Article: An unexpected surface: Research and treatment of a 19th century mounted oyster shell by Froment-Meurice
Author: Emily Brown
Source: *Objects Specialty Group Postprints, Volume Twenty-Three, 2016*
Pages: 199-220
Editors: Emily Hamilton and Kari Dodson, with Laura Lipcsei, Christine Storti, and Leslie Friedman, Program Chairs
ISSN (print version) 2169-379X
ISSN (online version) 2169-1290
© 2018 by The American Institute for Conservation of Historic & Artistic Works
727 15th Street NW, Suite 500, Washington, DC 20005 (202) 452-9545
www.conservation-us.org

Objects Specialty Group Postprints is published annually by the Objects Specialty Group (OSG) of the American Institute for Conservation of Historic & Artistic Works (AIC). It is a conference proceedings volume consisting of papers presented in the OSG sessions at AIC Annual Meetings.

Under a licensing agreement, individual authors retain copyright to their work and extend publications rights to the American Institute for Conservation.

This article is published in the *Objects Specialty Group Postprints, Volume Twenty-Three, 2016*. It has been edited for clarity and content. The article was peer-reviewed by content area specialists and was revised based on this anonymous review. Responsibility for the methods and materials described herein, however, rests solely with the author(s), whose article should not be considered an official statement of the OSG or the AIC.

AN UNEXPECTED SURFACE: RESEARCH AND TREATMENT OF A 19TH CENTURY MOUNTED OYSTER SHELL BY FROMENT-MEURICE

EMILY BROWN

An oyster shell set into a delicate gold, silver, and gilt-silver metal mount belonging to the Walters Art Museum required treatment. Made in the late 1870s in Paris by the celebrated goldsmith firm Froment-Meurice, the object was damaged and heavily tarnished. Analytical testing and literature research indicated that the silver components might, in part, contain an originally applied patination layer (oxidized silver or *argent noir*). Since intentionally patinated silver surfaces are rare in museum collections and literature resources are scarce, it was decided not to polish the silver components, while the object would be cleaned overall and tarnish reduced only on the gilt-silver and gold components. After careful testing, an acidified thiourea solution made with sulfuric acid and gelled with xanthan gum was used to reduce the tarnish on the delicate gold and gilt-silver components. The formulation of the gel allowed for an extremely controlled application, and treatment resulted in a bright, shiny surface for the gilt-silver and gold metal, which required no additional buffing or polishing. The intent of this article is twofold: first, it will present current research, resources, and further avenues to investigate oxidized silver within the context of the Froment-Meurice workshop; second, it will describe an efficient, controlled method to chemically reduce tarnish on delicate gold and gilt-silver surfaces.

KEYWORDS: Froment-Meurice, Gold, Gilt-silver, Silver, Oyster shell, Pearl, Oxidized silver, *Argent noir*, Patina, Tresors D'Argent, Tarnish removal, Thiourea, Xanthan gum gel

1. INTRODUCTION

An oyster shell set into a delicate gold, silver, and gilt-silver metal mount was tarnished and damaged, requiring treatment (fig. 1). Attributed to the celebrated Parisian goldsmith Émile Froment-Meurice, the object belongs to the Walters Art Museum (WAM) in Baltimore, Maryland. William Walters, a successful and wealthy Baltimore businessman, acquired the piece through his Paris art dealer George Lucas, who paid a sum of money to the Froment-Meurice firm on November 7, 1878 (Briggs 2015). This purchase likely includes this object and may have included several other objects owned by William Walters. In a contemporary description of items in the Walters collection, the author mentions a "handsome private table service," as well as a mounted oyster shell "from Meurice" sitting in the parlor of the Walters' townhome:

> [A] charming conceit in gold and silver, representing two little boys attempting to pry open a huge pearl oyster, which is supported by two gilt mermaids, and sprigs of seaweed in gold are seen lying in the polished interior of the shell. (Lamb 1892, 256)

Much of the history of usage, care and handling, display, and storage of the oyster shell is undocumented and was unknown until the 1970s. One historic image exists of the oyster shell with another similar object (fig. 2). This photograph was likely captured in the mid- to late 1930s, around the time the Walters collection was being cataloged for the establishment of a public museum, then named the Walters Art Gallery. Based on the object's undamaged appearance in this image, it was damaged after this date—how it was damaged is unknown. What *is* known is that after this time, the object was stored in a room lined with rubber floor mats. Over many years, these mats generated hydrogen sulfide pollutant gas, which hastened tarnishing of the silver objects stored in the room, including the mounted oyster shell—a fact well known to current WAM staff (Craft 2015).

During the examination and literature research phase of this project, I came across Judy Rudoe's 1993 paper describing the popularity of patinated silver in France beginning in the mid-19th century, and its use by Froment-Meurice. For objects with this decorative finish, a chemical solution is applied to the surface to intentionally create an artificial, dark tarnish, often referred to as oxidized or colored silver,

Fig. 1. Émile Froment-Meurice, *Two Putti Discover a Pearl in Oyster*, ca. 1878, oyster shell, pearl, silver, gold, gilt-silver, 21.9 × 16.3 × 15.25 cm, Walters Art Museum, #57.1015 (Courtesy of the Walters Art Museum)

Fig. 2. Object on left: same as figure 1; object on right: artist, title, date, and materials unknown, 6.7 × 6 cm, Walters Art Museum, #57.1017 (Courtesy of the Walters Art Museum)

French gray, or *argent noir* (darkened silver) (Selwyn 2004). This information, combined with observations made during examination and limited analytical investigation, led me to believe that a portion of the silver components on the Walters mounted shell may have been given an intentionally patinated surface at some point in its history.

This project was not intended to be a technical study; however, the possibility of the object having an originally patinated surface was intriguing enough to warrant my continued interest and further investigation. With the time and resources available, I was not able to find or examine works with an oxidized silver surface, nor was I able to locate published photographic examples of these surfaces. Research indicates that the existence of these types of surface finishes are rare in museum collections; thus, my colleagues and I decided and that a conservative treatment approach was most appropriate to preserve any remnants of original finish for potential future analysis.

2. THE GOLDSMITH FIRM FROMENT-MEURICE

The goldsmith firm Froment-Meurice was founded in the early 19th century by François-Désiré (F.D.) Froment-Meurice and was continued after his death in 1855 by his son Émile (Marchessaeu 2003). F.D. created many elaborate silver, gilt-silver, and gold pieces enhanced with enamels and jewels in the Neogothic and Neorenaissance style. Among his most known works is the toilet set of the Duchess of Parma, which was displayed in the Great Exhibition of 1851 in Hyde Park, London, and is now in the collection of the Musée d'Orsay. Many published sources, both in French and English translations, describe the works of Froment-Meurice under F.D.'s direction, such as world exhibition catalogs and his biography penned by Philippe Burty. It is through these resources that Rudoe gleans information about F.D.'s use of oxidized silver in his designs and the materials he may have used to produce them.

F.D. passed away in 1855, just as he brought his firm into international renown. At the time of his death, Émile was 18 years old and apprenticed in the firm's workshop located at 372 rue Saint-Honoré, Paris. He did not take direct lead until 1859. Until about 1865, works created by Froment-Meurice follow in the stylistic tradition of F.D.

Émile retained the international renown established by his father and continued to create sumptuous pieces for royalty, foreign heads of state, the Church, and wealthy patrons. Under his direction, the firm became the official goldsmith for the City of Paris. He is known for creating a three-tiered papal crown for Pope Leo XIII commemorating his golden jubilee of priesthood in 1888, and exhibiting in the 1865 and 1867 international expositions. Unfortunately, company documents no longer exist. According to Briggs (2015), they were destroyed by fire, perhaps caused by the collapse of Émile's house at 49 rue d'Anjou on April 25, 1913 (*New York Times* 1913). Tragically, Émile and his wife, Rose-Félicie-Berthe Thomas de Montcourt, were killed. The *New York Times* reported on April 26, 1913, that the two were dining with their grandson François when the house collapsed into a 20-ft. excavation adjoining the property. Rescuers located the victims in the rubble by following the cries of François, who miraculously survived with only a few bruises.

2.1 FROMENT-MEURICE AND OXIDIZED SILVER

In Napoleonic Era France and England, there was a resurgence of gilding as a means of promoting the wealth and aura of the newly burgeoning Neoclassic French Empire. Pre-existing works in silver were typically gilt overall by means of mercury fire gilding. However, by the 1840s, electroplating technology was patented and became widely utilized in the goldsmith industry as a safer, less expensive alternative (Vitali 1997). Rudoe (1993) writes that in 1840s France, it was fashionable to create antiqued or oxidized silver surfaces by way of intentionally darkening or coloring the surface using chemical means, and that F.D. employed this technique for his works:

> Froment-Meurice's biographer, Phillipe Burty, described several oxidized items and noted that the writer, Eugéne Sue, who commissioned several pieces of silversmith's work from Froment-Meurice, discussed with the artist which parts were to be in *argent noir* [black silver]. In one of his letters to Froment-Meurice, Sue even requested, "a small bottle of liquid to blacken the bright silver" (Burty 1883 p.23). (Rudoe 1993, 162)

Two examples of jewelry pieces with surviving oxidized surfaces attributed to F.D. exist in the collection of the British Museum, notably a necklace (accession #1978, 1002.725) and a finger ring (accession #AF.2578). Froment-Meurice and many of his contemporary metal artisans were able to create stunning works that utilized the combination of bright gold and silver against darkened silver surfaces. Oftentimes these objects would contain other materials such as enamels, jewels, and ivory, resulting in richly textured and complex surfaces.

2.2 TRESORS D'ARGENT

A more recent publication can now be added alongside Rudoe's research—the 2003 French catalog *Tresors D'Argent [Silver Treasures] Les Froment-Meurice*, authored by Daniel Marchessaeu. This catalog accompanied an exhibition at the Musée de la Vie Romantique [The Museum of Romantic Life] in Paris, from February 4 through June 15, 2003, and contains many examples of the firm's work under the direction of both F.D. and Émile.

In general, the catalog text is art historical in nature rather than technical (Pouliot 2015; Quandt 2015). Works represent the artistic grandeur the firm is known for—exquisite objects in silver, gilt-silver, and gold combined with glass, enamels, jewels, and figured stone. Also apparent among the selection are objects with combination of bright silver and gold metal paired with dark metal surfaces, or dark stone and black enamel. Many of the material descriptions in the catalog for these objects are simply "argent" or "silver," even when the accompanying image displays a uniform, homogeneous dark surface appearance. One such example is *Presse-papiers commandes par la duc d'Aumale*, which is described as "Porphyre, argent, or, ivorie, email et aquarelle sur ivorie," or "Porphyry [rock], silver, gold, ivory, enamel and watercolor on ivory," seen in figure 3 (Marchessaeu 2003,154, 208).

However, *Lyre d'argent a la memoire de Victor Hugo*, dated 1885, is described as "argent, argent oxyde, tôle peinte," or "silver, silver oxide, painted sheet metal" (Marchessaeu 2003, 206), indicating that the silver is in part intentionally patinated to appear dark. As can be seen in figure 4, the silver surfaces appear very dark overall, which makes it difficult to draw conclusions about the care and treatment the object received, or how the current appearance relates to its manufacture, or history of display and use.

The most remarkable works in the catalog are two objects and one drawing that bear a striking resemblance to WAM 57.1015: one extremely similar mounted oyster shell (private collection) (fig. 5), a smaller silver object (private collection) (fig. 6), and a contemporary design drawing dated 1878 (collection of Patrimonio Nacional, Madrid) (fig. 7).

When compared to WAM 57.1015 in figure 1, figures 5 and 6 display bright gold and silver surfaces, which may lead the viewer to believe that the mounted oyster shell in the Walters collection was intended to have a similar appearance. However, it is important to note that both *Coquille d'huître* and *Coupe couquille*, as well as *Presse-papiers commandes* (see fig. 3), belong to private collections where their history and care is unknown and that objects of this type were not mass produced but made for clients to their individual liking.

2.3 FROMENT-MEURICE IN AMERICAN COLLECTIONS

Although most of the work by Froment-Meurice is housed in European collections, pieces do exist in American museums, albeit in limited numbers. Examples include *Jewel Casket* at the Los Angeles County Museum of Art (accession #M2005.174a–b) and *Centerpiece* at the Philadelphia Museum of Art

Fig. 3. Émile Froment-Meurice, *Presse-papiers commandes par la duc d'Aumale*, 1886–1888, materials unknown, 21 × 23 × 12 cm, Private collection (Courtesy of Marchessaeu 2003, 154)

(accession #1980-41-1), and a very intriguing silver and gold shield made around 1881, which was designed by Gustave Doré.

Commissioned by the government of Argentina, this shield was presented to US Ambassador Thomas O. Osborn to commemorate his assistance negotiating the boundary between Argentina and Chile. It is listed in the 1907 catalog of the Art Institute of Chicago (AIC) under inventory #1451. The catalog describes the object as "An elliptical shield of oxidized silver, with borders and divisions between panels in gold and enamel," and "On a scroll is an inscription in Spanish dated Buenos Ayres, July 13, 1881. The

Fig. 4. Émile Froment-Meurice, *Lyre d'argent a la memoire de Victor Hugo*, 1885, argent, argent oxyde, tôle peinte [silver, silver oxide, painted sheet metal]. Maison de Victor Hugo, Paris, inv. #1004 (Courtesy of Marchessaeu 2003, 206)

Fig. 5. Émile Froment-Meurice, *Coquille d'huître*, ca. 1880, coquille d'huître, perle, argent de argent doré, dans son écrin d'origine gainé de cuir rouge [shell, pearl, silver and silver gilt, in its original case of red leather], 20.5 × 13 cm, Private collection (Courtesy of Marchessaeu 2003, 20, 212)

Fig. 6. Émile Froment-Meurice, *Coupe couquille*, ca. 1880, argent, socle de marbe rouge [silver, pedestal of red marble], 14.4 × 15.7 × 14.3 cm, Private collection (Courtesy of Marchessaeu 2003, 113, 213)

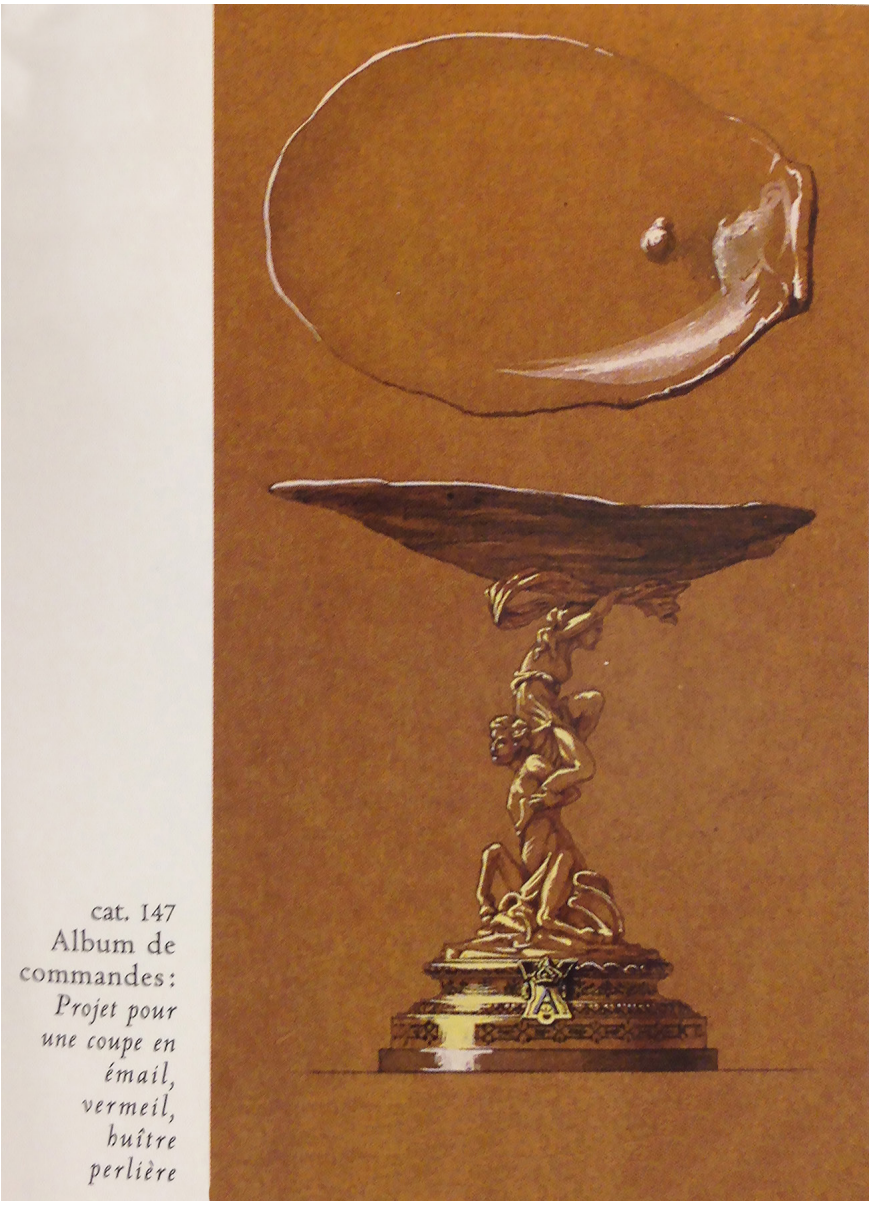

Fig. 7. Anonymous, *Projet pour une coupe in émail, vermeil, huître, perliére*, 1878, Patrimonio Nacional, Madrid (Courtesy of Marchessaeu 2003, 85, 220)

substance of this inscription is given in English above" (Art Institute of Chicago 1907, 324). In 1907, the shield was listed as being on loan from Thomas O. Osborn, although evidence suggests that the shield was at one point in the collection of the Chicago History Museum (Clark 1935). A short article and image of this object is found in the December 5, 1894, issue of the journal *The Jewelers' Circular and Horological Review* (fig. 8). Along with the commemorative lyre to Victor Hugo, this may be further evidence that Froment-Meurice was producing silver objects with oxidized finishes in the late 19th century, and therefore it is possible that the Walters mounted oyster shell may contain such a surface.

2.4 CHEMICALS USED TO COLOR SILVER IN THE 19TH CENTURY

Rudoe's 1993 article refers to several sulfide-containing chemical compounds used by arts-and-crafts silversmith Henry Wilson in 1903 to color silver: barium sulfide, ammonium sulfide, and

Fig. 8. Artist unknown, *Shield Presented to Thomas O. Osborn, U.S. Minister, by the Argentine Republic*, ca. 1881; collection, materials, and measurements unknown (Courtesy of *The Jewelers' Circular and Horological Review Vol. XXIX* [No. 19] 1894)

potassium sulfide. Additionally, Drayman-Weisser (1984) writes in her technical study of an archaeological silver kanthros of the late 19th century Parisian restorer Leon André, who would "antique" archaeological silver objects using silver chloride after the removal of corrosion products.

During my consultation with Drayman-Weisser (2015), she noted that a lavender color, which is visible on the head of the detached Froment-Meurice putto (see section 3.2.1), looked very similar to a color found on the kanthros. She believes that this color is a by-product of the silver chloride restoration treatment that may have been carried out by André's workshop in the late 19th or early 20th century. XRF analysis was unable to detect chlorine at the time of her study, as it was not within the detection range of the instrument. Since the kanthros is in the study collection of the WAM, the author was able to visually examine the object to compare the surface appearance and color—the two lavender colors were indeed strikingly similar.

3. *TWO PUTTI DISCOVER PEARL IN OYSTER* BY ÉMILE FROMENT-MEURICE

3.1 DESCRIPTION

The object (see fig. 1) depicts two putti playfully discovering a pearl inside an open oyster shell set into and supported by two decorative nets of seaweed—a clasp and a false hinge. In the bottom half of the shell, an irregular natural pearl is set in a carved cavity. The shell, putti, and seaweed are held aloft by a merman and mermaid, who have intertwined fish tails that gracefully extend into the waves of the sea that form the foot. This decorative stem is mechanically attached with a metal screw and nut to the round base. Two small maker's marks on the outside of the round base—a boar's head and the initials F.M., and an ear of wheat in a lozenge—attribute the piece to Froment-Meurice (Briggs 2015). XRF analysis determined that the two putti are composed of a silver-copper alloy containing a trace amount of iron, the seaweed clasp and hinge from a gold-silver alloy, the decorative stem from a silver-copper alloy, and the round base of a silver-copper alloy with a gold-enriched surface (Gates 2015; Matsen 2015).

The decorative stem and putti are likely lost wax cast and finished by chasing with tools to add fine surface details. The gold seaweed clasp and false hinge appear to be made by a variety of techniques, including casting, stamping, hand forming, granulation, and finishing with fine tools, where all pieces are soldered together. In addition, a white metal is visible in places on the interior of the false hinge. The hinge may therefore be composed of at least two different metal alloys, where all parts are soldered together and then electroplated with gold to give the surface a uniform color and appearance.

The seaweed clasping the bottom half of the shell is soldered to the two outstretched hands of the merman and mermaid of the decorative stem, which is made from several cast and chased pieces soldered together. The gilt-silver base appears to be either lost wax cast or stamped, and likely gilt by way of electroplating.

The putti, shell, and seaweed were originally attached together mechanically by means of small metal pins on the metal pieces, which were inserted into corresponding holes in the shell. Interestingly, x-ray radiography shows that the pearl, originally adhered into the cavity in the bottom half of shell, contains a small hole drilled through its length. Considering that it does not appear to mount the pearl in the shell, it is possible that the pearl was repurposed from a piece of jewelry.

3.2 CONDITION AND EXAMINATION

Prior to treatment, this inherently fragile object was in poor condition overall. It was damaged and in five separate pieces: the top half of the oyster shell, the natural pearl, the seaweed hinge, and one putti were all detached from the decorative stem and bottom half of the oyster shell (see fig. 1). Surface dirt and grime was evident overall. Two different types of adhesive residues from possibly two prior campaigns of repair were also evident on several areas of the shell and metal components. The false hinge was bent out of its original alignment and could no longer attach properly or support the top half of the shell. Both halves of the shell were also very fragile and exhibited weakening of the layered structure at the edges, which was prone to delamination, flaking, and breaking.-

The metal surfaces displayed a variety of tarnish and corrosion phenomena (fig. 9). Specifically, the silver surfaces on the putti and decorative stem exhibited extreme darkening from what appeared to be silver tarnishing, but a close microscopic examination revealed a complex surface appearance. Overall, these surfaces exhibited a homogenous shiny, steel-grey color with a subtle purple-blue iridescence. A matte black, powdery corrosion product appeared to sit on top of this color and in some places was visible underneath and creeping out over the adhesive. Also visible under the adhesive were areas of bright silver, which would indicate a "clean" or polished surface.

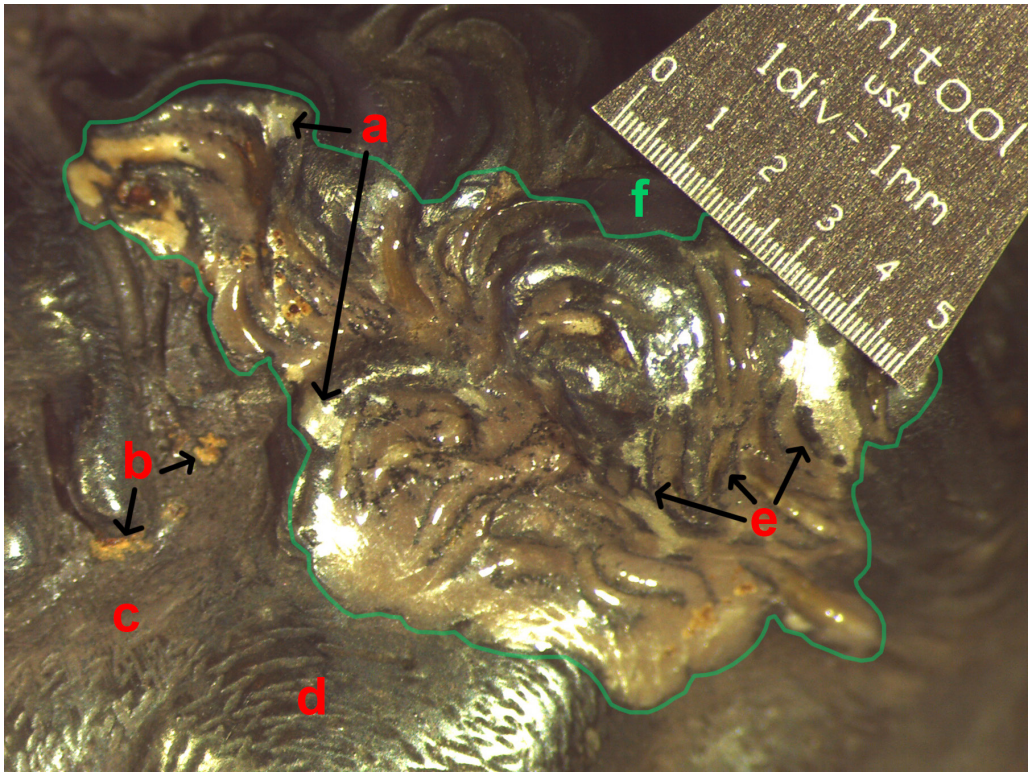

Fig. 9. Head of putto in area partially covered with aged adhesive. a: shiny silver; b: iron corrosion; c: matte lavender color; d: steel-gray color; e: matte black powder. Image captured using a Leica IC80 digital camera with LED illumination. (Courtesy of the author)

In addition to this a matte, lavender color was visible in the recesses of the design on the two putti, as were local spots of iron corrosion. The lavender color, most visible in the hair and back of the neck, is consistent with the appearance of halide corrosion seen on archaeological silver objects (Craft 2015; Lauffenburger 2015; Selwyn 2004), and very similar to the lavender seen on the silver kanthros mentioned in section 2.4. As the kanthros is in the study collection of the WAM, I was able to examine the object as a comparison—the two lavender colors were strikingly similar. This color was not seen on the decorative stem of the oyster shell; instead, the recesses of the stem were brighter—more of the appearance of polished silver. There was no evidence of an overall protective coating, although the object was probably exposed to household cleaning products during the course of its history as a decorative object in the Walters' parlor. Objects conservation staff with long-standing knowledge of both the collection and the history of cleaning products used in the past thought that a product that could impart a lavender-colored residue would not have been used on this object, as it was purchased by William Walters soon after its manufacture and has little conservation or display history.

The gold surfaces of the seaweed net also displayed heavy accumulations of black tarnish and powdery black material rather than the steel-gray color seen on the putti and decorative stem. High points appeared brighter, as did the outside of the hinge, which was likely protected from air and pollutants due to lying on that surface during storage. In some places, particularly parts of the underside of the clasp and inner area of the hinge, bright gold was visible through a covering of aged adhesive. The gilt-silver surface of the round base displayed uneven and blotchy tarnish on both the top and underside, where fingerprints were visible. The surfaces of the top of the base and bottom of the foot, which were protected from atmospheric pollutants, were bright metal with very little darkening. These areas, which have been protected from tarnishing, heavily suggest the gold and gilt surfaces were originally intended to appear as

bright gold. Literature resources discussed in section 2.1 also support the conclusion that bright gold surfaces were intended and sought after to portray the rich opulence of these types of decorative objects.

3.2.1 XRF Analysis and Interpretation

Due to time constraints and the treatment-focused nature of this project, in-depth technical analysis of all aspects of the corrosion products observed was not undertaken. Again, conclusions as to the nature and cause of the blackened surfaces rely heavily on the extensive experience the Walters conservation staff has with the collection and its conservation history. Limited XRF analysis was undertaken to explore the composition of the alloys and surface tarnish associated with the silver components with WAM conservation scientist Dr. Glenn Gates, as well as with conservation scientist Catherine Matsen in the Scientific Research and Analysis Lab at Winterthur Museum. The geometry of the object in relation to instruments used in both institutions prevented the analysis of key areas of interest, including the recess of the decorative stem.

Sulfur was detected on all metal components analyzed, including the gold seaweed net, clasp, round gilt base, and foot of the decorative stem. Both the putti and decorative stem were composed of a silver-copper alloy; however, iron was also detected in the alloy of both putti, which corresponds to the appearance of iron corrosion on both parts. Chlorine was also detected on the head of the detached putto, with a higher response rate associated with the lavender color visible in the recesses (Gates 2015). As mentioned in section 2.4, the 19th century Parisian restorer Leon André would use silver chloride to intentionally antique silver, and therefore an argument could be made that a chloride-containing solution was used to patinate the surface of the putto. Conversely, chlorine could also be present as a result of handling. Given the fact that the putto was detached from the object for so long, it is entirely likely that it was handled more frequently than other components.

4. DEVELOPING A TREATMENT RATIONALE

This project was undertaken with the consultation of WAM conservation staff members Meg Craft, Julie Lauffenburger, and Terry Drayman-Weisser; conservation scientist Dr. Glenn Gates; and Jo Briggs, curator of 18th and 19th Century Art. Many goals of the overall treatment were clear: clean the surfaces by removing dirt and grime, and repair the object, making it whole. It was also clear from observation and literature resources that the gold and gilt surfaces exhibited tarnish rather than an intentional coloring and should be cleaned to reveal a bright, shiny gold surface.

As described previously, the nature of the silver surfaces was less clear. The stratigraphy was complex, inhibiting an understanding of how the surfaces may have been originally prepared, and cleaned or polished in the past. Literature and analytical research previously described cast a note of caution for the wholesale removal of tarnish. Rudoe documents F.D.'s use of oxidized silver and the popularity of the fashion in Western goldsmith arts until World War I; however, there is no literature reference yet found as to whether Émile employed the technique for this work apart from descriptions found in *Tresors D'Argent* and the 1907 catalog of the Art Institute of Chicago. It is also apparent that there is a scarcity of published literature about the use of oxidized silver from an art historical or technical perspective, as well as from the conservation treatment or investigation viewpoint.

Given the rarity of known oxidized surfaces produced in the 19th century in museum collections, I deemed it prudent that a conservative approach be taken in the treatment of the silver surfaces of the mounted oyster shell. We decided that the best approach would be to clean the object overall to remove accumulated dirt, grime, and adhesive residues, but to only remove tarnish on the gold and gilt-silver metal components. Gold seaweed components would be reshaped and the pieces reassembled. This course of treatment would make the object whole again and restore a brighter, well cared for appearance

in keeping with 19th century aesthetics of shiny gold surfaces contrasted with matte black as is evident in literature research while preserving options for future treatment and analysis.

4.1 CLEANING TESTS

Cleaning tests using cotton swabs with solvents and mild abrasives on the metal surfaces, as well as the shell and pearl, were conducted. Dirt and grime were effectively removed with 1:1 deionized water:ethanol, and the adhesives were removed with the 1:1 mixture or acetone. In general, mild abrasives caused a lightening of the steel-gray color on the decorative stem, but they did not generally affect the lavender color of the putto as readily. Unfortunately, areas of tarnish cleaned on the gilt-silver base were patchy and uneven using mild abrasives.

5. TREATMENT

5.1 SURFACE CLEANING AND CONSOLIDATION

Treatment began with surface cleaning to remove dirt and grime from the metal and shell components using swabs made with low-lint cotton (Webril Wipes) dampened with a combination of 1:1 deionized water:ethanol, or dilute Triton XL-80N in deionized water, which was cleared with 1:1 deionized water:ethanol and 1:1 acetone:ethanol. Aged adhesive was removed or reduced with either deionized water or acetone where possible. In some cases, complete removal from the object would place too much strain on delicate forms. Once the surface was cleaned, flaking areas of shell were consolidated on the surface using dilute Paraloid B-72 in acetone.

5.2 TARNISH REDUCTION USING ACIDIFIED THIOUREA

Acidified thiourea chemically dissolves silver sulfide tarnish, and complexes with and sequesters the free silver ions, resulting in the removal of tarnish from the surface (Selwyn 2004). In current conservation practice, thiourea is seldom used on silver objects due to side effects observed to adversely affect the surface, namely overcleaning, etching, forming unknown surface complexes, and increasing the rate of retarnishing, as well as health hazards to the user (Contreras-Vargas, Ruvalcaba-Sil, and Rodríguez-Gómez 2013). A recent study (van Santen 2014) corroborates these observations. Instead, mildly abrasive materials such as calcium carbonate and alpha alumina are widely used to polish silver.

However, in the case of the mounted oyster shell, it was determined that cleaning with abrasive materials would remove an unacceptable amount of original material from the gilt-silver surfaces, as well as place undue mechanical stress on the intricate and delicate seaweed forms. With these physical limitations, thiourea remains the best nonabrasive treatment option for objects of this type. After careful testing and consultation with Richard Wolbers, I decided to use a gelled solution of acidified thiourea to chemically reduce tarnish on the gold and gilt-silver components. This would achieve optimum physical control over application and contact time. A solution of thiourea and sulfuric acid was gelled with xanthan gum using the following recipe derived from one commonly used at WAM, gelled with xanthan gum (Wolbers 2015):

- 2 g xanthan gum
- 100 mL deionized water
- 5 mL concentrated sulfuric acid
- 8 g thiourea

The gel was made first by adding the xanthan gum to the water, letting it sit overnight, then adding the sulfuric acid and thiourea to the gel after it formed. Different acids may be used to acidify the

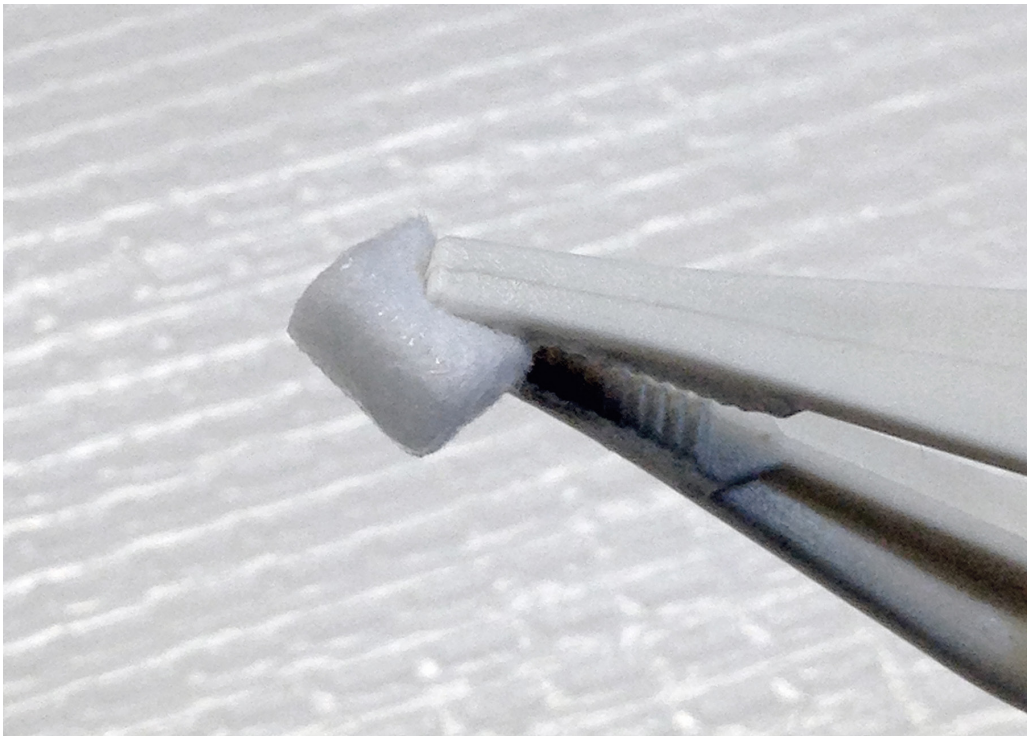

Fig. 10. Small cotton pads held with plastic tweezers to reduce risk of abrading the surface (Courtesy of the author)

thiourea, including hydrochloric, formic, and phosphoric acids (van Santen 2014). In this case, sulfuric acid is used to allow for quick action of the gel, which decreases dwell time, and thus time allowing thiourea to complex with the surface (Drayman-Weisser 2015).

In general, the thiourea gel was applied with a dry cotton pad, swab, or small brush, then rinsed several times with deionized water delivered with a cotton pad, swab, low-lint tissue (Kimwipe), or bristle brush. Areas were then dried with a Kimwipe and 1:1 acetone:ethanol. Specific application methods for the various components are as follows.

Gilt-silver base: Thiourea gel was used to reduce tarnish by applying in small amounts on cotton pads held with plastic tweezers (fig. 10). The gel was gently manipulated for up to 10 seconds before removing with a dry cotton pad, then immediately cleared and rinsed twice with small cotton pads wetted with deionized water and dried with Kimwipe tissue. A 1:1 acetone:ethanol mixture was applied to drive water off the surface. The clearance solvent was observed to remove an additional layer of grime or possibly a previous protective coating. Overall, the surface was treated with three applications of the gel, with two additional applications in areas of heavy tarnish (figs. 11, 12). Application areas did not exceed approximately 1 x 1 cm, which allowed for quick application, removal, and rinsing in under 20 seconds per application.

Seaweed hinge: Tarnish was reduced on the gold hinge by applying small amounts of gel with a small sable brush or a rolled cotton swab. Like the round base, the gel was gently manipulated for up to 10 seconds before removing with a dry brush or swab and rinsing with deionized water. Depending on the location, rinsing was done with a wetted swab, a larger round bristle brush or large sable brush, a wetted Kimwipe, or a wetted cotton pad. Brushes were very effective in cleaning the delicate, curving surface, and often the surface was rinsed and dried by placing a Kimwipe over the area and then gently tamping with a wet bristle brush (fig. 13). This pushed the wipe into the recesses of the form and removed the remaining gel. Dry bristle brushes were used to dry and buff the cleaned area, and aided with removing loose tarnish.

Fig. 11. During tarnish removal of the gilt-silver base (Courtesy of the author)

Fig. 12. During tarnish removal of the gilt-silver base, showing two small maker's marks (Courtesy of the author)

Fig. 13. Rinsing the gel using a Kimwipe and bristle brush wetted with deionized water (Courtesy of the author)

Fig. 14. Using a ring stand to hold the mounted shell upside down during treatment (Courtesy of the author)

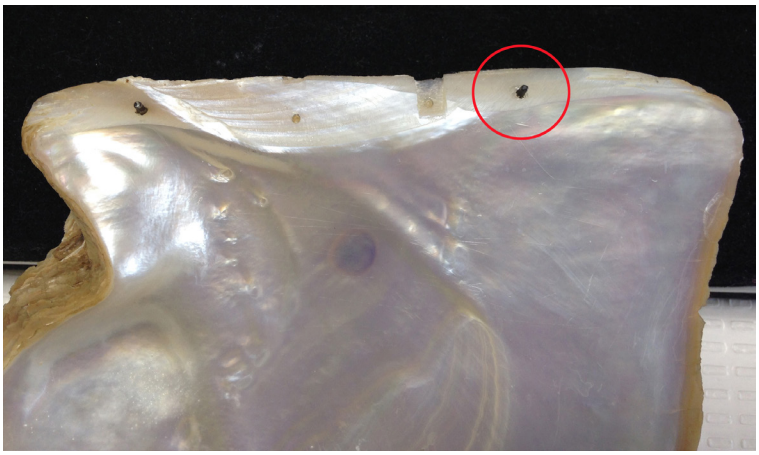

Fig. 15. The new pin circled in red (Courtesy of the author)

Fig. 16. After treatment, fully assembled (Courtesy of Walters Art Museum)

Fig. 17. After treatment, partially assembled (Courtesy of Walters Art Museum)

Fig. 18. The outside of the custom housing (Courtesy of the author)

Fig. 19. The inside of the custom housing (Courtesy of the author)

Seaweed clasp: Tarnish was reduced on the gold seaweed clasp in a very similar manner to the gold hinge with the same dwell time per application. Additional steps to protect the oyster shell were taken: where room allowed, silicone release Mylar was used to protect the shell by inserting it between the gold and shell, and the silver putti and decorative stem were protected by wrapping the components with Parafilm M. To allow access to the underside, the object was rested against a soft pillow or held upside down using a ring stand (fig. 14).

5.3 ASSEMBLING THE EXTANT COMPONENTS

The natural pearl was adhered to the carved cavity in the interior of the bottom half of the oyster shell with a 3:1 blend of 40% (w/w) Paraloid B-72:40% Paraloid B-48N in acetone:ethanol (approximately 10% ethanol w/w) (referred to as 3:1 B-72:B-48N). A resinous material that filled the ends of the small hole drilled through the length of the natural pearl was toned with Golden Fluid Acrylics to visually integrate the darkened material.

An additional support pin was fashioned from stainless steel black annealed mechanics wire and adhered in the empty end hole on the interior top half of the shell with 3:1 B-72:B-48N (fig. 15). The detached putto was adhered in place using 3:1 B-72:B-48N bulked with a fumed silica matting agent and tinted with silver-colored graphite powder.

Although the hinge and top half of the shell could be assembled onto the mounted shell component (fig. 16), the decision was made to leave the object partially unassembled to facilitate safer travel, handling, and storage while off display (fig. 17). A multifunctional box (figs. 18, 19) was made to keep the components together safely while in storage and hand-carrying transport. This box included a Pacific Silvercloth upholstered interior to scavenge for pollutants that would tarnish the surfaces. Instructions were provided in the proper assembly procedure, along with recommendations to use a temporary soft wax to secure the pieces while on display.

6. RESULTS

Treatment resulted in an overall cared for appearance that in many ways is in keeping with images of similar objects by Froment-Meurice and the aesthetics of the time. The acidified thiourea gel successfully reduced tarnish on the gold and gilt-silver metal, resulting in a bright, shiny surface that required no additional polishing. The gel allowed for excellent physical control over dwell time and application, and minimized or eliminated contact with sensitive shell and silver components. Although the presence of a patination layer is still unconfirmed, the dark surface has been retained for possible future study.

7. FURTHER RESEARCH

This project has provided many avenues for additional research and investigation, including the following topics:

1. Study and analysis to better understand how thiourea gel interacts with gold and gilt-silver surfaces, and any long-term preservation issues.
2. Study and analysis of soiled treatment materials to determine the nature and amount of original material removed by acidified thiourea in comparison to abrasive polishing, such as with cosmetic sponges, calcium carbonate, and alpha alumina. Results would provide quantitative information as to whether gelled solutions of thiourea are an appropriate option for tarnish reduction on gilt-silver surfaces, where the gilding layer is particularly vulnerable to removal via abrasive cleaning.
3. Identifying additional primary resources as to the process and manufacture of coloring silver in the 19th century, particularly in France. This would improve the understanding of this technique and aid in the analysis of objects to identify original patination finishes.
4. Study and analysis of 19th century silver objects documented to have patinated surfaces. This may include comparing patinated surfaces to nonpatinated surfaces, developing methods of detecting and identifying these surfaces using both nondestructive (XRF) and destructive (FTIR, XRD, SEM-EDS, and cross section) analytical methods.

ACKNOWLEDGMENTS

The author would like to acknowledge the following institutions and persons integral to the successful research, treatment, and support for this project, and resulting presentations and publications: the WAM;

Winterthur Museum, Garden and Library; the University of Pennsylvania Museum of Archaeology and Anthropology; and Jo Briggs, William David Brown, Meg Loew Craft, William Donnelly, Terry Drayman-Weisser, Lauren Fair, Dr. Glenn Gates, Julie Lauffenburger, Catherine Matsen, Alexandra Nichols, and Richard Wolbers. In addition, special thanks to those who generously provided translation assistance for French text: Bruno Pouliot, Abigail Quandt, and Aislinn Smalling. Thank you also to the Foundation of the American Institute for the Conservation of Artistic and Historic Works for generous support through the George Stout Grant.

REFERENCES

Art Institute of Chicago. 1907. *General catalogue of sculpture, paintings, and other objects.* Chicago: Art Institute.

Briggs, J. 2015. Personal communication. Walters Art Museum, Baltimore, MD.

Clark, H. 1935. When Chicago was young, the elegant eighties. *Chicago Tribune.* http://archives.chicagotribune.com/1935/10/13/page/105/article/when-chicago-was-young.

Contreras-Vargas, J., J. L. Ruvalcaba-Sil, and F. J. Rodríguez-Gómez. 2013. Effects of the cleaning of silver with acidified thiourea solutions. *Proceedings of the Interim Meeting of the ICOM-CC Metal Working Group*. Edinburgh, UK. 227–232.

Craft, M. 2015. Personal communication. Walters Art Museum, Baltimore, MD.

Drayman-Weisser, T. 1984. The Walters Silver Kantharos: A technical study. *Journal of the Walters Art Museum Gallery* 42/43: 16–22.

Drayman-Weisser, T. 2015. Personal communication. Walters Art Museum, Baltimore, MD.

Gates, G. 2015. Personal communication. Walters Art Museum, Baltimore, MD.

Jewelers' Circular Pub. Co. 1894. The works of a famous ciseleur. *Jewelers' Circular and Horological Review* 19: 1. http://hdl.handle.net/2027/nyp.33433066013149.

Lamb, M. J. 1892. The Walters collection of art treasures. In *Magazine of American history with notes and queries, V. 27*, ed. M. J. Lamb. New York: J. J. Little & Co. 241–264. http://hdl.handle.net/2027/mdp.39015031937397.

Lauffenburger, J. 2015. Personal communication. Walters Art Museum, Baltimore, MD.

Marchessaeu, D. 2003. *Trésors D'Argent: les Froment-Meurice: Orfèvres Romantiques Parisiens.* Paris: Musée de la vie Romantique.

New York Times. 1913. Wealthy Parisian killed: Emile Froment-Meurice and his wife die when house collapses. April 26. http://query.nytimes.com.

Pouliot, B. 2015. Personal communication. Winterthur Museum, Garden & Library, Winterthur, DE.

Quandt, A. 2015. Personal communication. Walters Art Museum, Baltimore, MD.

Rudoe, J. 1993. Oxidized silver in the 19th century: The documentary evidence. In *Metal Plating and Patination: Cultural, Technical, and Historical Developments*, ed. S. La Niece et al. London: Butterworth-Heinemann. 161−170.

Selwyn, L. S. 2004. *Metals and corrosion: A handbook for conservators*. Ottawa: Canadian Conservation Institute.

van Santen, H. 2014. The cleaning of sterling silver with acidified thiourea cleaning solutions: Solution recipe optimization. Master's thesis, Unversiteit van Amsterdam, Amsterdam, Netherlands. http://dare.uva.nl/cgi/arno/show.cgi?fid=519142.

Vitali, U. 1997. A quest for the *domus aurea* in the resurgence of gilding. *English and French silver-gilt from the collection of Audrey Love,* ed. A. Phillips et al. London: Christie's Books. 17-27.

Wolbers, R. 2015. Personal communication. Winterthur Museum, Winterthur, DE.

SOURCES OF MATERIALS

Fumed silica-hydrophobic, Webril Wipes
Museum Services Corporation
385 Bridgeport Way
South St. Paul, Minnesota 55075
(651)450-8954
http://www.museumservicescorporation.com/scat/sa.html

Golden Fluid Acrylics, General's graphite powder
Dick Blick Art Materials
PO Box 1267
Galesburg, IL 61402
800-828-4548
https://www.dickblick.com

Kimwipe, Parafilm M, Thiourea
Fisher Scientific
800-766-7000
https://www.fishersci.com

Pacific Silvercloth
University Products
800-628-1912
https://www.universityproducts.com/pacific-silvercloth-and-silver-storage-tray.html

Paraloid B-48N, Paraloid B-72, Silicon release Mylar
Talas
330 Morgan Ave.
Brooklyn, NY 11211
212-219-0770
http://www.talasonline.com

Triton XL-80N
Discontinued by Dow Chemicals

Xanthan gum
The Personal Formulator
97 South Red Willow Rd.
Evanston, WY 82930
307-264-0367
http://www.personalformulator.com/wvss/product_info.php?products_id=197

EMILY BROWN is the Mellon Fellow of Decorative Arts and Sculpture at the Philadelphia Museum of Art. Formerly, she was a project conservator at the University of Pennsylvania Museum of Archaeology and Anthropology. In 2015, she received her MS and certificate in Objects and Preventive Conservation from the Winterthur/University of Delaware Program in Art Conservation. Graduate internships include work at the Shelburne Museum in Shelburne, Vermont; the Fitzwilliam Museum in Cambridge, England; the WAM in Baltimore, Maryland; and Winterthur Museum in Wilmington, Delaware. Previously, Emily was employed for 14 years at the private Philadelphia, Pennsylvania, restoration firm H.A. Eberhardt and Son Inc., where she restored ceramic and glass objects for private clients. Address: Philadelphia Museum of Art, 2600 Benjamin Franklin Parkway, Philadelphia, PA 19130. E-mail: Emily.brown@philamuseum.org