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Article: Conservation treatment considerations for and Egyptian polychrome wood coffin

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## **CONSERVATION TREATMENT CONSIDERATIONS FOR AN EGYPTIAN POLYCHROME WOOD COFFIN**

Linda S. Roundhill

### **Abstract**

This paper outlines the investigations and ultimate treatment of an ancient Egyptian polychrome wood coffin owned by the Burke Museum of Natural History and Culture (University of Washington, Seattle). Particularly of interest was discovering that the interior of the coffin appeared to have been previously treated with a carelessly applied dark orange lacquer resembling shellac. This darkened coating had obscured the painted design and it was feared that its further degradation would continue to jeopardize the remaining polychrome layers. Plans were considered for the removal of the coating, followed by the consolidation and stabilization of the coffin. After further investigation, however, it was discovered that the disfiguring resin had been applied by the coffin makers themselves, though the purpose it served remains uncertain. In conclusion, if a reasonable amount of precaution (in the form of study, careful examination and testing) had not been taken, the object's integrity would have been seriously violated. The progress of the investigation is outlined, followed by the methods eventually developed and used for the cleaning and stabilization of this object.

### **Background**

The Burke Museum of Natural History and Culture (founded in 1885) is located on the campus of the University of Washington. In 1902, a prominent Seattle banker named Manson F. Backus purchased a mummy and coffin from the National Museum of Egyptian Antiquities in Gizah, and sent them to the museum as a gift. The Ptolemaic mummy (300-30 BCE), excavated at Fayum, and the late 21<sup>st</sup>/early 22<sup>nd</sup> Dynasty (959 - 889 BCE) coffin, excavated at Thebes, became the centerpiece of the museum for many years (Fig. 1). Through time, however, the focus of the museum began to change. Eventually, Egyptian artifacts no longer fit well with the themes of a museum that was becoming more of a museum for regional natural history, and an interpretive center for the indigenous peoples of the Pacific Rim.

As a result, after being on and off display for about 80 years, the mummy and coffin were relegated to storage. In 1998, when another museum requested both items for loan, the coffin was brought to the attention of the current curatorial staff. The museum requested that the mummy and the coffin be examined to determine if they were in good enough condition for travel. After a cursory examination, both items were found to be in poor condition.



Figure 1. Mummy and coffin on display in 1940's (Photo courtesy of *Seattle Times*).

### Overall Condition

The coffin (Fig. 2) was particularly fragile. The original burial conditions had been far from ideal, as shown by erosion caused by flowing water, and dark organic stains from the slow



Figure 2. Lid of coffin, before treatment.

migration of that water (Fig. 3). The protective yellow lacquer coating on the exterior (common to 'Yellow-type' coffins that were made from the early Nineteenth to the early 22<sup>nd</sup> Dynasty; Ikram and Dodson 1998), was well preserved in some places, but degraded, blached and dull in others, and completely eroded in some areas (Fig. 4). Some of the wood used in the construction had shrunk a great deal, causing wholesale loss of the painted layers over the joints. Many years of display caused additional fading of pigments, degradation of media and damage caused by a lack of control over seasonal humidity changes (Fig. 5). It is a credit to the technology of the ancient Egyptians that the polychrome layers survived as well as they had.



Figure 3. Side of coffin, with a large crack, organic staining and incrustations.



Figure 4. Mid-section of coffin before treatment.

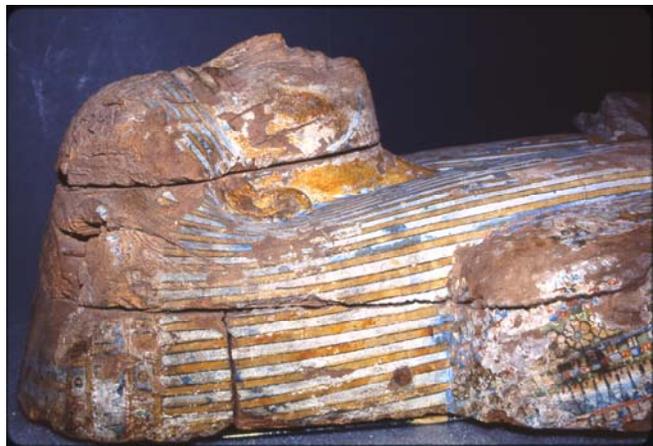


Figure 5. Detail of coffin lid, with shrunken joints, before treatment.

### Condition of Polychrome

Closer visual examination revealed cracked, cupping and flaking polychrome on upper surfaces and along the proper left side. The head area and decorative collar on the lid was also heavily damaged. The decoration technique in these areas included painting thin washes of color over a white ground, and then using an extremely thin lacquer coating over this, but also leaving unpainted and unvarnished areas of white ground (Fig. 6). Since the lacquer was thinner or absent, water action caused more erosion. There were also layers of dirt and incrustations such as mud, minerals, dust and grimy patches on the ends from handling. The interior had small piles of debris left from the disintegrating mummy that had been displayed inside it for so many years. Past treatments, recorded only by a few fortuitous surviving photographs from 1963, apparently included cleaning the interior with a whisk broom to remove all the fragments of linen, dust, and fragments of fallen polychrome that had accumulated on the inside (Fig. 7).



Figure 6. Detail of flaking polychrome paints in the area of the partially lacquered collar.



Figure 7. Interior of coffin being cleaned, ca.1963 (photographer unknown).

The painting on the interior of the coffin was very different from the exterior. Like other examples from the period, most of the exterior of the lid and trough is covered with small figures in red and dark blue on a dark yellow background (Fig 8). The overall effect is very yellow. The exceptions are the bare foot end and the decorative headdress and collar where the lacquer is very thin and also have some reserve white areas where the ground shows through. The interior, however, has brightly-colored matte paints applied over a thick, bright white ground, and not coated with the same thin yellow lacquer in evidence on the exterior (Fig. 9). The areas of

uncolored white ground are used effectively for robed figures, making them glow against a yellow ochre-colored background.



Figure 8. Coffin exterior, side.



Figure 9. Smears of dark orange resin, eg. on the right-hand figure.

### Mysterious Resinous Accretion

Unfortunately, portions of the beautiful vignettes on the interior are marred by smears of a thick, glossy resin the color of dark orange shellac. At first the smears appear to be totally random, but careful study revealed that it was placed deliberately on most of the powdery green areas, even though the application of it was sloppily done and often incomplete (Fig. 10). Sometimes, an entire brightly colored area had been coated and was now dark and streaky, but the same motif repeated on the opposite side of the coffin interior had no such treatment (Fig 11). In the same way, the coating appears randomly on only some of the red and yellow-painted areas. The appearance of it suggested that someone had tried to preserve the flaking, fragile paints with a resin that had since darkened to the orange/brown color with age.

The dark patches resembled an inept conservation treatment to such a degree that a treatment plan was formulated that included their removal, if at all possible. If the coating were left on, the continued shrinking and flaking of it would further endanger the original paint. Success was not assured. If the resin proved to be shellac, it would probably be hard to remove and might leave stains behind. However, there was a chance that the removal of the orange-brown smears would reveal the original detail and luminous colors as they were meant to be, and this seemed worth the extra time involved.

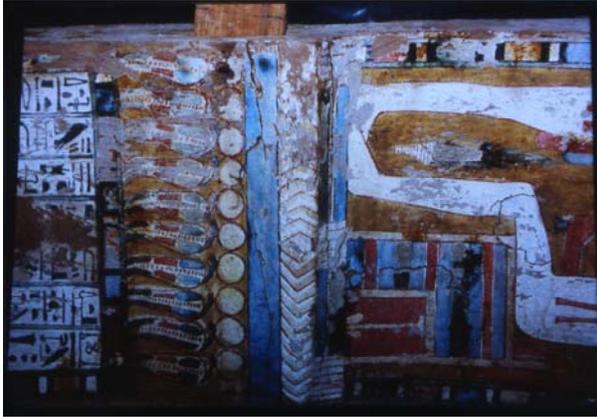


Figure 10. Band of red, white and blue cobras, center left, obscured by dark resin.



Figure 11. Band of cobras on opposite side of coffin interior, no resin coating (image reversed for comparison).

### Treatment Considerations

However, a detailed treatment plan had to wait. The funds for a lengthy, involved treatment simply did not exist. Second, there was no suitable location to do the work. The museum has no conservation lab, little extra space and the use of solvents in even small quantities is forbidden by University environmental regulations. The author's own lab was still being constructed, and it would be many months before completion. Third, a lot of research was necessary before it would be understood exactly what had happened to the coffin, and how it should be treated. Fourth, the Ptolemaic mummy was also in need of extensive investigation and research into background and possible treatment plans.

And so, vigorous fundraising efforts began, and several students and volunteers were employed cataloguing bones and doing basic research into Egyptian funerary arts. The Burke Museum also began planning for proper storage of the mummy and coffin, which meant developing a suitable storage and display case with safe environmental controls. At one point it was suggested that it might be better for the Burke Museum to give the coffin and mummy to another museum—one with extensive Egyptian collections. It was decided, however, that these items were too great a part of the tradition and history of the museum to allow de-accessioning.

### Background Research Results

Interim research provided little relevant information. Published case studies on this type of coffin were seemingly non-existent, (the article by Johnson, Head and Green was found after this work

was completed) and published catalogues mentioning this type of coffin often had small, indistinct black-and-white snapshots. Inquiries were made along the usual museum and conservation information conduits, but everyone contacted seemed to have limited experience with exactly this type of coffin. The original color of the lacquer should have been more transparent, or close to it, or it probably would not have been applied. Even so, if the lacquer inside proved to be original, what was its purpose? If the Egyptians were the authors of this disfigurement it would seem to cast doubts upon their standards of craftsmanship. These coffins were meant as serious furniture for the dead, designed to help them make the journey to the after-life, painted with prayers and incantations for the deceased. Attention to detail was the expected norm, but this lacquer was often applied sloppily and with almost no regard for the finely painted images.

There were of course, different levels of perfection in coffin manufacture. High social status usually meant the best of everything, but continuing down the social pyramid, things were a little less perfect. Additionally, by this time in the coffin-making business, motifs and scenes were becoming more stylized and mass-produced for the funerary market. While the coffins of the 21<sup>st</sup> Dynasty enjoyed a sort of renaissance of pictorial elaboration, designs tended to be generic, and only personalized in limited ways. Coffins and coffin parts were sometimes re-used to save on wood. Concurrently, somewhat less attention to detail was paid to the mummification process, with the result of more mummies decaying with time. This may account for the excessive damage and staining of the interior bottom of the coffin.

It is therefore possible that after the master coffin-painter was finished with his work on the inside, a less experienced trainee or common laborer completed the coffin in an assembly line fashion. This work may have included applying a resin as a fixative for certain colors, or to enhance or highlight certain features on the inside. There is also the possibility that this coating was meant as an aromatic unguent with religious or spiritual significance and aesthetics were not a consideration. There are several examples of coffins from this Dynastic Period where a black, bitumen-like substance was liberally applied over beautiful painted decorations, intentionally placed but without regard to the aesthetic result. These are assumed by Ikram and Dodson to imitate the style of high-status black coffins of the Eighteenth Dynasty and meant to “endow the coffins with the power of the black-fleshed King of the Dead, Osiris” (Ikram and Dodson 1998, 233). If so, then sometimes the aesthetic decorations and even the inscriptions were clearly subordinate in importance to the spiritual significance of the added layer. Obviously, one should never consider removing such a layer for the sake of our modern aesthetic preferences.

### **Detailed Investigation Results**

The search began for clues to determine whether the old resin should be removed or preserved. Eventually, a detailed examination was arranged and the evidence for and against began to accumulate. For instance, the resin was still quite soluble in alcohol, less soluble in acetone, but insoluble in water, toluene and mineral spirits. It also fluoresced under ultraviolet light in the same way as shellac, which seemed to enhance the case for a modern shellac treatment.

On the other hand, the lacquer on the exterior (which undoubtedly was original) had all the same properties mentioned above, even though it was a thin, transparent yellow. Examples of the lacquer having been applied to exposed wood, which one would expect if it had been a salvage treatment to stop flaking, were conspicuously missing. It would seem plausible, then, that both coatings were original. Judging from the dark tide-lines surrounding the area where the mummy was laid, perhaps the excessive darkening of the resin on the interior may have been due to having been enclosed with the organic vapors associated with decaying organic material. The decay was probably caused by the water seepage mentioned above, or from a failed mummification process. The latter is not common in this period, but this coffin shows some evidence of having been reused or changed at the last minute. It is also possible that a different formulation of lacquer was used.

A closer look at the interior bottom revealed a lot of the orange resin under the layers of dirt. Besides general debris there was also a thin layer of a fine alluvial mud on top, presumably from burial, which should authenticate the resin beneath it. However, the same sort of muddy accumulation was found within the drilled holes in the coffin bottom (Fig. 12). No other examples of similar holes were found in any publications, and various sources indicated that they were highly unlikely to be original. This seemed to indicate that at least some of the mud was post-excavation and could not, therefore, authenticate the resin it covered. Alas, the original assumption (that the resin was a modern treatment attempt) could not be disposed of entirely, and conflicting evidence continued to delay the treatment decision.



Figure 12. Holes drilled into bottom of the coffin along with muddy accumulation

Finally a reference to Alfred Lucas's 1927 studies of ancient Egyptian technology was found, referring apparently to the smears of resin on similar coffins of the period:

“There can be no doubt that this varnish...was originally colorless, or practically so, since there are a number of instances where a white painted surface, [which] is partly varnished and partly unvarnished,...and the edges of the varnished portions are so very irregular and unsightly that this cannot have been the original appearance...” (Lucas 1934, 357).

It would seem that this sloppy ancient technique was not only possible but normal for coffins of this type. This was eventually corroborated by Helena and Richard Jaeschke (conservators with extensive experience in the treatment of Egyptian artifacts; Jaeschke H & R 2000). Shortly after this, the gas chromatography analysis ordered by the Burke Museum finally came back. The results were negative for shellac and positive for a variety of organic compounds such as camphor and verbenone (mono-terpene ketones found in various plants, including species found in Egypt; Nicholson and Shaw 2000).

Work finally began on the coffin in August 2000. Many different samples of pigments, coatings, putties and accretions were saved for future analysis before any treatments were performed.

### **Treatment of Coffin Lid and Trough Exterior**

The coffin was first cleaned of surface debris from non-damaged areas, using cotton swabs dampened with just enough distilled water to encourage dust and powdery residues to stick to the cotton when rolled gently across the surface. Damaged areas had to be cleaned under magnification with small natural-hair brushes. Some areas could not be cleaned before consolidation as there were loose flakes of paint just resting on the surface. These had to be consolidated in place under magnification. A tiny dental instrument was used to tease the fragments into place during drying, as the application of the consolidant solution sometimes caused the fragments to move.

Many tests were performed to determine the best solvent/consolidant combination because there were several important criteria:

- the fragile paint flakes had to be re-affixed to the surface of the ground layer
- the loose and crumbling ground had to be strengthened and re-affixed to wood substrate
- the consolidant must not alter the intended appearance of the polychrome decorations
- the treatment had to at least offer the hope of reversibility, so only resins that had proven longevity and that remained soluble in non-damaging solvents were considered.

The lacquer coating was generally water resistant, but wherever it was degraded or missing the red and yellow paints used on the exterior of this coffin were quickly affected by water, with some loss of pigment. As a result, consolidants that are only reversible in water had to be eliminated from consideration. Alcohol and acetone were not appropriate solvents because of the solubility of the original yellow lacquer, and the blues and green paints began to crumble and dissolve in acetone, suggestive of a resin binder. Other solvents were tested, but only toluene, and xylene had no negative effect on any of the original coffin materials. It was eventually decided that the fragile paint layers should be consolidated on the exterior with Acryloid B-72

(70/30 ethyl methacrylate/methyl acrylate copolymer) in xylene. Various concentrations were tried, but only those ranging from 15% to 20% weight/volume had any stabilizing effect on the paint flakes.

The exterior was coated with 20% B-72 w/v in xylene, applied by brush. If, after drying, more consolidant was necessary, an additional coat was applied. The resin solution was absorbed quickly and deeply, seeming to penetrate all the way down to the wood substrate. The only visible color changes occurred in the degraded areas. Where the lacquer was well-preserved, the consolidation appeared to cause no visible change, except a slight increase in gloss, which was corrected by swabbing afterward with toluene. Where the lacquer had become white and opaque and the colors had become faded and tonally bleached, the consolidation restored the colors and resin transparency to that approaching the undamaged areas (Fig. 13). Exposed wood did darken as a result of the consolidation, but since the wood would not have been seen originally and was only exposed as a result of damage, this color change was not considered problematic.



Figure 13. Side of coffin lid, after treatment.

Large fragments of paint and gesso separating from the wood substrate were stabilized using 40% B-72 in toluene to which was added about the same volume glass micro-spheres. Dry powder earth pigments were added to match the color of the wood. Enough solvent was added to aid mixing and flow. This fill mixture was then injected between the flake and the wood through 24g Teflon needle attached to a 5 ml syringe.

### **Treatment of the Trough Rim**

The flat rim of the trough upon which the lid sits has a very thin wash of lacquer on top of an extremely thin layer of yellow-painted gesso. The lacquer had become fragmentary and brittle in

places, and tiny cupped fragments of lacquer and the underlying paint were easily dislodged by incidental contact. Simple consolidation helped but did not prove to lend enough mechanical stability to allow treatment of the interior of the trough to proceed. It was found that a combination treatment worked well, and this was extended for use on some of the interior surfaces as well. First, the entire rim was consolidated by saturation with 5% Acryloid B-72 in toluene. This acted as a waterproofing layer as well as a toughening treatment for the powdery gesso and paint. After drying, all the tiny lifting flakes were further fastened down by running a solution of Primal WS-24 acrylic colloidal dispersion (diluted 1:2 with distilled water) under each from the tip of a small brush. When touched to the edge of a flake it ran under it but the water was not absorbed because of the B-72 pre-treatment. Then, as the bead of resin slowly dried, it formed a bridge between the flake and the wood. Primal WS-24 dries clear and can be reversed in toluene in the same way as B-72.

### **Treatment of Trough Interior**

The interior required a different approach. Not only was the painting technique entirely different but the sheer amount of accumulated soil and debris made treatment much more difficult. Consolidation with concentrations of B-72 greater than 2.5% tended to darken the colors unacceptably. The trough bottom had a very thick lacquer layer in places. It also contained a great deal of debris which included fallen paint flakes, soil, dust and deteriorated linen fragments (left from when the mummy had been displayed inside the coffin). This debris was removed after two preliminary steps. First, a search was made for fragments of wood or painted gesso that could either be reattached or saved for analysis. Second, very soft camel-hair brushes were used to both clean off paint remains and to corral the debris onto areas of bare wood, avoiding areas where there were loose paint flakes. On well-preserved areas, stiffer natural bristle brushes could be used to clean off soil and debris. A vacuum was then used to suck out the debris through a rubber latex tube.

The remaining muddy soil (source unknown) was removed where possible using damp swabs as described above. Next, all the painted areas were consolidated with 2.5% Acryloid B-72 in toluene using a 1/4" natural bristle brush.

The complex paint layers on the interior that were lifting or needed more consolidation were treated individually, depending upon whether there was also ancient lacquer present or not. If original resin was present, more concentrated solutions of B-72 (approaching 20%) were used if necessary. Injections of the B-72 putty described above were employed where large fragments were detaching, and the technique developed for the fragile rim paint was used when required.

Beneath the soil on the interior bottom were several areas of very thick, hard mineral incrustations over the painted designs. In some places, the paint was protected by well-preserved original resin and the incrustation had formed on top. A small sample of the incrustation was removed with a scalpel and mixed with a solution of hydrochloric acid to test for carbonates, but there was no reaction at all. A larger sample was removed for future analysis, and then a glass bristle brush (0.5 cm wide) was used to reduce the heavy incrustation down until it became translucent enough to discern the painted details beneath, but not far enough to abrade the

original lacquer. A 20% solution of B-72 in xylene was then applied to help restore the transparency of the lacquer. This minimized the effect of the incrustation and helped to reveal some previously obscured details (Fig. 14).



Figure 14. Coffin trough interior, after treatment.

### Structural Stabilization

It was expected that a certain amount of wood joint stabilization would be necessary, but multiple forms of manual testing proved that the main joints of the coffin were all surprisingly tight. Some surface splitting and detached fragments were mended or stabilized with B-72 used as an adhesive, or with the B-72 putty described above. All mends to wooden parts were performed after first sealing the surfaces with 10% B-72 in acetone.

### Comments

No loss compensation was attempted at this time.

An excellent display/storage case for the mummy and coffin was designed and constructed by Snow and Company of Seattle, WA, with guidance from the museum staff and utilizing conservation principles. The coffin environment is now controlled by a CICU Air-safe System (developed by NoUVIR Research) to minimize damage due to humidity changes and control air quality. Lighting is provided by fiber optics to minimize light damage while still providing enough light to allow the interior to be studied.

The occupant of the coffin (whereabouts unknown) was later identified as “(something illegible) Khonsu” by the inscription on the exterior, proper right side, at the waist. The time period was further narrowed to the Reign of Osorkin the First, 924-889 BCE, and the type declared to be Yellow-type YV (Dodson 2002).

The stabilization treatment was successful and subsequent regular examinations have discovered no new damage, even during and after a loan period to another museum.

### **Conclusion**

It is hoped this candid account of an error averted may help other conservators facing a similar crisis of decision. The temptation to clean off all disfiguring accretions for the sake of aesthetics must be resisted until decisions concerning irreversible procedures can be made with confidence.

### **Acknowledgements**

The author would like to thank Laura Phillips and the staff of the Burke Museum Archaeology Department for their hard work, continuing dedication to the proper conservation of their collections and their patience during the long treatment process. Thanks also go to the late Frany Backus, granddaughter-in-law of Manson Backus, and her friends who raised money for this project in her name.

### **Suppliers**

Acryloid B-72, dry pigments, glass microspheres:  
Conservator's Emporium, Reno, NV ([www.consemp.com](http://www.consemp.com))

CICU Air-safe System:  
NoUVIR Research, Seaford, Delaware ([www.nouvir.com](http://www.nouvir.com))

Glass-bristle brush:  
Original source discontinued, similar items found at Earnest Miner, Ouaquaga, NY,  
([www.hailcesare.com](http://www.hailcesare.com))

Primal WS24, Conservation Resources, Inc., ([www.conservationresources.com](http://www.conservationresources.com)).

Teflon needle and syringes:  
Small Parts, Inc., Miami Lakes, FL ([www.smallparts.com](http://www.smallparts.com))

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