with transparent amber plates. Three of the portraits have been identified as Henry IV of France (1553-1610), his second wife Maria of Medici and young king Louis XIII. On each side of the portraits, as well as along the edge of the base, are inset garnets and onyxes. On grounds of its figurative content the goblet was probably made in France and the inscription may well allude to the murder of Henry IV in 1610.

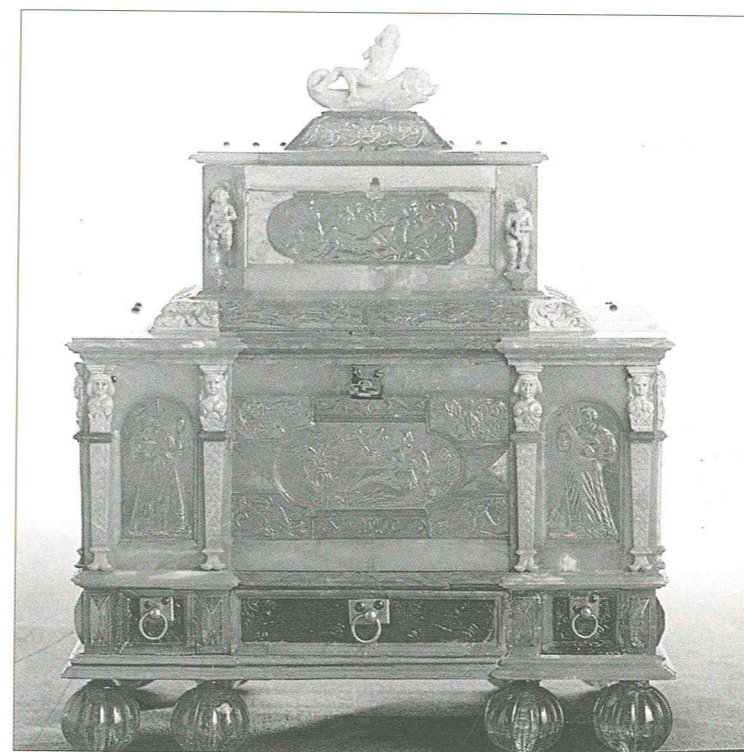


Fig.2

The edge fittings of the lid and base are made of guilt silver.

GOBLET WITH LID (Fig.4) No. 129. Height 302 mm
Ca 1625-1650

The goblet is made of alternating transparent and opaque amber. The decoration consists of tritons and grapevines, etc. in transparent amber. In the bottom of the cup is inset a relief, showing Bacchus with a goblet in his raised right hand, exquisitely carved in white amber, mounted on black-painted mica foil and covered by a transparent amber plate. Underneath the base is inset another relief in white amber with a human skull and a Latin inscription: JOHAN. KOHN. FECIT. REGIOMONTI. ("Johan Kohn made it, Königsberg")

The edge fittings of the lid, cup and base are made of guilt silver.

GOBLET WITH LID (Fig. 5) No. 280 Height 180 mm

The goblet is made of transparent to semi-transparent amber. It has a simple decoration of engraved ornate lines on the base and cup as well as on the six decorative supports just beneath the cup. The edge fittings of the base, cup and lid are made of guilt silver.



Fig.3



Fig.4

TANKARD, ORIGINALLY WITH LID (Fig. 6)
No.130. Height 100 mm. Ca 1625, probably made in Germany

The lid was missing before the accident.

The wall of the tankard is divided into ten panels with carved decoration. The large upper part of each panel show a sea-god while the small, lower parts are occupied by various fruits. Inset at the bottom of the tankard and covered by a transparent amber plate is a relief, showing a seated pair of lovers, carved in white amber and mounted on a black background. The edge fittings of the base and rim, as well as the handle, are made of guilt silver. Into the handle is inset the figure of a female herm in amber.

Authenticity and provenience

Goblet no 126 differed from the other five objects, by the unusual shade of the surface colour and in the striking difference in colour between the surface layer and the inner part of the amber. The opaque surface layer was dark reddish-brown, while the inner part contained both opaque white and transparent crystal clear areas.

It is a normal phenomenon that the surface layer of amber is darker than the core, due to oxidation, but in



Fig. 5



Fig. 6

this particular case the colour was quite unusual and none of the other five objects looked anything like it. Because of this, one small fragment from each layer was analysed by infrared spectroscopy. This showed beyond any doubt that the material really was amber and, furthermore, that the amber was of Baltic origin.

General outline of the damage

The destruction of the object was nearly total. Most of them, apart from the large box, had been more or less smashed to pieces. A commendable effort had been made to assemble the fragments into different groups, each relating to one of the original objects. In spite of this it turned out that most of the smaller pieces and fragments were totally mixed up. (Figs. 7-8)

Measures to be taken

It was quite obvious that the conservation/restoration work would have to include the following steps:

- Searching for and fitting together an innumerable amount of pieces and fragments of amber (extremely time-consuming)
- Cleaning the amber and the metal details
- Joining the pieces with a suitable adhesive
- Restoring structurally significant losses of original material with a suitable filler

Cleaning

The cleaning of the amber was carried out with deionized water, soft brushes and cotton swabs.

The cleaning of the metal details was done with a commercial silver polish.

Adhesive

Important properties:

- Reversibility

It should preferably be possible to remove the adhesive. Some adhesives are known to lose their solubility with time, due to chemical cross-linking.

- Long term stability

The adhesive should not degrade chemically or physically with time.

- Safety

The adhesive itself as well as the substance in which it is dissolved must not be harmful neither to the material it is going to be used on, nor to the person using it.

- Strength

The adhesive should have just the sufficient amount of strength. This implies that the adhesive should not be stronger than the material it is going to be used on. If, perchance, a joint should be exposed to any kind of strain or stress, it is better that the break occurs along the glue line rather than through the original material.

Since both ethanol and acetone partly dissolve amber, many of the more commonly available commercial adhesives, often containing these solvents, could not be used.

Paraloid B-72 (copolymer methylacrylate/ethylmethacrylate) is soluble not only in ethanol and acetone, but also in toluene, which has no damaging effect on amber. Toluene, however, being an organic solvent, is quite dangerous to the health and rather unpleasant to work with, since it causes headache, dizziness and nausea.

Initially we consequently tried to find an adhesive, which was soluble in a substance harmless to amber, as well as easy and safe for us to work with.

In the end we decided to use a water-soluble commercial fish glue ("High Tack Fish Glue", Lee Valley Tools Ltd) from Canada. Tests were carried out on pieces of amber, which had been purchased for this purpose. This adhesive turned out to be very easy to work with and its adhesive properties seemed, at least to start with, extremely good. Furthermore it was not too strong.

We then began gluing together some of the objects, e.g. goblet no 129. Everything seemed to proceed very well indeed, until a couple of days later, when we discovered that several joints showed signs of cracking up and falling apart. This became painfully obvious to us when we tried to stem the objects! The adhesive simply did not seem to get a proper hold of the smooth and slippery surfaces of the fractures. We also realised



Fig. 7

that the adhesive tended to shrink very much upon setting, whereby parts of the rather fragile surface layer was pulled away from the underlying material.

In order to start dissolving the adhesive on goblet no 129, the object was placed in a humidity chamber - with devastating consequences! The damp atmosphere affected the surface of the amber negatively and it became clouded. We realised that the goblet at some stage had been lacquered, something we had not been able to detect neither with the naked eye, nor under the microscope. No written record with this information existed either. The cloudiness did not disappear when the goblet was removed from the humidity chamber and left to dry. Unfortunately toluene had no effect what so ever on the disfigured surface. So, in spite of their ill-reputed effect on amber, both ethanol and acetone were tried as well. It then became evident that only acetone had the capacity to actually remove the cloudiness.

After this frightening ordeal we still had to solve the problem of finding a more suitable adhesive, and in the end we decided to "play it safe" and settled for

Paraloid B-72 in toluene. Paraloid B-72, which has been on the market for about 30 years now, is one of the most commonly used adhesives within conservation and is widely renowned for its excellent long-term stability. Furthermore it could be used as a filling material when mixed with colour pigments and a thickener such as fumed silica.

The fact that we would have to use toluene as the solvent was not ideal from a health and safety point of view. Bearing in mind, though, that we would only use relatively small amounts of toluene at a time and that our work area was provided with a fume-exhaust, we found this alternative to be the best.

Filling material

Already from the start it was obvious that a filling material would be needed to stabilise some areas, where the original amber material had been lost in the accident. An ideal filler should look like amber and, as with the adhesive, not be too strong, i.e. rather somewhat weaker than amber itself. Furthermore it should not shrink, and it should be easy and safe to work with.



Fig.8

The following materials were tested:

1. Paraloid B-72 in toluene was mixed with natural pigments and fumed silica. After setting the substance remained somewhat sticky, never dried completely, was not transparent, but had a decent lustre

2. PVA (polyvinylacetate)-emulsion, mixed with pigments and fumed silica. When setting the substance shrunk too much, it became hard and stiff and had a dull appearance.

3. A mixture of fish glue, pigments and fumed silica also shrunk too much.

4. Uncoloured silicone was mixed with pigments. The substance smelled strongly of acetic acid, but the colour was good and it was transparent. It was tested on a piece of amber, but actually adhered too well to it. Apart from that it was a bit too rubbery.

5. Experiments were made with wax mixtures of varying proportions of dammar resin, yellow beeswax and pigments:

a) 1 part of dammar resin (heated to 120° C) and 4 parts of beeswax (heated to 60° C) mixed with pigments. The substance set far too quickly and could not be worked.

b) 4 parts of dammar resin and 1 part of beeswax were mixed with pigments. This substance turned out far too sticky.

6. From an old factory, once manufacturing acetic acid, we got an old recipe for artificial amber. This was made from turpentine resin, colophony and shellac. By varying the proportions of the ingredients we managed to obtain a visually perfect end product. Unfortunately though, it set far too quickly and thus could not be worked.

7. Bonosol, "liquid plexiglass", (polymethylmethacrylate), dissolved in toluene, was mixed with polyester dye. The shrinkage of this substance upon setting was minimal, the grade of transparency could be controlled and the lustre was excellent.

Damage report and conservation procedure for each individual

LARGE BOX, no. 139. DAMAGE

This large box was not anything like as damaged as the rest of the objects. Some fragments of the amber covering the upper side of the lid, just around the ivory

crowning group, had been dislodged from the wooden support. A cartouche (partly reconstructed in a modern plastic-like material) at the lower edge of the front had been broken into pieces.

LARGE BOX, no. 139. CONSERVATION

The ivory details were cleaned with a mixture of 75% ethanol and 25% water with a small addition of ammonia.

The amber was gently wiped off using slightly water-moistened cotton buds attached to wooden sticks.

The loose fragments were glued back with Paraloid B-72 in toluene. Also the reconstructed cartouche was reassembled and glued. It had once been painted in a most peculiar shade, which did not resemble the original amber colour at all. It was consequently repainted in a more suitable colour.

SMALL BOX, no. 131. DAMAGE

The smaller of the two boxes had been exposed to a much higher degree of destruction.

The amber attachments of the feet to the bottom of the box were all broken and the inner metal pins exposed.

At the bottom storey six of the twelve rectangular faceted amber rectangles, mounted on brass foil and each of them situated just beneath a female herm in the middle storey, had been broken to pieces. The oblong panel relief at the back long side had fallen out and disintegrated. The framing as well as the support, brass foil, mica foil (analysed in Scanning Electron Microscope), the relief itself and the covering plate lay scattered in hundreds of tiny fragments all around the material.

The middle storey had suffered the most extensive damage. In most of the cases the amber panels had been forced apart along the notches. But there were also numerous breaks straight through some of the panels.

The small upper storey was actually relatively undamaged, apart from the triton in the crowning group, which had broken off at the waist. The putto to the right at the front had lost a part of his left leg (the lower part of the legs as well as the feet were missing since earlier). These broken-off pieces were fortunately quite easy to locate.

SMALL BOX, no. 131. CONSERVATION

The loose feet were stabilised by application of several layers of Paraloid B-72 around the bared metal pins.

The fragments of the six missing faceted amber pieces from beneath the female herms were eventually found and glued together. They were then glued back to their original position on the box.

As many as could be found and identified of the various elements of the dislodged relief at the back long side were eventually glued together. Some fragments were unfortunately lost forever, while some fragments simply could not be fitted together.

The framing was assembled first. It did not become complete, but there was still enough of it to support both the brass foil and the overlying black-painted mica foil. This dark surface provided the background for the small white amber relief. The motif consisted of a resting male figure with a spear leaning against his shoulder. Just above his legs a cupid with a bow could be seen and in the background a landscape with trees and buildings. Many of the fragments were the size of less than one millimetre. The head of the reclining man, which in its complete state was no more than 2x2 mm, consisted of about a dozen of fragments, which had been found after long and tedious searching in heaps of amber scraps. Apart from the difficulties in actually finding and identifying such tiny fragments, they were also extremely difficult to physically stem. It goes without saying that the microscope was the most important tool used during this stage of the work!

It was not possible to restore the whole plate covering the relief, since quite a few fragments were missing in the central part of it. This meant that the relief lay bare without any protection in this area. To solve this problem a thin piece of polyester plastic, Melinex, was cut to the same size and shape as that of the covering plate and glued to its under-side. The visible parts of the Melinex were then painted with glass paint (DEKA, Glas-und Dekorationsmalfarbe), which had been mixed to the same shade of colour as that of the covering plate.

At last all the assembled elements of the relief were to be restored to its original position at the back of the box. Then a new problem immediately arose! The relief had originally been tongue-and-grooved into position and now the tongues made it impossible to insert the relief back into the opening in the wall. Having discussed the matter with The Collections of the Royal Palace we made the decision to file off the upper tongue, which was already damaged and of which only one third remained (the lower tongue was almost complete). With a handheld high-speed rotating tool, fitted with a diamond cutting-disc, the remains of the upper tongue were removed and thus, at last, the relief could be reinserted.

In the middle storey most of the pieces were simply glued together without any problems. Several of the female herms, however, had been broken in small fragments and it took quite some time to find these among all the amber scraps.

The small upper storey had originally been tongue-and-grooved into a base at the centre of the upper side of the middle storey from which it disconnected when the accident happened. After assembling it could not be fitted into this base, since the tongue at each of the long sides prevented it. One of the tongues was therefore filed down so that the upper storey could finally be glued back into position.

GOBLET, no. 126. DAMAGE

The lid was undamaged.

The yellowish-brown upper part of the base had broken in two halves and the stem had broken off just beneath the node.

The folded lower part of the cup was broken into six fairly large and a number of smaller pieces. Here the four cover plates and the small portrait reliefs on their brass-and copper mounts had fallen out. Two of the cover plates had broken as well. The upper, smooth part of the cup had broken into six large pieces. In connection with this the six lion heads had fallen off and been partly damaged. Old photographs of the goblet actually show that the lion heads had been damaged already in the past (bits and pieces of the lower jaws and mane curls were missing).

The metal edge fitting of the cup was missing before the accident.

GOBLET, no. 126. CONSERVATION

Most of the broken parts were glued together and put back in their original position. The break through the stem, just beneath the node, could also have been just glued, but in this particular case the joint would probably not have been strong enough. One problem was, that the break went diagonally through the stem and as a result there would always be a certain strain on this area, since the two parts of the stem would not safely rest one on top of the other. They would rather tend to slide apart, especially since the fractured surfaces were very smooth and slippery (almost glass-like) and did not grip into each other well enough. Furthermore the break was exactly where it would be most natural to put your hand if you needed to lift

the goblet. After consulting The Collections of the Royal Palace we drilled a hole in each of the fractured surfaces, which were then joined with a fitted Perspex plug. We also felt that a stronger adhesive than Paraloid B-72 was needed here to enhance the stability of the joint and decided to use an epoxy adhesive instead. We chose a two-component epoxy adhesive (Araldite Standard, Casco, CIBA GEIGY). This type of adhesive is not used very often within conservation, since it is not reversible and it is also generally considered to be too strong. But this was one of the few instances where we strongly felt that the use of such an adhesive would be justified. This object would simply not survive another catastrophe!

The opaque surface layer of this goblet had an unusual dark reddish-brown colour, while the fractured surfaces revealed that the centre of the amber was very light in colour. When the fractured amber pieces were glued together, the difference in colour became far too conspicuous in areas, where the surface layer had broken off and laid the inner part bare. To eliminate this contrasting effect such areas were covered with a thin layer of adhesive (Paraloid B-72) mixed with natural colour pigments in the same shade as that of the surface. Finally the goblet was lacquered a couple of times with a 7% solution of Paraloid B-72 in toluene.

GOBLET, no. 129. DAMAGE

Apart from the stem, which was intact, the rest of the goblet was smashed to pieces. Most of the pieces belonging to it had been collected in a box, while others were scattered among the parts belonging to the other objects. The lid and the base were both in two parts. The gilt silver edge fitting of the cup had mysteriously disappeared in connection with the accident. Inside the cup, at the bottom, was a round depression (20 mm in diameter), which had held a relief, carved in white amber and mounted on black-painted mica foil with brass foil underneath and covered by a transparent amber plate. The brass foil and the mica foil were found among the collected bits and pieces. It was possible to assign them to this particular goblet, since their diameter was the same as that of the depression at the bottom of the cup. The cover plate was eventually found in many pieces. All that remained of the relief itself was a small head of a male figure. But after going through the heaps of amber scraps over and over again we managed to recover most of the small white fragments. Eventually we managed to put together a lovely scene showing a rather drunken



Fig.9

Bacchus with a goblet in his hand, reclining against a wine barrel and surrounded by lush tendrils of vine and grapes. The fine detail of the carving was exquisite, the vine tendrils being only 0.1 mm in diameter.

GOBLET, no. 129. CONSERVATION

At first the broken parts of the goblet were joined with fish glue, but after the above experience with this glue, they had to be glued a second time with Paraloid B-72 in toluene. Before all parts of the cup had been put together, the small fragments of the relief were glued together and repositioned at the bottom. The joining of the cup itself was extremely complicated, since there were no exact fits, due to severe crumbling of all edges. After several failures the cup was finally, somewhat loosely, glued together rapidly in one single moment. To retain the shape of the cup, as well as keeping the fragments in position, soft polythene foil was wrapped around it. To create an even pressure rubber bands were fixed all around

the cup on top of the polythene foil. The parts could then gently be adjusted into position. Considering the poor prospects the final result was very satisfying.

Around the glued joints were voids in need of being filled to stabilise the object. As a filling material we chose an epoxy resin (Araldite 2020) mixed with fumed silica and pigments. To make the fillings reversible the edges around the voids were brushed over with Paraloid B-72 in toluene. If needed the epoxy filling could then be removed by first dissolving the Paraloid with toluene.

The lower part of the stem was glued back into the depression in the foot base. The corresponding depression at the under-side of the cup, where the upper part of the stem should be inserted, had become too wide and shallow for a proper fit. In order not to risk the future of this object we decided once again (for the same reasons as with goblet no. 126) to use an epoxy adhesive (Araldite Standard, Casco, CIBA GEIGY) to secure the joint.

This goblet was also lacquered with 7% Paraloid B-72 in toluene.

GOBLET, no. 280. DAMAGE

The lid was in two parts.

The cup and the base were broken. The upper metal edge fitting of the cup had fallen off. Several amber plates at the base had detached from the lower metal edge fitting and only three, one original and two replacements, remained in situ. The replacements in a lighter shade of amber had been painted on the reverse side to look aged.

The cup was made up of ten sections, which had all fallen apart. The lower part of the cup was made up of five sections. At the very top of the stem, i.e. the part which would eventually constitute the inner bottom of the cup, was inset a relief, carved in white amber and covered by a transparent amber plate. Around this, as a support for the cup, were six decorative consoles, of which one was a replacement (in amber) which had been painted to look old. Four of the six consoles were broken and two had fallen off. The stem itself, with a brass pin running through the centre, was broken in not less than seven places and was extremely wobbly.

This goblet had not been lacquered.

GOBLET, no. 280. CONSERVATION

The various parts, including the lid, were glued together with Paraloid B-72 in toluene. By looking at an old photograph it was possible to put the amber plates of the base in the correct order due to the arrangement of the inscribed flowers near the edge of the base.

The base, stem and cup were glued separately. When joining the cup and the stem it turned out that two of the consoles were not in direct contact with the cup, which made the whole construction quite unstable.

Due to loss of material in the bottom of the cup and the fact that two of the consoles were not actually in direct contact with it, the joint between the cup and the stem was not stable. To improve the stability small pieces of Perspex were painted with a mixture of Bonosol and polyester dye and inserted between those two consoles and the cup. The same mixture was used to fill out the voids in the bottom of the cup.

TANKARD, no. 130. DAMAGE

The base and the bottom had become detached from its metal edge fitting. About $\frac{1}{4}$ of the main body of the tankard was intact and the rest had been broken in pieces. The guilt silver handle and upper edge fitting, as well as the brass ring just above the base,

had totally separated from the amber body of the tankard. In addition the upper metal fitting had become slightly misshapen. The female herm had detached from the handle.

TANKARD, no. 130. CONSERVATION

The piecing together of the different parts began from the bottom of the tankard and continued upwards.

The base was not wholly complete and Japanese tissue paper was glued onto the concave inside of it to help holding the pieces together. They were then inserted into the metal fitting of the base and glued with Paraloid B-72. The sections of the wall were first glued together and then glued to the base. The upper part of the wall sections did not fit into the groove of the edge fittings, which had become too narrow after having been slightly compressed at the accident. The fitting was gently widened. Since original material was missing just between the base and the wall, a filler made of Paraloid B-72 and natural colour pigment was used to fill in this space in order to improve the stability. The brass ring around the base covered most of the filled in area and made it practically invisible.

The handle was originally attached to the lower metal ring with two guilt silver pins, which had become seriously deformed and thus could not be reused. After being glued together the diameter of the amber body of the tankard had increased slightly and the pinholes at the lower part of the handle could no longer be aligned with the corresponding holes in the brass ring. Instead two U-shaped sprigs of guilt 1 mm silver thread, which could be adjusted to fit the holes in both the stem and the brass ring, were made to replace the two original pins.

Epilogue

In December 2001 the conservation of the six amber objects was finished and they were packed and returned to The Collections of the Royal Palace, accompanied by directions for their future care. Any handling of them should be kept to a minimum, but if absolutely necessary, extreme care is required! Amber is in itself a rather fragile material and in this particular case the amber has been exposed to a serious physical trauma, first being smashed to pieces and then glued together, leaving it with very little of its original strength. It has to be accepted that these objects in their present state are very unstable and must be treated accordingly. This magnificent collection fortunately managed to survive an almost

fatal catastrophe and with proper care and a bit of common sense it will still be there for future generations to enjoy and admire. (Fig. 9)