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AN OVERVIEW OF LOSS COMPENSATION IN THE ATHENIAN AGORA

Alice Boccia Paterakis

Abstract

A series of case studies are presented which exemplify decisions regarding the compensation of artifacts from the Agora Excavations in antiquity and in modern times. The artifacts represent utilitarian, votive, military, honorary and architectural functions and include 5th and 4th c. B.C. bronze statuary and a bronze shield, a 4th c. B.C. ceramic water clock (klepsydra), a marble ionic capital from the 2nd c. B.C. Stoa of Attalos, the marble stage facade from the 1st c. B.C. Odeion of Agrippa, a Roman ivory statuette of Apollo, 5th c. B.C. red figure kraters, Hellenistic and Byzantine ceramics, and human skulls from various periods. The decisions regarding the type and extent of compensation are shown to be influenced by numerous factors which include 1) the uniqueness and degree of preservation of the artifact, 2) the availability of physical and literary evidence to support the compensation, and 3) the destination and function of the object after treatment.

I. Introduction

A number of artifacts in the collection of the Athenian Agora have been chosen which exemplify various approaches to loss compensation. In the discussion of materials for compensation are included adhesives, consolidants, lacquers and inpainting media. Unfortunately individual treatment records were not kept from 1931, the beginning of the excavation by the American School of Classical Studies, until 1979, when the conservation laboratory was established by Koob. Fortunately, however, the published archaeological record of a few of these objects included conservation information. Also, a few old notes discovered in the files regarding conservation materials have contributed significantly to this article. The following factors which have influenced the decision for and extent of compensation are 1) the uniqueness and degree of preservation of the artifact, 2) physical and literary evidence to support the compensation, and 3) the destination and function of the object after treatment.

II. Case Studies

II.A. Copper Alloy Objects

II.A.1. Nike Head (acc. no. B30)

A bronze head of Nike represents a unique ancient example of compensation for loss. A 5th c.
B.C. copper alloy head of Nike, the winged goddess of victory, was recovered from a well in 1932 and was cleaned by prolonged soaking in water followed by electrochemical cleaning in zinc and sodium hydroxide (Shear 1933). This head was originally gilded by the foil gilding method in which sheets of gold were attached using grooves cut into the surface of the statue (Thompson 1940, Paterakis 1995, Paterakis 1998) (Figure 1). The gold reserves of the Athenian state were stored and displayed on Nike sculptures in this manner in the 5th and 4th centuries B.C. on the Acropolis. The sculptural detail and refinement of the bronze surface suggest that the statue was intended to be presentable to the public with or without its gold (Shear 1973). Two sets of grooves in the surface suggest that the head was covered with gold at two different times. The first set was carved after casting in inconspicuous places in order not to interfere with the aesthetic appearance of the head without gold. It is believed that the statue was stripped of its gold in the crisis of 406 B.C. to contribute gold to the needs of the state. After stripping most of the grooves were disguised by filling them with bronze (Figure 2). A bronze was chosen similar in color to the head which was hammered, carved and polished to render it indistinguishable. In 336 B.C. gifts made to Athens by Alexander the Great may have enabled the second gilding, traces of which remain today. Instead of reusing the grooves for the second gilding, new grooves were carved in more conspicuous places.

II.A.2. Copper alloy sword (acc. no. B1382)

A copper alloy sword was found in two pieces in a well in 1971 (Shear 1973). Although there are no conservation records from the first intervention, a recent treatment revealed that the sword had been doweled and filled around the dowel with a polyester resin paste and fiberglass strands. This paste was probably made from an unidentified polyester resin, which was marketed as a 'stone cement', to which a filler, metal powder and pigment had been added. In the recent intervention to combat bronze disease the sword was immersed for several months in a 3% solution of BTA in ethanol. This softened the fill which was then removed mechanically exposing more bronze disease (Figure 3).

The earliest reference found by the author to the use of polyester resin putty for gap-filling bronze is a 1961 article by Organ (Organ 1961). This was followed by articles dealing with polyester resin and fiberglass sheets for the repair of bronze by France-Lanord in 1969 (France-Lanord 1969) and Lane in 1974 (Lane 1974). Polyester resin putty manufactured by the Plastic Padding company of the U.K. have been used by conservators in the U.K. since the early 1970's for gap-filling copper alloy objects. The Plastic Padding putty is styrenated polyester resin with a benzoyl peroxide catalyst. The only written reference found by the author for this material is a British Museum report from 1992 (Shashoua 1992).

Once the sword was stabilized it was necessary to fill the join for strength and for display in the museum. The successful use of polyester resins on copper alloys over the last 20 odd years and the strength demonstrated by the first fill were deciding factors in the choice of the two-part
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polyester resin putty, "Chemical Metal", manufactured by Plastic Padding Ltd. in the U.K. The surface of the metal was lacquered with Incralac prior to filling with 'Chemical Metal'. One side of the gap was moulded with dental wax which reduced the extent of mechanical finishing using a scalpel, metal files, a Dremel Moto Tool, and fine grade sandpaper moistened with ethanol. The fill was painted with Rowney Cryla colors (Figure 4).

II.A.3. Bronze Shield (acc. no. B262)

A bronze shield was recovered in 1936 which has been identified as one of those captured by the Athenians from the Spartans in 425 B.C. at the battle of Pylos (Shear 1937) (Figure 5). The bronze was reported to be extensively corroded preserving little metal. After removing most of the overlying earth it was coated with paraffin wax to provide support for lifting, a technique mentioned by Lucas in his 1932 volume entitled *Antiques: Their Restoration and Preservation*. (Lucas 1932). After removing the paraffin wax the pieces were chemically cleaned. The fragmentary condition of the shield was supported by a backing of bleached beeswax into which each fragment of the shield was set. The gaps in the shield were integrated by painting the beeswax (Figure 6).

Waxes and copper alloys

Beeswax and paraffin wax have been used extensively in the past for consolidation, compensation, mending and lacquering of copper alloy objects and other materials in the Agora. Lucas recommends these waxes for the consolidation of copper alloys after cleaning (Lucas 1932). Severe corrosion of copper caused by the acids in beeswax is evident in several objects (Paterakis 1996). The acids produce metal soaps containing copper ions which can increase the rate and degree of corrosion (Burmester and Koller 1987). The mineralized state of the Agora shield may account for its relatively stable condition embedded in beeswax. Paraffin wax may be distinguished from beeswax in the Agora by its lower melting temperature of 50 to 54 degrees Celsius. Molten paraffin wax was used for coating metal objects as described by Plenderleith in his 1934 volume entitled *The Preservation of Antiquities* (Plenderleith 1934).

Resins and copper alloys

Unidentified lacquers which have remained soluble in acetone or ethanol have been applied to many copper alloy objects. The following commercial synthetic resins documented in our files may have been used: Unichrome A-140, Maranyl, vinyl acetate, Celluloid, Vinylite or Alvar. Unichrome A-140 was probably a polyvinyl acetate manufactured by the Metal & Thermit Corporation in New York city in the 1950's. It is still soluble today in acetone. Maranyl soluble nylon, manufactured by Imperial Chemical Industries Ltd. of London, was reportedly used as a
5% solution in ethanol to lacquer objects in the 1970's; it is still soluble in ethanol. A few references to an unspecified vinyl acetate, used as a 5% solution, are mentioned in the files. Vinyl acetates were popular as consolidants for fossils in the 1920's and 1930's in the U.S.A. and the U.K. (Howie 1984). It is not clear in all cases whether vinyl acetate refers to the monomer or polymer. According to Howie, polymerization of the vinyl acetate monomer occurred in the object, presumably producing a low molecular weight polyvinyl acetate. Notes from the 1940's in the Agora mention the use of Vinylite, a polyvinyl acetate resin manufactured by the Bakelite Company, for the lacquering and consolidation of artifacts, in particular ivory.

II.B. Ivory and Bone

II.B.1. Ivory Statuette (acc. no. BI236)

More than 200 fragments of an ivory statuette were recovered from a well in 1936 (Shear 1937) (Figure 7). This 30 cm high Roman statue has been identified as a replica of the statue of Apollo Lykeios attributed to Praxiteles. Conservation treatment began in 1936 by drying the fragments slowly to prevent splitting. They were cleaned with alcohol and consolidated with a solution of 'Celluloid' in amyl acetate and acetone. Cellulose nitrate was produced by the Celluloid Manufacturing Company in the U.S.A. beginning in 1872, and their product name 'Celluloid' became the generic name for cellulose nitrate around the world. An Agora recipe calls for 2 grams of Celluloid in the form of Leica film strips to be dissolved in acetone and amyl acetate forming a 2% weight to volume solution. A British Museum report of 1926 (British Museum 1926) and Lucas (Lucas 1932) recommend a 1% Celluloid solution in equal volumes of acetone and amyl acetate for the consolidation of ivory using Celluloid from motorcar side screens! Lucas discourages the use of photographic film since the gelatin coating must first be removed and since the film may be contaminated with the reagents used for developing. The Agora recipe must predate the Second World War since Leica film was no longer made from cellulose nitrate after the war. A celluloid solution was also used for reconstruction of the statue. Lucas (Lucas 1932) recommends sealing the edges with Celluloid before joining them with Celluloid. Apparently Plenderleith's 1934 volume was not consulted for the treatment of the Apollo statue in which he states that cellulose nitrate adhesive should not be used on ivory, presumably on account of its acidity. Instead, Plenderleith recommends a 15% solution of vinyl acetate in toluene for mending ivory. The statue was gap-filled with bleached beeswax as recommended by Plenderleith (Plenderleith 1934) (Figure 8).

The use of cellulose nitrate as an adhesive has been the subject of debate over the past two decades. Koob in a 1982 publication states that acid impurities from the nitrification process during manufacture accelerate the hydrolysis of the cellulose nitrate and contribute to its instability (Koob 1982). The literature states that this acidity may also damage ivory and lead. In spite of these negative characteristics, the Apollo statue displays sound joins and solid beeswax fills, and the ivory appears in good condition. Shashoua after testing artificially and naturally aged cellulose...
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nitrate determined that the HMG brand adhesive may have a lifetime up to 100 years (Shashoua et. al. 1992). The museum case displaying the Apollo statue was severely jarred in the early 1980’s knocking the statue loose from the base along the cellulose nitrate join under the feet. Fortunately the adhesive proved to be weaker than the ivory.

In stark contrast to cellulose nitrate is shellac, which was used extensively on many materials in the Agora between the years 1931 to 1978 (Figure 9). Shellac is difficult to reverse and is often stronger than the material it joins. Extensive damage has occurred to the joined edges of ceramic, stone and other materials as a result of the detachment of the fabric by the shellac! If Lucas’s suggestion to seal the edges with Celluloid before mending had been followed, the shellac joins might have resulted in less destruction and easier reversibility (Lucas 1932). Cellulose nitrate has been used in the Agora from the early days. The first adhesive brand used was Duco Cement, followed later by UHU Hart and HMG. Today the two adhesives used most frequently in the Agora are HMG cellulose nitrate and HMG Paraloid B72. Paraloid B72 was used as an adhesive prior to its manufacture by the HMG Company (Koob 1986). The use of Paraloid B72 is avoided in the hottest months when the temperature in the laboratory reaches its Tg of 40 degrees Celsius! HMG cellulose nitrate, with a Tg of 100 degrees Celsius, is often substituted in these cases. Paraloid B48N is also used occasionally.

II.B.2. Human Skulls (acc. nos. AA25, AA82, AA143, AA147A)

Human skeletons were treated by the physical anthropologist, Angel, in the Agora from 1939 to 1970. We know from publications in the 1940’s that he impregnated skulls with a 35% solution of Alvar 2½/70 in acetone and that he reconstructed skulls using Alvar 7/70 and celluloid (Angel 1943, Angel 1945). Angel also used metal wires, sheets of Alvar, plasticine and plaster for reconstruction of the skulls. Some of these joins had sagged due to the low Tg of the resins used. Attempts to reverse the adhesives used by Angel on four human skulls in the Agora proved for the most part successful using acetone, ethanol or toluene.

II.C. Stone

II.C.1. Marble Ionic capital (acc. no. A2073)

One of the original marble Ionic capitals from the Stoa of Attalos dating to the 2nd c. B.C. was partially restored in plaster from many fragments (Travlos 1971) (Figure 10). The reconstruction was used as a model to carve the new capitals during the reconstruction of the Stoa of Attalos in the 1950’s (Figure 11).
II.C.2. Stage Front of Concert Hall (Odeion) of Agrippa (acc. nos. A586, A1174, S553, S554, S558, S1391)

A section of the stage front from the auditorium of the concert hall of Agrippa, dating to 15 B.C., was originally faced with a marble screen panelled with herm statues (Thompson 1950). The reconstruction of the panelled stage front was made in 1949 and is on display to the public in the lower colonnade of the Stoa of Attalos. Although no records have been found of the materials used, cement is apparent on the face where panels are missing. Rather than replacing these panels with new marble, the surface of the cement has been painted to imitate marble veining (Figure 12).

II.D. Ceramics

II.D.1. Clepsydra (acc. no. P2084)

In 1933 fragments of a ceramic clepsydra, or waterclock, were found in a well of 400 B.C. context (Young 1939). Water clocks were commonly used in the Athenian law courts in the 5th and 4th centuries B.C. to time the length of speeches. In the 1930's the clepsydra was mended with shellac and restored in painted plaster. The complete reconstruction of the waterclock was required to determine its capacity and the duration of the water flow (Figure 13).

In the following four ceramic objects (II.D.2-5) a fine grade dental plaster was used for reconstruction. The edges of the plaster fills were incised to facilitate sealing and inpainting. Paraloid B72 was used to seal the edges of the vessels before mending and filling and to seal the surface of the plaster fills before inpainting with Rowney Cryla colors.

II.D.2 Black Glazed Hellenistic Skyphos (acc. no. P31796)

This black glazed skyphos is an example of complete structural reconstruction carried out in 1990 (Rotroff 1997, no. 161). Double-sided dental wax moulds were used to cast missing areas. A template and circumference chart proved to be very useful during the reconstruction of the body and rim. Silaplast, an elastomeric impression material with silicone base, was used to cast the handle which was adhered with Paraloid B72. The two floating sherds were inserted into the plaster fill (Figure 14). All surfaces of the ceramic were protected with a layer of Clear Plastico no. 10, a latex masking fluid, prior to inpainting by airbrushing.

II.D.3. Red glazed Hellenistic Amphora (acc. no. P31964)

The scholar who published this piece requested a reconstruction of the profile for photography
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and publication in 1991 (Rotroff 1997, no. 444). Since a large amount of the vessel was missing a total reconstruction was not considered necessary. The pot was mended with UHU Hart cellulose nitrate adhesive. Discs the size of the original circumference at the shoulder and rim, which were supported on a central stand in the amphora, were used as a guide during the reconstruction. Reconstruction was made by moulding with dental wax and Silaplast (Figure 15).

II.D.4. Red Figure Bell Krater (acc. no. P30019)

This 5th c. B.C. krater, excavated in 1972, is an example of partial reconstruction for the presentation of the figurative sherds (Rotroff and Oakley 1992, no. 48). Paraloid B72 adhesive was used in the reconstruction. A circumference chart was used as a guide during the assembly of the rim. Use of a template during the reconstruction showed the pot to have an assymetrical profile. Since the entire foot was lost its replacement was not considered feasible; the krater was instead given a flat resting surface in plaster. The fills were inpainted by brushing (Figure 16). The scholar who published this piece determined the placement of the figurative sherds. Too much was missing to consider a pictorial integration of the figurative sherds. A middle grey tone was chosen for the inpainting since it distinguishes the filled areas from the existing sherds and from the light background in black and white photo reproduction. Since the krater was not destined for display in the museum but rather for storage in the study collection the filled areas were not repainted a more harmonious color.

II.D.5. Red Figure Column Krater (acc. no. P30197)

This red figure column krater had been mended with shellac, a polyester resin 'stone cement' with fiberglass and an epoxy adhesive and completely restored in painted plaster after its excavation in 1972. The rim had been drilled and doweled with nails and adhered with the polyester resin. No records were kept of this intervention. Since a correct alignment of the pieces had not been achieved, damage caused by an earthquake in 1981 afforded the opportunity for the krater's reconstruction by Koob. After taking down the first restoration and removing all forms of adhesive, plaster and paint using ethanol, acetone and methylene chloride, the 140 krater pieces were desalinated and reconstructed with Duco Cement. All areas to be filled were moulded with plasticine. Sections of the base, neck and rim and the handles were restored using detachable plaster fills, a technique published by Koob in 1987 (Koob 1987) (Figure 17). Once completed, 3 more sherds were found belonging to the krater which were keyed into cutouts in the plaster. The degree of painted integration which delineates the figures was determined by the Director of the Agora Excavations who wished to display the krater in the Museum (Figure 18). The scholar who published this piece considered this painted intervention excessive (Rotroff and Oakley 1992, no. 71).
II.D.6. Glazed Byzantine Bowl with Salt Efflorescence (acc. no. P9602)

A Byzantine bowl displayed extensive contamination by soluble salts which had crystallized lifting the glaze off the surface (Frantz 1938) (Figure 19). Since this bowl had been extensively restored in plaster in the 1930’s its desalination was problematic (Figure 20). Conservation treatment of this bowl was undertaken by Stamm (Stamm 1997). The uplifted glaze was lowered into position onto the surface by dissolving the underlying salt crystals with the application of ethanol as a wetting agent followed by a 2.5% (vol/vol) concentration of Primal WS24. The glaze was subsequently consolidated with 3% and 5% (wt/vol) solutions of Paraloid B72 in ethanol:acetone (7:3). The paint coating the plaster fills was removed and the plaster consolidated with several coats of 3% and 5% Paraloid B72 to protect it from dissolution and to prevent its migration into the ceramic fabric during desalination. If the paint coating the plaster is intact and water resistant, it could serve to protect the plaster during immersion. The goal was to remove the salts without dissolving the plaster. The solubility of plaster in water is minimal, approximately 2 grams per liter. During desalination by immersion, the minimum quantity of water possible should be used to minimize dissolution of the plaster. Once the saturation point of the plaster has been reached with an ionic conductivity of approximately 450 μmhos (μsiemens) (20° to 25° Celsius), the vessel may remain immersed until maximum ionic concentration of the salts is reached. It was found that consolidation of the plaster with a 3% solution followed by a 5% solution of Paraloid B72 prior to immersion protected it against softening but not against dissolution.

III. Conclusion

Those conservation materials and methods recorded in the Agora prior to 1979 were based largely on the publications of Lucas (Lucas 1932) and Plenderleith (Plenderleith 1934). For many applications locally available materials were used whereas polymers such as Maranyl, Vinylite, Unichrome and Alvar were imported. These resins and waxes served multiple uses as adhesives, consolidants, lacquers and fill materials. Although the old notations are few and don't identify objects with treatments, they are invaluable for the diagnosis of the present condition of the artifacts and for their retreatment. The factors which have influenced compensation decisions in the Agora over the last 65 years are, for the most part, unchanged. Two basic trends distinguish the approach to compensation today from the earlier years and these are the rules of reversibility and minimal intervention. In the early years the concept of reversibility existed but was not a principal consideration. Notes dating from 1951, which refer to adhesives and consolidants as 'cements', state that "the nature of the cement and of the solvent used is of less importance, in our experience, than is the method of application." (Anonymous 1951). Since the establishment of the conservation laboratory in 1979 the rule of reversibility has been respected and the principle of minimal intervention guides all phases of conservation, including compensation.
References


Frantz, M.A. 1938. Middle Byzantine pottery in Athens. *Hesperia* VII. 429-467 (452, fig.13).


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**Manufacturers of Materials**

Alvar (polyvinyl acetal; 1940's): Shawinigan Products Corporation, Shawinigan Falls, Canada.


Clear Plastico no. 10 (latex masking fluid; 1980's): California [Author was unable to identify the manufacturer of this material]

Dental Wax: Anutex, Toughened Pink Dental Modelling Wax, Associated Dental Products Ltd., Purton, Swindon SN5 9HT, U.K.

Dremel Moto Tool: Dremel, Division of Emerson Electric Co., 4915 21st Street, Racine, Wisconsin 53406.


Harbutt's plasticine: Peter Pan Playthings Ltd., Bretton Way, Bretton, Peterborough PE3 8YA, U.K.

HMG cellulose nitrate adhesive, HMG Paraloid B72 Adhesive: H. Marcel Guest Ltd. Collyhurst Road, Riverside Works, Manchester M10 7RU, U.K.

Maranyl (soluble nylon; 1970's): Imperial Chemical Industries Ltd., Millbank, London SW1, U.K.

Paraloid B72, B48N and Primal WS24: Rohm and Haas Ltd., Lennig House, Masons Avenue, Croydon, Surrey CR9 3NB, U.K.

Rowney Cryla (Artists' Acrylic Colour): Daler Rowney, Bracknell, Berkshire, U.K.

Silaplast (elastomeric impression material, silicone base): Detax, Karl Huber GmbH & Co., KG D-7500 Karlsruhe 1, Germany.
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UHU Hart (cellulose nitrate adhesive): UHU GmbH, 77813 Buhl, Germany.

Unichrome Lacquer A-140 (polyvinyl acetate; 1956): Metal & Thermit Corporation, 100 East 42nd St., New York 17, New York.


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Figure 1. Nike head (B30) after cleaning, showing grooves for foil gilding.

Figure 2. Rear of Nike head (B30) with grooves filled in antiquity with copper alloy.
Figure 3. Sword (B1382) joined before recent filling.

Figure 4. Sword (B1382) after recent filling and inpainting.
Figure 5. Shield (B262) as discovered in 1936.

Figure 6. Shield (B262) after filling with beeswax and inpainting.
Figure 7. Ivory Apollo statuette (B1236) prior to reconstruction in 1936.

Figure 8. Ivory Apollo statuette (B1236) after reconstruction with cellulose nitrate and gap filling with beeswax.
Figure 9. Pot mended in the early days of the Agora Excavations using shellac.
Figure 10. Marble capital (A2073) from the Stoa of Attalos after reconstruction with plaster.

Figure 11. Replicas of marble capital (A2073) used in the 1950's reconstruction of the Stoa of Attalos.
Figure 12. Marble stage front of Odeion concert hall (A586, A1174, S553, S554, S558, S1391) after reconstruction with cement.
Figure 13. Reconstructed water clock (P2084) in action.

Figure 14. Black glazed Hellenistic skyphos (P31796) during reconstruction with plaster.
Figure 15. Red glazed Hellenistic amphora (P31964) reconstructed with plaster before inpainting.

Figure 16. 5th c. B.C. red figure bell krater (P30019) after reconstruction with plaster and inpainting.
Figure 17. 5th c. B.C. red figure column krater (P30197) after reconstruction with plaster.

Figure 18. 5th c. B.C. red figure column krater (P30197) after inpainting.
Figure 19. Byzantine bowl (P9602) with glaze dislodged by salt crystals.

Figure 20. Glazed Byzantine bowl P9602 with extensive plaster fills during treatment.