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## Caring for Platinum and Palladium Prints: Storage and Display

**Jennifer Jae Gutierrez**

The in-depth research summarized in this volume provides new information about the material characteristics of platinum and palladium prints. It also reveals areas in which further investigation is needed to explain the causes of deterioration in these "permanent" processes. This essay is informed by this new knowledge as well as by the conservation community's emphasis on practical and sustainable approaches to preventive conservation. The overview that follows provides recommendations for best practices for the storage and display of photographic prints, with special attention to the vulnerabilities of platinum and palladium prints. Though questions remain about the deterioration processes of platinum and palladium prints, the risks associated with making these important photographs accessible can be minimized by applying our collective knowledge to set standards for responsible stewardship.

### The Vulnerabilities of Platinum and Palladium Prints

In his influential 1899 guide to platinum printing, the *Photo-Miniature*'s editor John A. Tennant described the fundamental components of platinum photographs as a metallic platinum image material on a high-quality paper support. Tennant cautioned that while pure platinum metal is inherently stable and resistant to chemically induced changes, prints may be susceptible to deterioration if the photographer should stray from careful working practices:

> Here it should be noted that the absolute permanence or "life" of the print depends upon the simple nature of the image and its support—pure platinum on pure paper. These conditions are imperative. When we depart from them, we create complications which endanger the simplicity of the image, and thus open a way for chemical changes.[1]

While Tennant did not discuss palladium printing, which was not introduced until 1917,[2] his ideas extend to palladium prints as well. Indeed, instrumental analysis of platinum and palladium photographs in numerous collections reveals that very few are composed simply of platinum and/or palladium metal and cellulose.

The process of making a platinum photograph starts with a piece of paper that is sensitized, then exposed, developed, cleared, and finally washed to remove residual processing chemistry. In the same 1899 *Photo-Miniature* article Tennant cited six different paper manufacturers from which ready-sensitized papers could be purchased, and he recommended four different papers for sensitization by the photographer. In his instructive sections on processing methods he cited five formulas for sensitizers, ten formulas for developers, and three formulas for clearing solutions.[3] This single article documents the huge variety of papers and chemical solutions recommended for platinum printing at the end of the nineteenth century. Yet it represents only a small sample set of the diverse range of materials used throughout the history of platinum and palladium printing. The final composition of a platinum or palladium photograph is directly impacted by the chemical compositions of the paper, sensitizer, processing chemicals, and finishing techniques used by the photographer. These complex issues are addressed throughout this volume.

The paper support has often been identified as the most fragile component of a print. When properly processed, the paper supports of platinum and palladium prints should remain in good condition. However, even the high-quality, pure-cellulose papers used

Figure 1. Margrethe Mather, *Judith*, c. 1916–20. Platinum/palladium print, 23.9 × 18.9 cm. Center for Creative Photography, University of Arizona, Tucson, Purchase.

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by platinum paper manufacturers (and photographers who sensitize their own papers) are susceptible to deterioration by extrinsic forces such as light, high levels of temperature and humidity, and atmospheric pollution. Sizing or other organic additives that constitute a paper support, along with coatings and colorants, also influence what components are present in a final print.

Inorganic compounds in both sensitizers and developers were used selectively to impart desired aesthetic characteristics. Mercury compounds in particular were commonly used in the nineteenth and early twentieth centuries to give platinum prints a sepia tonality and reduce the appearance of granularity. Historic literature and recent research show that the use of mercury-salt additives sometimes creates a less-than-stable image that may fade.[4]

The photographer's choice of clearing agents and the thoroughness of clearing and washing also significantly impact the final composition of a photograph. Chalky fillers or clay, found in some papers, can make it inherently difficult to thoroughly remove iron compounds during the clearing and washing process. If incompletely cleared, platinum or palladium prints will contain residual iron compounds that will gradually develop yellow to orange-brown stains in the paper.

It is impossible to identify the material composition of a platinum or palladium photograph through visual examination alone (fig. 1). When possible, nonsampling instrumental analysis is strongly encouraged to provide a better understanding of the photographs being preserved. It remains uncertain whether conservation treatments can safely mitigate the intrinsic weaknesses caused by the presence of residual processing chemicals, including iron and, in some cases, mercury. However, proper storage and display practices will minimize the risk of chemical changes.

## Recommendations for Storage

In planning for the storage and display of photographs, it is important to consider how the environmental conditions affect long-term preservation. The temperature, relative humidity (RH), air quality, and light in the storage environment, along with enclosures and furniture, all impact the longevity of photographs.[5]

### *Environmental Conditions*

Deterioration of platinum and palladium photographs caused by chemical reactions that occur within the materials themselves include image fading and discoloration, stain formation, and embrittlement of the paper support. These undesired chemical changes occur in photographs stored in conditions with elevated temperature and relative humidity. Relative humidity represents the amount of water vapor in the air and, depending on the temperature, determines the amount of water that can be absorbed by objects. When moisture is present, some chemical reactions occur, and as the temperature rises these reactions accelerate. Sustained high humidity can cause not only chemical deterioration but also biodegradation such as mold growth. Extremely high or low humidity levels in a storage environment can cause paper supports to expand or shrink, leading to mechanical deterioration such as cracking, cockling, or curling.[6]

Extensive research conducted by the conservation and international standards communities confirms that cooler temperatures, moderately dry RH levels, and low light levels retard the processes of chemical and mechanical deterioration.[7] Dedicated cold-temperature RH-controlled vaults (50–62°F [12–17°C] or cooler; ~35–40% RH) are recommended for the long-term storage of photographs, but they are expensive to install and maintain.[8] Cold vaults without RH control are simpler and less expensive

Table 1 | Preservation Impact of Specific Temperature and RH Combinations

| Temperature °F/°C | % RH | Preservation Index | Rate of Change |
|---|---|---|---|
| 80/27 | 60 | 15 | Very fast change |
| 70/21 | 50 | 39 | Ambient/office/common display conditions |
| 70/21 | 40 | 51 | Change reduced slightly from ambient |
| 60/16 | 50 | 72 | Change reduced slightly further from ambient |
| 60/16 | 40 | 96 | Change 2½ times slower than ambient |
| 50/10 | 35 | 244 | Change 6 times slower than ambient |
| 35/2 | 35 | 863 | Change greatly curtailed; life expectancy 22 times greater than ambient |

but must be used in conjunction with sealed storage cabinetry or microclimate housings.[9]

To determine the best environmental conditions an institution can achieve if cold storage is not an option, caretakers must understand the nature of the climate in their geographic location, the characteristics of the building envelope, and the capabilities of the mechanical systems.[10] Twenty-first-century concerns about energy consumption and sustainable practices have spurred many roundtables, symposia, and conferences about new approaches to achieving proper preservation environments. The preservation field no longer demands tight, year-round temperature and relative humidity levels. Instead, it acknowledges that temperature and RH can fluctuate within a given range, typically 60–70°F [16–21°C] and 30–55 % RH, with care taken to prevent conditions from drifting above or below those ranges for extended periods of time. Institutions are developing approaches to environmental management that take advantage of seasonal weather patterns in their outdoor environments, such as heating and humidifying less during colder months in temperate climates.[11]

### *Quantifying the Impact of Temperature and Relative Humidity*

The influence of temperature and relative humidity on the life expectancy of collection materials has been quantified by the Image Permanence Institute (IPI). IPI's online preservation tool, the Dew Point Calculator, evaluates the effects of specific temperature and relative humidity combinations based on four types of material decay: chemical decay, the risk of mechanical damage from material expansion and contraction, the potential for mold growth, and the potential for metal corrosion.[12] The Dew Point Calculator's Preservation Index (PI) estimates the overall rate of chemical decay in organic materials as determined by set combinations of temperature and RH values. The higher the PI, the slower the rate of chemical decay.

Table 1 provides comparisons of several potential storage environment conditions for photographic prints, including temperature and relative humidity levels recommended as standards for museum display environments (70°F [21°C], 50% RH). The greatest increase in PI is observed when both temperature and relative humidity are decreased. This comparison demonstrates the overall impact of lowering either temperature or relative humidity, the effects of lowering both, and the importance of cooler temperatures and moderately low relative humidity in improving overall longevity of collection materials in storage.

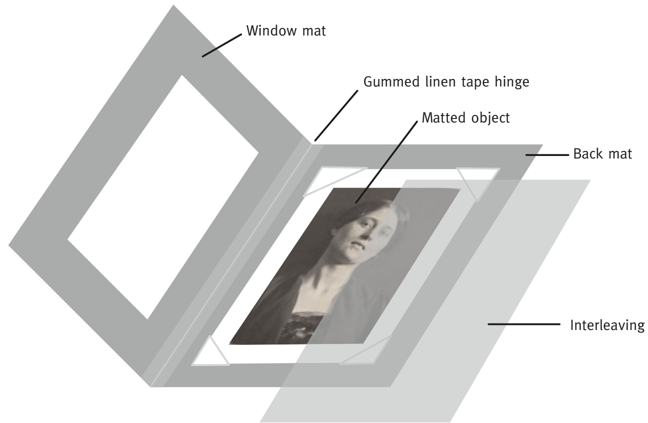


Figure 2. Elements of a mat board package.

### *Individual Enclosures*

Along with establishing suitable and sustainable environmental conditions, it is essential that storage enclosures and containers for photographs are strategically selected.[13] Individual enclosures are typically in direct contact with a print and protect it from physical damage, such as abrasion. Given their proximity to a print, the materials selected for individual enclosures must be of the highest quality and chemically inert. The International Organization for Standardization (ISO) has published several standards relating to modern photographic materials, but none are written specifically for platinum and palladium prints. Regardless of photographic process, all materials used for individual enclosures should pass the Photographic Activity Test (PAT) and meet enclosure specifications as described in the ISO standards.[14] These specifications recommend a high–alpha cellulose, lignin-free paper, and several inert plastics, such as polyester and high-density polyethylene. Certain materials, such as pressure-sensitive tapes, should not be used in close or direct proximity to photographs. Substandard adhesives such as rubber cement should be avoided altogether.

The ideal individual enclosure for storage of platinum and palladium prints in museum collections is a museum-quality mat board package consisting of a back mat behind the print, a window mat on top, and a sheet of soft, smooth, lightweight interleaving paper between the print and the window mat (fig. 2). The back mat provides rigid support, and the window mat elevates adjacent objects (or frame glazing) from being in direct contact with the print's surface. Interleaving paper protects the print surface in storage and during handling.

When possible, prints should be secured to back mats using nonadhesive techniques such as paper corners and folded strips.[15] The density and hygroscopic attributes of a mat board package also provide protection from brief instances of high relative humidity in a photograph's environment. Boxes, flat file drawers, and frames will further retard ingress of moisture and provide another layer of protection from humidity changes and gaseous pollutants. Mat boards and containers made from paperboard containing pollutant scavengers (such as activated charcoal and zeolites) can also be helpful in geographic locations with high levels of gaseous pollutants and for prints mounted on acidic or ligneous mounts.

Mounted and unmounted prints in research collections with active use are frequently housed in polyester enclosures, with high-quality, thin, rigid paperboards placed behind the print to minimize flexing and prevent prints from creasing. Folders are also used where individual museum mats are not practical. When a few prints are grouped inside folders, interleaving should be placed between each print.[16] Four-flap paper enclosures or sink mats with added spacers or fillers between the window mat and back mat can be used for prints mounted on thick boards. Albums should be housed in boxes and stored flat. Where evidence of abrasion is present, it may be helpful to interleave album pages so long as the binding is not thereby strained by the additional bulk.

### *Storage Containers*

When stored on open shelving, albums and individual prints within mats or folders benefit from storage in containers, such as rigid paperboard boxes. The storage containers provide protection from dust, light, fluctuations in relative humidity, water leaks, and, to limited degrees, even fire. Like-size prints should be stored together to allow safe stacking, with even weight distribution to reduce the risk of abrasion. In some cases smaller prints may be safely stored on larger works if a rigid paperboard divider protects the objects below. When prints are smaller than their storage container, it is important to provide chemically inert, nonabrasive polyethylene foam blocks or folded archival corrugated board to customize the interior space and prevent prints from shifting in the container.

Dust can accumulate in storage and study room environments, so careful housekeeping practices must include regular cleaning. Wiping the exterior of a box each time it is served to a researcher helps to prevent dust and grime from transferring to hands and ultimately to a print's enclosure or, worse, to its surface. Gloves are meant to help protect the prints, but if they become soiled or reduce dexterity, it may be safer to handle collection materials with clean hands.

### *Prioritizing Storage Resources*

The benefits of storing platinum and palladium photographs in inert housing materials are indisputable. However, this practice cannot independently prevent deterioration caused by poor environmental conditions. Proper and sustainable relative humidity and temperature conditions must be maintained in the storage environment to prevent chemical changes of image material and mechanical changes to paper supports.

If an institution can invest only in improving the environmental conditions in storerooms or in replacing storage enclosures, the preservation community has long advocated for improving environmental conditions because the long-term gain for every object in that environment is much greater. Institutions that struggle to maintain ideal long-term temperature and relative humidity levels may consider storing their platinum and palladium prints in sealed, vapor-proof packages (described in greater detail below) to provide additional protection from moisture-induced changes.[17]

## Recommendations for Display

Questions about the safest conditions for exhibiting photographic prints have lingered for decades in the collective consciousness of the field of photograph conservation. Since the early 1980s conservators observing visual changes in photographs caused by display have advocated for more conservative light levels and shorter exhibition durations. The metallic image material in platinum and palladium prints should not fade due to light exposure, but applied color or decorative mounts may be susceptible to fading when displayed, and the paper support may darken when exposed to light.

### *Lighting*

In general, two categories of light must be monitored and controlled in exhibition spaces: artificial and daylight. Both sources can emit not only visible radiation but also invisible infrared (IR) and ultraviolet (UV) radiation. Infrared radiation is a source of heat and has the potential to accelerate the rate of chemical deterioration processes. The heat from IR may not only increase the temperature within a frame or display case but also influence the RH within. Ultraviolet radiation is highly energetic and a potential source of deterioration. Both IR and UV radiation should be reduced as much as possible or completely eliminated in lighting systems used to display platinum and palladium photographs.[18] Exposure to visible light, which is also highly energetic, should also be minimized.


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The type and intensity of light (visible, IR, and UV) and the duration of exposure must be carefully controlled and monitored to limit the potential for light-induced damage to photographs. The degree of light exposure, also referred to as illuminance, is dependent on the intensity of the light source and the distance between the light source and the artwork on display. The intensity of light that illuminates a photograph can be measured and expressed in either foot-candles (FC) or lux. Overall exposure during a display period is sometimes referred to as a total light dose (TLD), foot-candle hours (FCH), or lux hours (1 FC = 11 lux). The TLD or FCH is the product of illuminance multiplied by duration of exposure. For example, a 3 month (12 week) photograph exhibition lit at 5 foot-candles in a museum open 5 days a week, 10 hours per day, will expose the objects on display to a total of 3000 FCH (5 days/wk × 10 hr/day × 12 wks × 5 FC).

The quality and intensity of exhibition lighting can be controlled by the type of light source, the use of filters in conjunction with the light source, and the use of protective glazing in a frame package (fig. 3) or display case. Traditional museum light sources, including incandescent and halogen lamps, must be filtered to eliminate the IR and UV components of radiation output. UV-filtering acrylic glazing can dramatically reduce or eliminate the risks of deterioration caused by UV radiation by preventing it from entering the frame package. When light-emitting diode (LED) lighting systems were first introduced, few museum-quality options were available. However, the variety of lamps available has evolved to include those with zero-UV output. Studies of the effects of LED light sources on fragile materials have led many museums to convert to this energy-efficient and sustainable light source for galleries.[19]

Exhibition design may also be influenced by display lighting. Some institutions have found it advantageous to select dark wall paint for exhibitions that are lit at low light levels. The contrast creates the illusion of a brighter space and may also assist viewers in adjusting their vision to lower light levels.

### *Measuring the Impact of Light*

A range of illuminance between 5 FC and 10 FC (55–110 lux), limited by shorter duration (or display at 3 FC) where media are fugitive, has long been a museum standard for the display of cellulosic materials such as photographs, works of art on paper, and textiles.[20] Microfade testing is a preventive monitoring technique used to predict the potential impact of display lighting on museum objects. It measures color changes that include both fading and darkening.[21]

The Blue Wool Standards are an internationally recognized reference for the light stability of objects. These standards use the predictable fading of dyed blue wool textiles to measure and compare various objects' sensitivity to light exposure (Blue Wool 1 is extremely sensitive to light and Blue Wool 7 is extremely stable to light).[22] Microfade measurements performed at the National Gallery of Art on platinum prints in good condition have generally shown that most exhibit a lightfastness between Blue Wool 2 and 3, findings that suggest display at 5 FC for 3 months should not cause measureable or noticeable fading of the image or darkening of the paper support. Some prints exhibited a lightfastness greater than Blue Wool 3, which might allow for a somewhat longer display period (6 months) and/or display at a slightly higher light level (10 FC for 3 months) before any change in the paper support becomes visible.[23]

### *Temperature and Relative Humidity*

The temperature of exhibition spaces cannot be dictated entirely by the needs of the objects on display. Most are inherently warmer than storage environments because visitor comfort must be considered. A typical range for museum exhibition spaces is 70–75°F (21–24°C), which

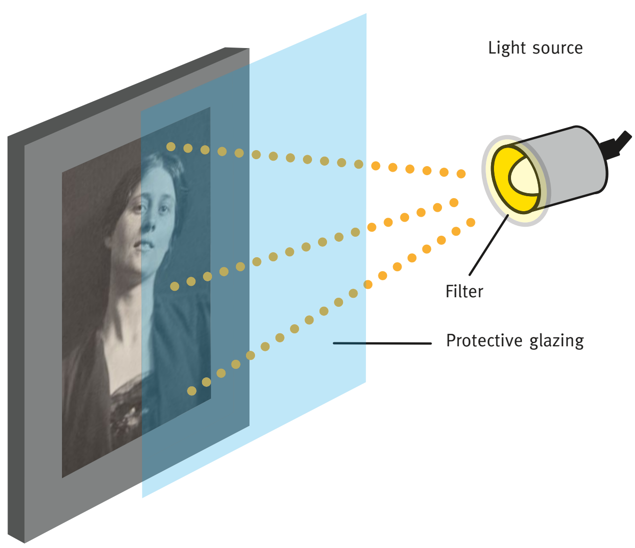


Figure 3. Controlling the quality of exhibition lighting. The quality of light used to illuminate prints on display can be adjusted (1) at the source, by controlling type and intensity; (2) by using filters; or (3) by providing protective glazing in frame packages.

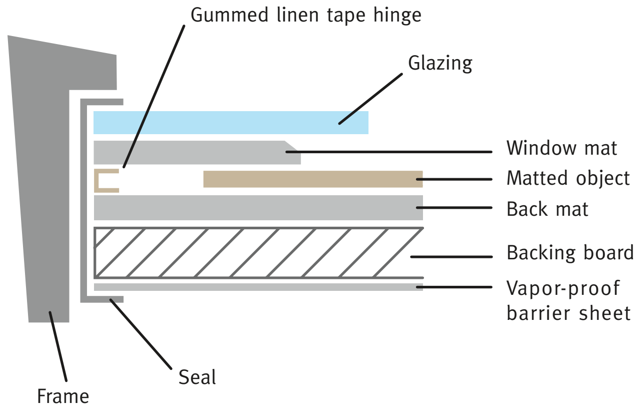


Figure 4. Elements of a basic sealed frame package. The arrangement of a sealed package's components may vary according to the specific needs and presentation of a given object to provide different levels of climate and physical protection.

is acceptable for short exhibition periods as long as the temperature is not allowed to increase significantly.

Relative humidity levels are less discernible by visitors, and therefore it is possible to make RH in display environments closer to that of the storage environment, but 50% RH is a common exhibition set point. To ensure a stable RH for prints, microenvironments can be created by preparing sealed packages for display. Cases used to display unprotected prints and albums can also be designed with reservoirs to accommodate silica gel buffers to control RH and zeolites or activated charcoal to scavenge pollutants.

### *Sealed Frame Packages*

In addition to matting platinum and palladium photographs, institutions may opt to create sealed packages for display, travel, and storage. There are multiple solutions for making acceptable sealed packages that help to provide a barrier against short-term fluctuations in environmental humidity and maintain a constant moisture content within.[24] A sealed package can be placed in an exhibition frame for display purposes or left unframed for added protection in storage. The guidelines provided earlier in this essay for selecting mat board package materials as individual enclosures should also be applied to mat board packages created for framing.

The fundamental components of a frame package include: (1) glazing, (2) a matted object within a window mat supported by a back mat, (3) a backing board, (4) a vapor-proof barrier sheet (if not supplied by a plastic backing board), (5) a seal, and (6) a frame (fig. 4). When the first four elements are stacked in that order from top to bottom and sealed together along all four edges with archival pressure-sensitive plastic tape or a metallic foil laminate heat set to the glazing, a sealed package is created. A sealed package can be placed in a frame for display or left unframed for added protection from high relative humidity in storage. A sealed package cannot provide protection from fluctuating and extreme temperatures. A cobalt dichloride or cobalt-free RH-indicator card can be placed inside a sealed package with a translucent polypropylene or acrylic backing board to allow the RH to be monitored without opening the package.

### *Exhibition Cases*

It is common for photographic prints to be displayed in exhibition cases. The selection of materials used to construct cases requires the same considerations as selecting long-term storage and display framing materials. As much as possible, the materials used to construct interior case components should emit zero-volatile organic compounds (VOCs) and pass the Photographic Activity Test. Examples of acceptable construction materials include glass, acrylic, anodized or powder-coated metals, high-density polyethylene (HDPE), aluminum/polyolefin laminates (rigid panels and flexible films), and untreated or inert paper and fabrics. Wood or wood products (such as plywood) used for interior surfaces should be sealed with a vapor barrier, such as an aluminum/polyolefin laminate film. Low-VOC latex paint does not provide a barrier to wood and is not recommended for use on the internal case compartment for the display of sensitive objects. Low-VOC paint is recommended for use on gallery walls and the exterior elements of display cases, and because it may take longer to cure than other paints, it should be allowed to cure at least two weeks in advance of installation to permit complete drying and off-gassing of water vapor.

## Conclusions

The conservation community strives to preserve cultural heritage for as many future generations as possible, but it is impossible to completely halt the aging of collection materials. Therefore, it is the responsibility of collections caretakers to minimize the rate of change to the best of their ability while providing opportunities for access. By coalescing our improved material understanding of platinum and palladium prints with twenty-first-century advancements in preventive conservation, photograph conservators, conservation scientists, exhibition designers, and curators can work together to carefully store and display platinum and palladium prints so they remain in good condition for many generations to come.

## Acknowledgments

I would like to thank my colleagues at the National Gallery of Art, Constance McCabe, Sarah S. Wagner, and Christopher Maines, for their assistance in the preparation of this essay. I also want to acknowledge the encouragement and support of my colleagues at the Center for Creative Photography, particularly Rebecca Senf, Tim Mosman, and Molly Kalkstein.

### *Notes*

1. [Tennant] 1899, 321.

2. "Palladiotype" 1917. Although the Platinotype Company introduced Palladiotype in 1917, other companies sporadically manufactured palladium and platinum-palladium papers as early as the 1890s. See Sarah S. Wagner, "Manufactured Platinum and *Faux Platinum* Papers, 1880s–1920s," in this volume.

3. [Tennant] 1899.

4. See Matthew L. Clarke, "Characterization, Degradation, and Analysis of Platinum and Palladium Prints," in this volume.

5. ISO 18920:2011, Imaging Materials—Reflection Prints—Storage Practices; ISO 18916:2007, Imaging Materials—Processed Imaging Materials—Photographic Activity Test for Enclosure Materials, www.iso.org.

6. Nishimura 2007.

7. Reilly et al. 1995.

8. Daffner 2003; Wagner 2007.

9. Voellinger and Wagner 2009a; Voellinger and Wagner 2009b.

10. Ford et al. 2012.

11. Linden 2012.

12. Dew Point Calculator, www.dpcalc.org/.

13. Lavédrine 2003.

14. ISO 18916:2007; ISO 18902:2013, Imaging Materials—Processed Imaging Materials—Albums, Framing and Storage Materials, www.iso.org.

15. See Jennifer McGlinchey Sexton and Jennifer Jae Gutierrez, "Nonadhesive Mounting Methods for Photographic Prints," in this volume.

16. See Jennifer K. Herrmann et al., "The Phenomenon of Platinum Print 'Image Transfer' to Adjacent Papers," in this volume.

17. Phibbs 2001.

18. Lavédrine 2003.

19. Weintraub 2010.

20. Wagner et al. 2001.

21. See Christopher A. Maines, "Microfade Testing to Predict Change," in this volume.

22. Cox-Crews 1989.

23. ISO 105:B08 1995, Textiles—Tests for Colour Fastness—Part B08: Quality Control of Blue Wool Reference Materials 1 to 7, www.iso.org.

24. Phibbs 2005.

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