1. INTRODUCTION

In North America, most conservation graduate programs train their students specializing in objects conservation to be prepared to care for three-dimensional (3D) objects made of a wide array of materials, including both organic and inorganic materials. While at larger museums and in private practice objects conservators typically become more specialized, in medium-sized or smaller museums objects conservators are usually responsible for the preservation of the museum’s entire 3D collections. Because of this reality, objects conservators have often shown to be remarkably resourceful and creative problem solvers by introducing and adapting new materials and techniques—often borrowed from other specialty fields—as we do our work.

Since the 1990s, objects conservators have increasingly incorporated paper as a conservation material in our wide array of treatments. This remarkable material can be used in the restoration and preservation of a large range of 3D works made of materials that, in most instances, are quite different in character than paper—hard, stiff, shiny, coarse, brittle, cold, heavy, dense, or bulky.

In addition to meeting the material criteria for modern conservation practice—including reversibility, strength, inertness, stability, minimal change in color over time, and compatibility with the original artwork—objects conservators resort to paper as a conservation material because of many other properties as well. Finally, having the option of using paper in sheet, fiber, or powder form—either in a dry or wet state—opens the door to even more types of applications. The main goal of this publication is to provide a survey—including a number of case studies I have undertaken—of the numerous applications and adaptations of this unique material in the field of objects conservation.

2. CHARACTERIZATION AND SOURCES OF PAPER

A sheet of paper is typically made of cellulose fibers placed in molds or onto screens from a water suspension and then dried under pressure. The cellulose fibers in paper are held together through a variety of bonds that
give the paper both strength and flexibility (Banik and Brückle 2011). Only acid-free papers are used in conservation, preferably those made without binders, additives, or coatings. Papers made from wood fibers are not used because they contain lignin, an acidic component that causes deterioration of the paper itself and potentially deterioration of materials in direct contact with it (Banik and Brückle 2011).

The papers used in the field of objects conservation are divided into Asian and Western papers. All are made from natural cellulose-based fibers derived from plants, each one with unique properties. The Asian papers are primarily made from the inner bark fibers of three plants (Hiromi Paper, Inc. 2017). The kozo—or mulberry tree inner bark—produces long and strong fibers, yielding an extremely tough paper (figs. 1a, 1b). The gampi shrub inner bark produces thin, short, and lustrous fibers, yielding a strong, crisp, and translucent paper (fig. 1c) (Hiromi Paper, Inc. 2017). The mitsumata tree inner bark produces soft, thin, and lustrous fibers, yielding a smooth and dense paper. Kozo paper, which is produced in a large range of weights and thicknesses, is the Asian paper most used by objects conservators. Gampi and mitsumata papers are used to a lesser degree.

Western papers used in the field of objects conservation are made of natural plant fibers such as linen (flax), hemp, and cotton (Collings and Milner 1978; Hunter 2011). Western papers used by objects conservators include acid-free mat board made from cotton, lab-grade ashless acid-free filtration paper, and fibrous cellulose powders; the latter two products are made from high-quality cotton linters (fig. 2). The archival, pH-neutral Green’s lens tissue made from the fibers of the abaca palm tree leaf stalks is also used (Hatchfield and Marincola 1994).

3. PROPERTIES OF PAPER FOR OBJECTS CONSERVATION USE

Paper is not only a material of choice because it meets the basic material stability criteria in modern conservation, but the fact that it is nontoxic to the practitioner and the environment makes it very desirable. Its high absorbency, ability to conform to surfaces, light weight, and that it is minimally affected by the solvents typically used in objects conservation also makes it attractive for specific applications. Compared to other restoration materials, paper is relatively easy to use, and the treatments are often more expedient and can be readily reversible without putting the artwork at risk of damage. The fact that paper restorations can be made to convincingly resemble the appearance of a wide range of materials—including metal, weathered archaeological glass, bone, wood, leather, and ceramic—makes it particularly appealing to modern conservators who intentionally use different materials in their work to distinguish the restoration from the original. Paper is also easy to clean up without leaving residues, though cellulose powder should probably not be used on objects with uneven, rough, or delicate surfaces because clean up can be problematic.

Fig. 1. Kozo paper, thick (a) and medium-thick (b), and gampi paper (c).
4. CONSERVATION MATERIALS USED IN CONJUNCTION WITH PAPER AND THEIR EFFECTS ON PAPER

Among the conservation materials that are used in association with paper for treatments are coatings, varnishes, adhesives, consolidants, binders, and retouching or inpainting media. For retouching, a wide variety of conservation-grade inpainting media are available, including acrylic emulsion paints (Golden), watercolors (Schminke or Windsor & Newton), aldehyde paints (Gamblin, which are soluble in isopropanol), dry pigments (Kremer), colored pencils (there are many brands—I prefer Caran d’Ache), water-soluble color pencils (Caran D’Ache), or combinations of these.

To impart the desired sheen, translucency, or specific color, a paper-based restoration can be coated or saturated with either water-based acrylics (Golden varnishes or mediums; Acrysol WS-24) or solvent-based acrylics (Paraloid B-72, 2%–30% in acetone:ethanol, 4:1). Adhesives and consolidants used in association with paper are either water-based adhesives (wheat starch paste; methyl cellulose) or solvent-based adhesives (Paraloid B-72, 50% in acetone:ethanol, 4:1; hydroxypropylcellulose is soluble in isopropyl alcohol). If a paper fill needs to remain flexible—for example, for a textile lining or a leather repair—BEVA 371 (a polymer and wax mixture), Paraloid F-10 (acrylic) (Nieuwenhuizen 1998, Kronthal et al. 2003) or Lascaux 303 HV (acrylic) (Baas and Hartman 2019) is recommended. The most widely used binder for cellulose fibers or powder for filling is Paraloid B-72 (30%–50% in acetone:ethanol, 4:1).

All materials discussed in this article have been researched and tested for professional conservation use. However, several recent publications specifically focusing on the interaction of these materials and paper deserve to be mentioned in this context. Soleymani describes her findings in her comprehensive doctoral thesis from 2015 on the subject of paints used by paper conservators (natural dyes, watercolors, and acrylics) in association with kozo paper. She confirms that the use of watercolors and acrylic emulsion...
paints on kozo paper is not physically or chemically detrimental to the paper after aging tests and exposure to UV radiation were performed. Tear-resistance tests demonstrated that there were no statistically significant differences in the physical properties of the paper painted with watercolors or acrylics. In her joint publication with Ireland and McNevin (2016), Soleymani concludes that watercolors may be more susceptible to fading on paper than acrylics.

Tkalčec, Bistričić, and Leskovac discuss the effects of four adhesives (methyl cellulose; rice starch; hydroxypropyl cellulose; and an acrylic, heat-activated copolymer) widely used in paper conservation on kozo paper in their publication from 2016. They, too, expose their specimen to accelerated aging and UV radiation as part of their experiments. They conclude that the degradation of the paper is retarded by the presence of the first three adhesives and that these adhesives actually improved the mechanical properties of kozo paper in comparison to untreated paper, with hydroxypropyl cellulose faring the best. They also found that the papers treated with methyl cellulose, rice starch, and hydroxypropyl cellulose exhibited enhanced stability against moist heat and UV aging. The study showed inconclusive test results for the acrylic copolymer, probably due to the weak adhesion forces between paper and adhesive (it was not a solvent-based adhesive but rather a heat-activated film). However, it did confirm that artificial aging and exposure to UV radiation did not affect the structure of the acrylic copolymers (which explains why these acrylics are so widely used as conservation materials).

5. APPLICATIONS OF PAPER IN OBJECTS CONSERVATION

As a material used in objects treatments, paper can have two very different functions. It can be used as a restoration material, remaining with the work of art once the treatment is finished, or it can function as a tool during treatment and not remain with the work of art once the treatment is complete. Sometimes paper serves both these roles in the same treatment. The term restoration in this article is used very broadly, referring to treatments in which paper is used as a fill material, bulking agent, support, barrier, and the like. It is also important to emphasize that each treatment scenario discussed in the following case studies is unique and that treatment decisions were made on a case-by-case basis. All applications are intended for indoor use only.

5.1 Paper as a Restoration Material

5.1.1 Paper as a Fill Material

Much of the treatment work that objects conservators engage in involves compensating losses in objects that are broken or fragmentary. This effort often consists of replacing restoration materials used by restorers in the past that have proven to be incompatible with the original artwork. Conservators have found that because of its aforementioned attributes, the fabrication of a paper restoration is often faster and less invasive to the original work of art than using other conservation materials. Additionally, paper restorations are typically readily reversible.

5.1.1.1 Bone, Ivory and Antler

Losses in objects made of bone, ivory, or antler can be compensated very convincingly with paper—in board, sheet, fiber, or powder form—depending on the shape of the loss. I used mat board to fill a loss on one of the fan stakes of a 19th century Chinese fan made of bone and retouched it with colored pencils once the fill was adhered with Paraloid B-72 adhesive (50% in acetone:ethanol, 4:1; fig. 3). The mat board was cut to shape with a scalpel.
5.1.1.2 Ceramic

Occasionally, ceramics can be restored with paper products. The Japanese raku flower vase in figure 4 features an Asian “golden repair”—a technique called kintsugi or kintsukuroi (Wikipedia 2017), made of gilded lacquer—and had incurred losses in the lacquer decoration (figs. 4b, 4c). The losses were compensated using medium-thick kozo paper painted with acrylics (fig. 4a) using brushes, and cut to the desired shape with scissors. The fills were adhered with Paraloid B-72 (50% in acetone:ethanol, 4:1; fig. 4c).

5.1.1.3 Weathered Archaeological Glass

The semi-translucent quality of medium-thick kozo paper tinted with watercolors and saturated with Paraloid B-72 (30% in acetone:ethanol, 4:1) is especially effective for filling losses in weathered archaeological glass objects (figs. 5a–c) (Artal-Isbrand 1998).
Rather than cutting the paper fill with scissors, it was torn after marking its outline with water using a traditional brush or a water brush (figs. 6a–c)—a technique borrowed from paper conservation—which resulted in a feathered edge of long kozo fibers.

I adhered the fill by overlapping the feathered kozo fiber margin with the edges within the losses of the ancient beaker and reactivating the acrylic consolidant on the paper fill with acetone on a brush (fig. 5c). This technique produces a join that is strong though barely visible (fig. 7). The resulting transparency and consistency of the acrylic-resin–saturated kozo paper is compatible with that of the thin-walled, weathered ancient glass object. This treatment is not only faster and less intrusive compared to a cast epoxy or cast Paraloid B-72 fill but it is also readily reversible without posing any danger of damage to the extremely delicate glass object (Koob 2003; Koob et al. 2013; Bristow and Cutajar 2019).

Fig. 6. To produce a paper fill with a feathered edge, the outline is marked with water using a traditional brush (a) or a water brush (b); the paper is then torn along the water mark (c).
5.1.1.4 Metal

Thick kozo paper can be a suitable restoration material for losses on archaeological metal objects, not only because of its resemblance to metal when saturated with acrylics and painted with watercolors but also for its remarkable strength. I took this approach on a 16th century Ottoman or Caucasian iron helmet (see fig. 15c) that had previously been repaired with metal sheet stock and wire. After removing all of the old restorations, I used thick kozo paper tinted with watercolors and coated with Paraloid B-72 (30% in acetone:ethanol, 4:1) for structural fills of the earpieces (fig. 8). To increase the thickness of the paper fills, several layers were stacked and adhered with Paraloid B-72. For the chain mail restoration, I cut and twisted strips of the medium-thick kozo paper onto themselves and shaped them into rings (figs. 8a, 9a). All restorations were adhered with Paraloid B-72 (50% in acetone:ethanol, 4:1 fig. 9b).

Fig. 7. Beaker, Roman, different views after treatment with kozo paper fills (a–c). (Courtesy of Sardis Archaeological Excavation, photo: Paula Artal-Isbrand)

Fig. 8. Thick and medium-thick kozo paper tinted with watercolors (a) used for the treatment of a Missyurka turban helmet, Ottoman Empire or Caucasus, 16th century, iron, 29.0 × 18.0 × 18.0 cm. Worcester Art Museum 2014.102. Bequest of John A. Higgins, after treatment (red arrow points to the restoration within the earpiece—the visible hole is the original hearing hole) (b).
5.1.1.5 Wood, Paper Mâché, Basketry, Leather, Skin, and Other Organic Materials
As a fill material, paper can also mimic the appearance of wood, paper mâché, basketry, leather, skin, and other organic materials. If it needs to remain flexible, it is coated or adhered with BEVA 371 or Paraloid F-10 (van der Reyden and Williams 1986; Webb 1998; Kronthal et al. 2003). Dignard’s annotated bibliography of “Adhesive Backing Treatments for Skin and Leather Objects” is a comprehensive source of publications reporting on the use of paper in the treatment of organic materials (Dignard 2013). In restorations on ancient Egyptian cartonnage made of layers of linen or papyrus and covered with a plasterlike material, Leveque uses layers of kozo paper as a backing for fills made of Paraloid B-72 bulked with 3M microballoons and tinted with dry pigments (Brown, Leveque, and Nau 2019).

5.1.2 Paper as a Reinforcement or Mending Material for Cracks, Weak Joins, Or Breaks
Because of the strength of the long kozo fibers, this Asian paper is very effective for reinforcing cracks or weak joins. I chose this paper in the treatment of an ancient archaeological Italic bronze body armor (fig. 10) that was unstable due to the failing lead solder joins from an extensive past restoration. The
solder had actually never properly bonded to the edges of the bronze fragments (the melting temperature for the lead solder is much lower than that of bronze) but was merely holding them together mechanically. I adhered thick kozo paper strips over the weak solder joins from the back with Paraloid B-72 (50% acetone:ethanol, 4:1) and painted them in situ with Gamblin aldehyde paints. Gamblin paints (used with isopropanol) were chosen because of the water sensitivity of the metal.

5.1.3 Paper as a Support of a Fragmentary Object

Paper lends itself as a permanent support for exceedingly fragile or fragmentary objects in order to keep separated or severely cracked pieces together and to provide a backing to make them safe to handle. I used kozo paper as a support for an ancient curse tablet from Antioch made of thin lead sheet that was rolled upon itself (fig. 11) in the collection of the Princeton University Art Museum (Heintz 2000). The

Fig. 11. Curse tablet, Antioch (Turkey), 4th to 5th century CE, lead, 7.8 × 2.1 × 2.2 cm. Princeton University Art Museum 2011-150 (5555-I 182), overall before treatment (a), and after unrolling, cleaning, and placement on a kozo paper support (b). (Courtesy of Princeton University Art Museum, photo: Paula Artal-Isbrand)
goal of this treatment was to clean and unroll this earth-encrusted and extremely brittle archaeological object in the hope of exposing an inscription on its inner face. The inscription, which had indeed survived, was then captured with the reflectance transformation imaging (RTI) method (Robert and Hollmann, in press). Once the object was cleaned and fully unfolded, I adhered all fragments to a thick kozo paper support with Paraloid B-72 (50% acetone:ethanol, 4:1; fig. 11b).

5.1.4 Paper as a Permanent Support for a Fill Material
Paper can also serve as a permanent support for a fill material, especially if the design of an object does not allow access for the removal of a temporary support or mold for the fill after the treatment is complete. I used this approach to support a large plaster fill on a half-life-sized, hollow 8th century Mesoamerican earthenware figure (Worcester Art Museum, 1964.8). The large figure had been capped off on its underside with an irreversible 20th century structural restoration made of epoxy and wood, making the interior of the object inaccessible. Then I fabricated a multilayer kozo paper support made of thick paper stock saturated with Paraloid B-72 that was adhered to the inside edges of the loss with Paraloid B-72 to hold the plaster fill in place (fig. 12). After the plaster had cured, the paper backing was left in place.

5.1.5 Paper as a Barrier Layer
Paper can also serve as a barrier layer on the interface of an adhesive join to help access it in the future should it be necessary to reverse it or to isolate the artwork from a mounting system used for its display. Both these scenarios presented themselves in the conservation of a monumental polychrome wooden Chinese head of a Guanyin (fig. 13). The glass eyes that make this imposing statue appear lifelike were originally inserted through an access port consisting of a cut-out section within the lower eyelids, which was replaced with a wooden plug. This plug was lost on the proper left eye. The treatment consisted of carving a wooden replacement. Before adhering it with Paraloid B-72 (50%, acetone:ethanol, 4:1), I lined all contact surfaces with a kozo paper barrier adhered with wheat starch paste. If needed, this restoration can easily be removed in the future by saturating the join lined with kozo paper with acetone. A similar barrier, though on a larger scale and solely adhered to the artwork, was also created on the underside of the head to contain the fragile and deteriorated wood of the neck and isolate it from a new exhibition mount.

5.1.6 Paper to “Inpaint”
Asian papers or the archival pH-neutral Green’s lens tissue tinted with acrylic emulsion paints have also been used to “inpaint.” This application was introduced in the 1990s to compensate extensive paint loss on polychrome wooden sculpture with fragile surfaces. Green’s lens tissue fills were adhered to the highly watersensitive surfaces with the hydroxypropyl cellulose adhesive Klucel G (Hatchfield and Marincola 1994).
5.1.7 Paper as a Bulking Agent for Adhesives and Fillers

Paper powder has been used as a bulking material for adhesives and fillers ever since paper was first produced, according to Thornton (1998). Fibrous cellulose powder continues to be used widely in objects conservation for bulking adhesives to serve as fillers in objects of any material (Krumrine and Kronthal 1995; Kronthal et al. 2003). In their publications, Podany et al. (1994, 1995) and Jordan (1999) mention using the proprietary spackling compound Polyfilla, made of calcium sulfate and cellulose fibers, which can be bulked with additional paper pulp to achieve a desired consistency.

5.1.8 Paper as a Pigment

Paper conservators toast fibrous cellulose powder over low heat to achieve different shades of color ranging from tan to brown (fig. 14) to use in their restorations. Futernick and Evans describe the process in the AIC Wiki section of the Paper and Book Group (AIC 1987). Toasted cellulose powder bound with gelatin

Fig. 13. Guanyin, Chinese, 13th century CE, polychrome wood, 60.0 × 51.0 × 51.0 cm. Worcester Art Museum 1932.15. Kozo paper adhered to the underside of the sculpture served as a barrier to protect the fragile wood (a) from an exhibition mount (b). (Courtesy of Paula Artal-Ibrand (a) and Steve Briggs (b))

Fig. 14. Whatman CF-11 cellulose powder toasted to different shades (a). Toasting cellulose powder on a heating plate (b)
can be used to “inpaint” or fill stubborn stains that cannot be removed by other means, thereby imparting a textured surface to simulate the appearance of the original surrounding paper (Spaulding 2017). I have mixed toasted fibrous cellulose powder into paint on several occasions to achieve a similar effect.

The low-heat treatment of the cellulose powder during the toasting process should not affect the cellulose structure. According to Shinji, Hitoshi, and Ryusuke (2002), the tensile strength of natural fibers such as hemp is almost unchanged if exposed to heat under 160°C. Only at 200°C do the fibers decrease in tensile strength.

5.2 Paper as a Tool During Treatment

5.2.1 Paper as a Temporary Facing Material

Paper has long been used as a facing material to protect unstable and fragile surfaces of an artwork during transit or storage. For example, I used this approach in my private practice on wall mosaics before their removal from multiple churches in the Boston area that were sold into private hands. The facing paper is adhered to unstable parts of the surface of the artwork using an adhesive that is compatible with the artwork, either a water-based or solvent-based adhesive. After installation in its new permanent location, the paper facing is removed by reversing the adhesive with an appropriate solvent.

5.2.2 Paper as a Temporary Mending or Reinforcement Material

Strips of paper can be temporarily adhered to a fragmentary object during the reassembly process or to reinforce a weak join or crack during the treatment of an object. During the treatment of the turban helmet discussed earlier, I adhered paper “Band-Aids” with Paraloid B-72 to help with the placement and alignment of the fragmentary earpiece during the restoration process (figs. 8b, 15). I also used this

![Fig. 15. Missyurka turban helmet, Ottoman Empire or Caucasus, 16th century, iron, 29.0 × 18.0 × 18.0 cm. Worcester Art Museum 2014.102. Bequest of John A. Higgins, before (a), during (b), and after (c) treatment](image)
technique during the unrolling of the lead curse tablet discussed earlier to hold weak parts together during unrolling and cleaning to prevent further damage from occurring. Once the objects were stable, the paper Band-Aids were removed by wetting with acetone.

5.2.3 Paper as a Barrier During Cleaning Treatments with Poultices
For gel treatments, the thinnest of the gampi papers, gampi usouyo paper, serves as an efficient barrier between the surface of the artwork and the poultice. Warda et al. report in their 2007 article that gampi usouyo paper used as a membrane during gel treatments in paper conservation fully blocks the deposition of any gel residues onto the paper substrate. Pouliot also uses this specialty paper in his stain reduction treatments of ceramics to prevent any gel residues from transferring onto the object (2016).

5.2.4 Paper as a Poultice Material or as a Carrier for Cleaning Solutions
Because paper is so absorbent (hydrophilic) and maintains excellent contact with surfaces, it is extensively used in poulticing treatments. Pouliot et al. use a wide range of paper products in their poultice treatments, including fibrous cellulose powders, alpha cellulose powders, wet strength tissue (Kaydry EX-L), various chromatography papers, and specialized cellulosic powders (e.g., diethylaminoethyl cellulose fibers used for rinsing) (Pouliot, Fair, and Wolbers 2013; Pouliot and Wolbers 2016).

I used fibrous cellulose powder mixed with deionized water as a poultice to reduce a water-soluble stain on a Japanese glazed ceramic jar (fig. 16). The poultice material was prepared as described in Section 5.2.5. I had to apply several poultices until the stain was almost entirely gone.

5.2.5 Paper Used to Make High-Quality Molds
Because of the ability of paper fibers to conform to surfaces, paper can be used as a material to make molds. During his popular course “Making high-quality replicas of museum objects,” the late Danish objects conservator Erling Benner Larsen demonstrated how to prepare paper fiber pulp from laboratory-grade filtration paper to make a paper mold of an object (Larsen 1981). The filtration paper

Fig. 16. Water container for tea ceremony, Japanese, 8th century, glazed ceramic with lacquered wooden lid and metal handle, 12.7 × 12.2 × 12.2 cm. Worcester Art Museum 1954.89, before (a), during (b), and after (c) treatment.
is first torn into pieces that are soaked in deionized water overnight and then blended into a homogeneous paper fiber pulp (figs. 17a, 17b). The mold is made by pressing the pulp through a perforated aluminum sheet onto the surface of the object. This, of course, is recommended only for objects that can withstand getting wet and the pressure exerted on their surface during mold fabrication. Once the pulp dries, a sturdy mold made up of the intertwined polymer network of the long cellulose fibers results (fig. 17c). If a plaster cast is to be produced, the mold needs to be waterproofed first with, for example, a Paraloid B-72 consolidant (15% in acetone:ethanol, 4:1) (Koob 1986) by brush application. Shellac could be used for this purpose as well. Otherwise, the mold would disintegrate on contact with the wet plaster.

I adapted Larsen's paper mold technique in the treatment of a fragmentary Greek vase (Artal-Isbrand 2010). With about half of the vase missing and in danger of tipping over, the curator and conservator team had agreed that a partial reconstruction of the body, including the missing handle, would help stabilize the vase. Since the full profile of the vase was unknown due to the complete loss of the neck and mouth, the vessel was to be restored only to the shoulder level.

After a full disassembly, a desalination treatment, followed by reassembly of the vase fragments and filling of small losses with plaster, I had to devise a filling strategy for the large loss. The mold materials that I typically use to support the plaster for small fills, such as dental wax sheets or the modeling clay Plasticine, were inadequate for a fill this large. Instead, this treatment called for the fabrication of a large mold that had to be lightweight yet strong enough to hold the weight of the wet plaster. I fabricated a paper pulp mold following the Larsen technique. When the pulp fully dried, the mold was removed from the vase (fig. 18a) and waterproofed with Paraloid B-72 consolidant. This lightweight but strong mold—which also incorporated a separately made plaster handle—was then placed over the area of the large loss and fastened to the object with twill tape (fig. 18b). Plasticine was applied to the edges of the mold to serve as a retaining wall for the plaster, and custom-made thumbtacks were pressed through the mold to indicate the desired thickness of the final cast (fig. 18b). Because of the curvature of the mold, the plaster was poured in two stages. Once the plaster set and dried, the thumbtack holes filled and it was shaped with tools (including scalpels, pottery-making metal scrapers, abrasive paper, etc.), it was consolidated with Paraloid B-72 (8% in acetone:ethanol, 4:1) (fig. 18c), and airbrush painted with Golden acrylic emulsion paints as described by Sigel and Koob (1997) (fig. 18d).
6. CONCLUSION

This article has demonstrated the vast potential of paper as a material used in the field of objects conservation by presenting numerous applications employed by objects conservators over the years, complementing them with illustrated case studies of treatments that I carried out. I hope that this article may serve as a reference for objects conservators as we incorporate this extraordinary material borrowed from the field of paper conservation into our repertoire of conservation materials and tools.

Finally, a word of caution. As we plan our conservation treatments, we must also keep the preservation of the paper itself in mind when we use it as a restoration material. Indeed, paper is tough but it, too, is susceptible to deterioration, especially from exposure to acidic materials—as paper conservators well know. It is important that we do not place paper restorations in direct contact with materials that are acidic or that become acidic over time. Art materials that are acidic are typically organic in nature. Such materials are, for example, dark wood (which has a high lignin content), deteriorating leathers, and plastics (which often produce acidic byproducts over time as they break down). Additionally, we ought to understand the makeup of the wide range of unorthodox...
materials, often composites, used in modern and contemporary art before selecting paper as a material for our conservation treatments. Under such circumstances it is key to fully isolate a restoration made of paper from these materials by creating an appropriate barrier layer between the components. Paper may also be substituted entirely with synthetic materials such as the wide range of polyester products available for conservation purposes (including cast films and woven, nonwoven or spun-bonded fabrics).

ACKNOWLEDGMENTS

I was first introduced to the extraordinary conservation material paper and the clever and elegant techniques of handling and manipulating it by paper conservators Carolyn Long and Lynn Gilliland during a pre–graduate school internship at the National Museum of American History in Washington, DC, in 1988 to 1990. I remain forever grateful to them for all they taught me. I am also indebted to paper conservation professor Irene Brückle at the Buffalo State Art Conservation Program (now at State Academy of Art and Design, Stuttgart, Germany) for building on this knowledge while I was a student there. The contributions of my colleague, paper conservator Eliza Spaulding at the Worcester Art Museum, were invaluable while preparing this article. Finally, I want to thank objects conservation professor Bruno Pouliot at the Winterthur/University of Delaware Program in Art Conservation (WUDPAC) for sharing in my enthusiasm for this unique material—paper—and its vast potential in the field of objects conservation over the years, and for inviting me to teach a yearly seminar on this topic to the object majors. Much of the content in this article is the material that I covered during the WUDPAC seminars.

REFERENCES


**FURTHER READING**


**SOURCES OF MATERIALS**

Acid-free mat board (Rising Museum Board)

Legion Paper
38 E 32nd St.
New York, NY 10016
212-683-6990
[https://legionpaper.com/](https://legionpaper.com/)
Asian papers (kozo, gampi, mitsumata papers)
   Hiromi Paper, Inc.
   9469 Jefferson Blvd. #117
   Culver City, CA 90232
   310-998-0098
   http://store.hiromipaper.com/

Caran d’Ache color pencils, Caran d’Ache water-soluble color pencils, Schminke watercolors,
StaWet palettes, pottery tools, and water brush
   Dick Blick Art Materials
   401 Park Drive
   Landmark Center-Fenway
   Boston, MA 02215
   617-247-3322
   http://www.dickblick.com/

Harbutt’s Plasticine
   Conservation Resources International, LLC, UK
   + 44 123 555 3166
   http://www.conservation-resources.co.uk/

Kaydry EX-L (by Kimberly Clark)
   Thomas Scientific
   1654 High Hill Rd.
   Swedesboro, NJ 08085
   800-345-2100
   https://www.thomassci.com

Klucel G, and Paraloid F-10
   Conservation Resources International, LLC
   5532 Port Royal Rd.
   Springfield, VA 22151
   800-634-6932
   http://www.conservationresources.com/

Perforated aluminum sheet
   Metals Depot International
   4200 Revilo Rd.
   Winchester, KY 40391
   859-745-2650

Pigments
   Kremer Pigments
   247 West 29th St.
   New York, NY 10001
   212-219-2394
   https://shop.kremerpigments.com/
Paraloid B-72, Paraloid B-10, Gamblin paints, wheat starch, Green's lens tissue, Acrysol WS-24, Lascaux 303 HV, 3M glass microballoons, and BEVA 371, Hollytex, Pellon, Mylar, Reemay

TALAS
330 Morgan Ave.
Brooklyn, NY 11211
212-219-0770
http://www.talasonline.com/

Polyfilla
Polycell
AkzoNobel
Wexham Rd.
SL2 5DS Slough, UK
+ 44 333 222 717
http://www.polycell.co.uk/contact/

Sculpture House Pristine White Casting Plaster
Amazon

Sigma-Aldrich fibrous cellulose-fibers (medium; replaced Whatman CF 11 fibrous cellulose powder), Whatman cellulose filtration paper 542, alpha cellulose powder, diethylaminoethyl cellulose fibers
Sigma-Aldrich
3050 Spruce St.
St. Louis, MO 63103
800-325-3010

PAULA ARTAL-ISBRAND is objects conservator at the Worcester Art Museum, where she is responsible for the conservation and preservation of the museum’s encyclopedic collection of sculpture, decorative arts, and antiquities made of a wide range of media, including ceramics, stone, glass, ivory, plastics, wood, and metal. Artal-Isbrand received her MA in Art Conservation from the Buffalo State Art Conservation Program in 1994. After completing graduate and post-graduate internships at the Walters Art Museum and the Museum of Fine Arts, Boston, respectively, she joined the Worcester Art Museum in 1996. Major projects that Artal-Isbrand has overseen include the conservation of Roman mosaics from Antioch; the conservation of Paul Revere silver; and the conservation of ancient Greek, Chinese, and Japanese ceramics. Having a special interest in ancient Mediterranean archaeological conservation, Artal-Isbrand has served as conservator on several excavations in Turkey. She has owned a private conservation practice since 2000. Address: Worcester Art Museum, 55 Salisbury St., Worcester, MA 01609. E-mail: paulaartal-isbrand@worcesterart.org or paaris@gmail.com