



A Technical Study of Paul Strand's Platinum Prints

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I like the word search. I like the word research. I think the artist and the scientist are related in that they both do research, and that if there's no research job there's not much of a scientist or an artist.

— Paul Strand, 1973

Figure 1. Paul Strand, *Driftwood*, 1927. Platinum print, 25.2 × 20.2 cm. National Gallery of Art, Southwestern Bell Corporation, Paul Strand Collection, 1991.216.10a. ©Aperture Foundation Inc., Paul Strand Archive. This print is counter-mounted to another platinum print with dry mount tissue, a common finishing technique used to prevent prints from curling.

The preeminent modern American photographer Paul Strand (1890–1976) masterfully employed the platinum process from the 1910s through the 1930s to create many of his most striking photographs (fig. 1). Exploring multiple genres such as portraiture, landscapes, still lifes, and abstractions, Strand's images document the people and places of many locations, including New York City, the American Southwest, Mexico, Italy, and Africa. The first major exhibition of Strand's work was held in 1916 at Alfred Stieglitz's (1864–1946) Little Galleries of the Photo-Secession, known by then simply as "291." Stieglitz championed Strand (fig. 2), describing his art as "the direct expression of today" in the last issue of his periodical, *Camera Work*, which was devoted exclusively to Strand's photographs.¹

Strand's photographs are now found in the collections of many world-class museums. Major exhibitions of his work have been organized by the Museum of Modern Art in 1945, the National Gallery of Art in 1990, the Metropolitan Museum of Art in 1998, and the Philadelphia Museum of Art in 1971 and 2014. After Strand's death in 1976, his widow, Hazel Kingsbury Strand, and her associates created the Paul Strand Foundation. In

1983, the organization merged with the Aperture Foundation and became known as the Paul Strand Archive. Initially, the archive was the chief repository of Strand's negatives, prints, photographic equipment, library, and memorabilia. The majority of Strand's correspondence and other archival documents are housed at the Center for Creative Photography, University of Arizona. In 2010, the Philadelphia Museum of Art acquired the core print collection from the Paul Strand Archive at the Aperture Foundation, making it the owner of the most comprehensive collection of Strand's work.

The Paul Strand Collection at the National Gallery of Art currently consists of ninety-eight notable works from throughout the photographer's career, including twenty-one platinum prints (four of them work prints counter-mounted to the verso of exhibition prints). The National Gallery contains examples of Strand's platinum prints of New York, such as *People, Streets of New York, 83rd and West End Avenue* (1916) and views of New Mexico and Mexico from the 1930s.

While Strand's early platinum prints have the familiar matte appearance of a typical platinum print, with its platinum image particles dispersed through the upper layers of a plain uncoated paper, many of his prints from the 1920s and 1930s do not fit this description.² Strand's post-World



Figure 2. Alfred Stieglitz, *Paul Strand*, 1919. Palladium print, 25.2 × 20.2 cm. National Gallery of Art, Alfred Stieglitz Collection, 1949.3.411. ©Aperture Foundation Inc., Paul Strand Archive.



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Figure 3. Paul Strand, *Boy, Hidalgo*, 1933. Platinum print, 14.6 × 11.6 cm. National Gallery of Art, Southwestern Bell Corporation Paul Strand Collection, 1991.216.28. ©Aperture Foundation Inc., Paul Strand Archive.

3a. Detail, normal light, showing yellow mottled staining caused by the presence of the coating.



3a

3b. Detail, specular light, showing the sheen of the Japine surface and an area of abrasion on the knee.



3b

3c. Detail, UV fluorescence, showing yellow fluorescence corresponding to the coating.

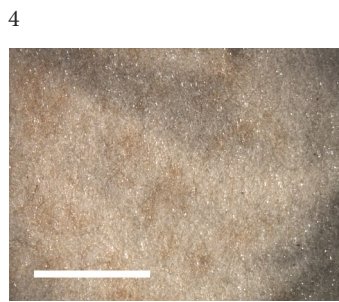


3c



Figure 4. Paul Strand, *Man with Sombrero, Mexico*, 1933. Platinum print, 14.8 × 11.9 cm. National Gallery of Art, Southwestern Bell Corporation Paul Strand Collection, 1991.216.30. ©Aperture Foundation Inc., Paul Strand Archive.

4a. Photomicrograph detail, showing yellow mottled staining caused by the coating. Scale bar = 2 mm.



4

4a

War I platinum prints have deep rich blacks and a noticeable surface sheen, uncharacteristic of “typical” platinum prints. It is therefore common for Strand’s platinum prints to be misidentified as gelatin silver prints.

Speculations from authors and experts on Strand’s work regarding Strand’s use of chemical additives, toners, coatings, and other modifiers to achieve the exact look he desired, combined with observations of deterioration of Strand’s platinum prints, including surface cracking and staining, make it difficult to know which attributes are deliberate aesthetic choices and which are signs of aging. This technical study was initiated in response to questions and observations regarding the unconventional appearance of Strand’s post-World War I platinum prints and issues concerning their condition. Concentrating on Strand’s preferred materials, working methods, and the aesthetic concerns driving the decisions he made while creating his platinum prints, this study sought to gain knowledge and identify trends relating to the condition issues observed in his prints and to develop strategies for their preservation, exhibition, and treatment.

Technical Study

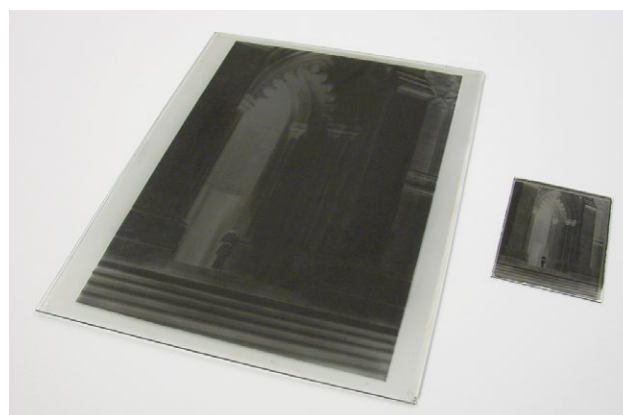
This research project began with a review of primary documents and secondary literature regarding Strand’s working methods and materials, including archival records in the collections of the Center for Creative Photography, Paul Strand Archive at the Aperture Foundation, the Museum of Modern Art Archives, the Archives of American Art, and the Frick Art Reference Library Archives. Richard

Benson, a photographer and master printer who worked for Strand and the Aperture Foundation, was interviewed about his relationship with Strand and his knowledge of Strand's platinum printing preferences.³

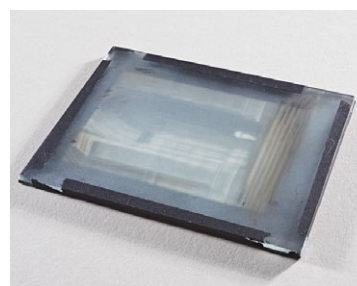
The technical study continued with examination of Strand's platinum prints in the National Gallery of Art, Philadelphia Museum of Art, Museum of Fine Arts, Boston, Paul Strand Archive at the Aperture Foundation, and Center for Creative Photography. In-depth visual examination, written and photographic documentation, and scientific analysis was conducted on selected Strand photographs (platinum, palladium, Satista, and gelatin silver prints) in the National Gallery collection. A Filemaker Pro database was created to organize the data, images, and reports generated through examination, documentation, and analysis and to track the progress of the project. In-depth photographic documentation of the prints included digital capture under a variety of standardized lighting conditions (normal, raking, specular, and ultraviolet), and photomicrographs created with a stereo-binocular microscope (figs. 3, 4). Selected prints were analyzed to identify the image metals, coatings, and other components. X-ray fluorescence spectroscopy (XRF) analysis was conducted on twenty-five prints in the National Gallery collection and twenty-eight prints at the Center for Creative Photography. Additional analysis of select National Gallery prints included attenuated total reflection–Fourier transform infrared spectroscopy (ATR-FTIR), scanning electron microscopy (SEM), microfadeometry, and microscopy for fiber identification. Together, these examination and analysis techniques yielded a wealth of new information regarding Strand's platinum prints.

Strand's Darkroom Practices

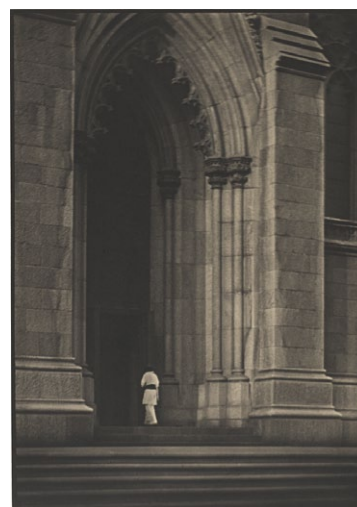
Strand felt strongly that the photographer belonged in the darkroom. He stated, "In the darkroom and making the prints themselves, that's the photographer's job. . . . Anybody who gives up the responsibility and the pleasure and the excitement of solving the technical problems given by any particular medium is a loser and the work will be less good."⁴ Strand was instructed in the basics of darkroom practice while studying as a 17-year-old with Lewis Hine (1874–1940) at the Ethical Culture School in New York City. He gained the majority of his technical photographic skills, however, from fellow members of the Camera Club of New York.⁵ Strand made his platinum prints in shared darkrooms and temporary ones when he was traveling. He did not have his own permanent darkroom until the late 1950s at his home in Orgeval, France, at which point he was no longer making platinum prints.



5a



5b



5c

Figure 5. Paul Strand, *St. Patrick's Cathedral, New York*, 1915. ©Aperture Foundation Inc., Paul Strand Archive.

5a right. Silver gelatin glass-plate negative (created in camera), 10.8 × 8.3 cm. Paul Strand Archive. 5a left. Silver gelatin glass-plate negative (enlarged), 35.6 × 27.9 cm. Paul Strand Archive.

5b. Silver gelatin glass-plate positive (created as interpositive), 10.8 × 8.3 cm. Paul Strand Collection, Philadelphia Museum of Art.

5c. Platinum print, 33.3 × 23.7 cm. Paul Strand Collection, Philadelphia Museum of Art, partial and promised gift of Marguerite and Gerry Lenfest, 2009. 2009-160-438.

Strand made his platinum prints by contact printing. In the 1910s, he primarily created enlarged negatives to make platinum prints in larger dimensions than his original, in-camera negatives. He contact-printed the negatives onto gelatin glass plates to create interpositives, or lantern slides, of the same dimensions. He then projected the interpositives onto larger gelatin glass plates to create enlarged negatives, from which he made contact prints. A complete set of the original negative, lantern slide, and enlarged negative used to create the platinum print *St. Patrick's Cathedral, New York* can be seen in figure 5. Many of Strand's lantern slides have a separate piece of ground glass bound with

black paper tape to the lantern slide. Strand used graphite pencil to apply retouching directly to the lantern slides or the ground glass. Additional retouching sometimes appears on the enlarged glass-plate negatives as well.

Strand typically made one or two platinum prints from his best negatives and did not focus on making perfectly matched multiples. There was no great demand in the market for multiple original prints at the time, and platinum paper was expensive, so it was not financially practical to make multiple prints.⁶ He occasionally reprinted earlier negatives at later dates, often in gelatin silver and/or photogravure. In 1941, Strand stated that 95% of his work existed as single prints on platinum paper.⁷ Despite his distinction, by the time he was in his 60s Strand had apparently sold only about ten prints to private collectors.⁸

In her 1978 dissertation, “Paul Strand: The Early Years, 1910–1932,” Naomi Rosenblum explained that “Strand regarded the photographic print as unique artifact” and

the result of an experiment with materials and ideas and suggested that duplication, the production of identical prints, should not be demanded of the photographer any more than a scientist is expected to repeat experiments once he has solved a problem. . . . This conception allowed the photographer, if he wished, to make additional prints in which the expressive content might be altered by changes in contrast, tonality, paper surface, and size.⁹



Figure 6. Paul Strand, *Panama-Pacific Exposition, San Francisco*, 1915. Platinum print, 25.4 × 32.7 cm. National Gallery of Art, Patrons' Permanent Fund, 1995.36.113. ©Aperture Foundation Inc., Paul Strand Archive.



Figure 7. Paul Strand, *Woman Carrying Child*, c. 1915. Platinum print, 32.07 × 24.13 cm. The Nelson-Atkins Museum of Art, Gift of Hallmark Cards, Inc., 2005.27.4383. ©Aperture Foundation Inc., Paul Strand Archive.

Strand's Platinum Papers

Strand had very particular preferences in photographic papers, and once he identified a paper he liked, he often used it until its manufacture ceased. Three main criteria influenced his paper selections: surface sheen, image tone, and the maximum density it could achieve. Throughout most of his career he was obsessed with achieving deeply saturated blacks and the perfect semigloss sheen. As Richard Benson explained, “Throughout all the years of his long working life only one ideal surface was imagined, and he used anything at hand to achieve it.”¹⁰

Strand appreciated the long tonal scale and permanence offered by platinum papers. He used commercially manufactured platinum papers from the early 1900s through to the end of their production in 1937.¹¹ He experimented with hand-sensitizing his own platinum paper but found the results to be unsatisfactory.¹² Therefore, he predominantly used papers that had been sensitized by the manufacturer. Strand may have used Eastman Kodak platinum papers prior to World War I, when Kodak ceased producing platinum products.¹³ He began ordering Platinotype Company platinum papers from Willis & Clements sometime after the conclusion of World War I in 1918.

Categorizing Strand's Prints

The research and analysis carried out for this technical study suggest that Paul Strand's platinum prints essentially fall into five potential categories:

1. platinum prints with mercury and lead on varied paper supports
2. platinum prints with lead on varied paper supports
3. platinum prints with lead and a trace of palladium on Japine paper
4. gold-toned platinum prints
5. blue-black platinum prints.

Category 1: Platinum Prints with Mercury and Lead on Varied Paper Supports

Platinum prints in this category were made by Strand early in his career, prior to the end of World War I. An example is *Panama-Pacific Exposition, San Francisco* (fig. 6). XRF analysis shows that the image metals for the prints in this category consist of platinum and mercury. A small amount of lead is present in these prints but does not track with the image density. Their surface appearances could be described as typical for platinum prints: soft, velvety images on fibrous matte papers in a variety of surface textures. Some prints from this category are printed on highly textured papers, whereas others, including *Panama-Pacific Exposition, San Francisco*, are on fairly smooth papers. None of the prints examined that fall within this category appear to have surface coatings.

Since Strand used manufactured papers, it is possible that the mercury found in these prints may have been added to the sensitizer by the manufacturer. However, Strand described the print, *Woman Carrying Child* (fig. 7) as having been made with a "big dose of mercury in a warm solution,"¹⁴ a statement which suggests that he both added a mercury salt to his developer and manipulated the temperature of his developer to adjust the print's image tone.

Category 2: Platinum Prints with Lead on Varied Paper Supports

Platinum prints from the second category are also from Strand's early work, made prior to World War I. The only difference between category 1 and category 2 is that the prints in category 2 have no mercury present in the image material, as was confirmed by XRF analysis. One example of a print from this

category is *People, Streets of New York, 83rd and West End Avenue* (fig. 8).

Category 3: Platinum Prints with Lead and a Trace of Palladium on Japine Paper

The platinum prints that fit into this category are on Japine Platinotype, a proprietary paper manufactured by the Platinotype Company.¹⁵ Japine was Strand's favorite platinum paper, and he used it nearly exclusively for his platinum printing from the 1920s to 1937, when the Platinotype Company ceased its production. Strand saw Japine Platinotype papers as essential to achieving the deep blacks and semigloss surface he desired. The paper played such an important role in Strand's work that it was described in detail in the original text panels for the Museum of Modern Art exhibition, *Paul Strand: Photographs, 1915-1945*, organized by Nancy Newhall in 1945. The exhibition panels explicitly identified platinum prints as Japine and described the paper in detail as a "surface manufactured by Willis & Clements, in which the paper fibers are fused by sulphuric acid" that provided a surface coming nearest to Strand's "ideal invisible smoothness."¹⁶ Chemical parchmentization imparts the Japine papers with a smooth surface and subtle sheen that allows for richer saturated blacks to be achieved.¹⁷

Japine prints can be visually identified by the characteristic appearance of the parchmentized surface. The paper fibers of Japine prints are not clearly visible under magnification, and the image material does not rest within clearly

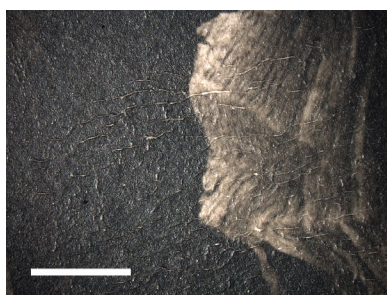


Figure 8. Paul Strand, *People, Streets of New York, 83rd and West End Avenue*, 1916. Platinum print, 25 × 33.7 cm. National Gallery of Art, Patrons' Permanent Fund, 1990.85.1. ©Aperture Foundation Inc., Paul Strand Archive.



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Figure 9. Paul Strand, *Driftwood, Maine*, 1928. Platinum print, 25.6 × 20.3 cm. National Gallery of Art, Southwestern Bell Corporation, Paul Strand Collection, 1991.216.15. ©Aperture Foundation Inc., Paul Strand Archive.



9a

9a. Photomicrograph detail, showing characteristic Japine surface with cracking. Scale bar = 3 mm.

defined paper fibers, as it would in a “typical” platinum print (fig. 9). Cracking of the parchmented surface is also a common characteristic that may sometimes be used as an aid for identification. Spectra obtained through ATR-FTIR analysis can be helpful in differentiating among gelatin silver papers, acid-modified papers such as Japine, and unmodified papers such as Platinotype KK.¹⁸ ATR-FTIR analysis performed during this study confirmed the presence of the parchmented Japine surface of several Strand prints.

Double-Sensitized Japine Platinum Papers

Several accounts indicate that Strand convinced the Platinotype Company to provide him with a special double-

sensitized Japine platinum paper. According to Beaumont Newhall, “Not content with the quality of Japine platinum paper . . . [Strand] persuaded the manufacturer . . . to produce double coated paper, after demonstrating to them the improved results which paper so prepared himself could produce.”¹⁹ Calvin Tomkins observed, “Strand experimented with ways to deepen and enrich the tones even further, adding to the prepared paper a platinum emulsion he had made himself.”²⁰ Richard Benson recalled Strand explaining that he had “brushed a platinum coating over a store-bought platinum paper so that he could make a print and send it to the company that made the paper to show them that their platinum content was too low.”²¹ Naomi Rosenblum further stated, “During the early twenties he recoated the English platinum stock with additional salts in order to prevent the paper from solarizing, until he was able to convince the Platinotype Company to add more metal salts to their product.”²² In a 1971 interview Strand himself explained the incident in great detail:

Years ago, when I made almost only platinum prints, there was a period after the World War I when the Platinotype Company in London were the only makers of platinum papers in the world. Their paper was good but it always solarized in the blacks. If you printed it too far it reversed and there was no way of overcoming that thing at all. At that time I was trying to make some platinum papers of my own, not very successfully. . . . I got the idea that it might be interesting to take a piece of this paper that solarized so easily from London and put some of my platinum sensitizing solution and paint it over the surface of their paper and mix it all together and let it dry rapidly, as it must, and find out whether . . . the solarization wasn't due to the fact that there wasn't enough platinum in the paper. So I tried it and I made this print from my recoated paper and I gave it a very thorough exposure in the sun and I got the most terrific beautiful blacks imaginable and no solarization. No matter how long you printed it, it would get blacker and blacker and blacker but no solarization.²³

“Solarization,” also described as “bronzing” or “reversal,” is a phenomenon in which the areas in a print that should be the blackest high-density areas reverse and appear lighter and browner in tone. To better understand Strand's reasoning for wanting the Platinotype Company to produce double-sensitized Japine paper to avoid solarization, the authors made sample platinum prints on

Figure 10. Platinum print step-tablets on vegetable parchment paper made by the Photograph Conservation Department, National Gallery of Art. (a) Single-sensitized and preconditioned to 15% RH prior to exposure. (b) Double-sensitized and preconditioned to 15% RH prior to exposure. (c) Single-sensitized and preconditioned to 30% RH prior to exposure. (d) Double-sensitized and preconditioned to 30% RH prior to exposure. (e) Single-sensitized and preconditioned to 85% RH prior to exposure. (f) Double-sensitized and preconditioned to 85% prior to exposure. When the single-sensitized paper is equilibrated to 15% RH (a), the print definitely displays solarization, whereas when the double-sensitized paper is equilibrated to 15% RH (b), the print does not. When the papers were equilibrated to 30% RH before exposure (c and d), the difference between the prints was not as clear, and at 85% RH (e and f) there is virtually no visible difference between the prints in the maximum density.

vegetable parchment paper to mimic single- and double-sensitized Japine Platinotype prints: one set was sensitized once and one set was sensitized, allowed to dry, and sensitized again.²⁴ The sensitized papers were equilibrated to 15% relative humidity (RH), 30% RH, and 85% RH just prior to exposure in contact with a step-tablet negative, and they were then processed in the same way. The results, which are shown in figure 10, suggest that while double-sensitizing the paper provided a viable solution to the problem of solarization, humidifying the single-sensitized papers prior to exposure might have provided another solution.

Strand communicated with the Platinotype Company to express his dissatisfaction with its product and describe the results of his experiments. The company eventually agreed to make a double-sensitized Japine Platinotype paper on the condition that Strand provide additional clients who would pledge to purchase the paper. Strand explained: “Stieglitz ordered some, and Laura Gilpin, the chap at the Frick Museum ordered some, and I ordered paper. This went on until they went out of business. Nobody wanted platinum paper any more and they went out of business in 1937. So for about 5 years we all had a pretty beautiful paper.”²⁵

The “chap at the Frick Museum” was Ira Martin (1886–1960), the chief photographer for the Frick Art Reference Library (FARL) from 1923 through the 1960s. Martin was a student of Clarence White, a member of the Camera Club of New York, the president of the Pictorial Photographers of America from 1927 to 1937, and a fellow consumer of the Platinotype Company’s special double-sensitized Japine platinum paper. In a letter to the Platinotype Company in April 1931, Martin wrote: “Mr. Paul Strand has been to see me several times about improving your paper and would like to say that if you see fit to add more metal with an additional selling price we will welcome the change. . . . Please fill the following

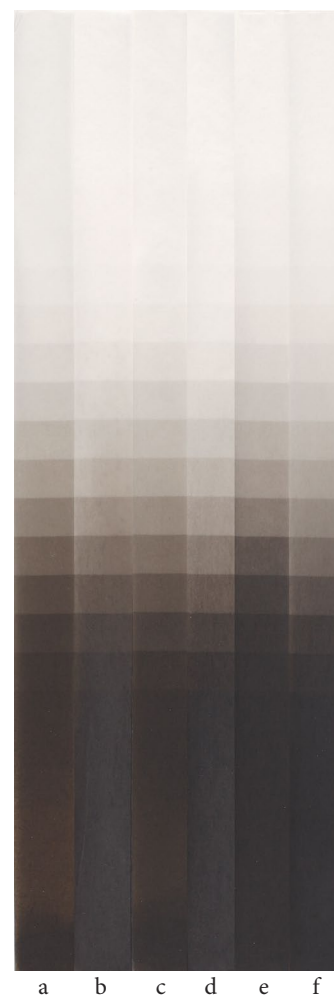
order with the improved emulsion.”²⁶

Indeed, the FARL collection prints from this time period are strikingly similar to Strand’s prints of the same era (see fig. 17a).²⁷ Examination and analysis with ATR-FTIR and XRF of thirty FARL prints donated to the National Gallery for this project identified twenty-three platinum prints on Japine paper, six platinum prints

on unmodified paper, and one gelatin silver print. While small spectral differences were discovered within each category, there is a general similarity between Strand’s and Martin’s prints on Japine Platinotype paper.

Presence of Traces of Palladium

Palladium was detected by XRF in many of the Strand Japine platinum prints from 1919 to 1933, but it was difficult to validate its presence based on these data alone because the peaks in the XRF spectra are very small due to the minute traces of palladium present.²⁸ A very small sample of a non-exhibition-quality print by Strand titled *Adobe Façade, New Mexico*, was donated by Anthony Montoya, former director of the Paul Strand Archive at the Aperture Foundation, to the National Gallery for this project. ATR-FTIR analysis of the sample confirmed it as a Japine platinum print, and scanning electron microscopy–energy dispersive spectroscopy (SEM-EDS) confirmed the presence of a trace of palladium, which was also detected by XRF (fig. 11).²⁹



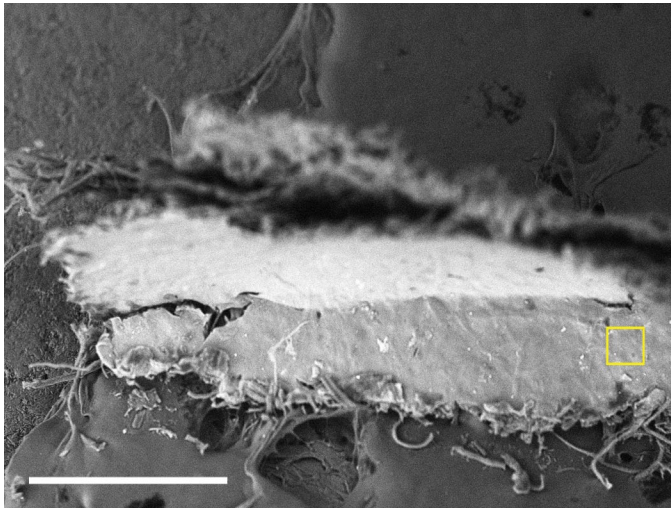
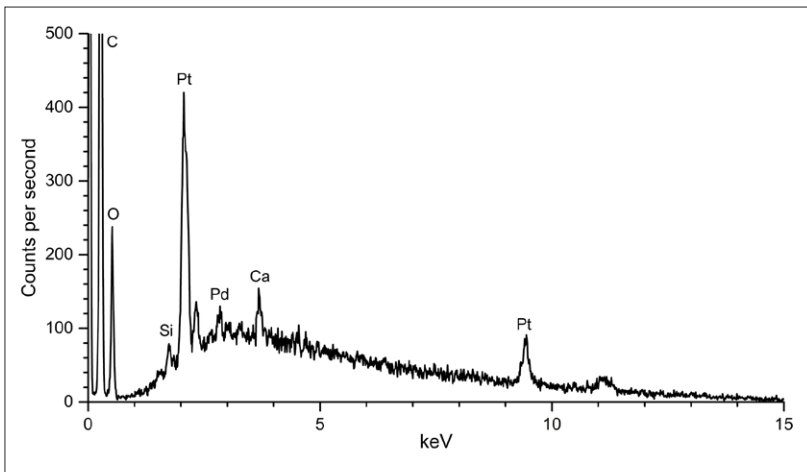


Figure 11. Analytical results for Paul Strand, *Adobe Façade*, New Mexico, c. 1931–32, platinum print. Anthony Montoya personal collection, SW-DET-516 PLAT.

11a. SEM image. Scale bar = 500 μm .

11b. EDS spectrum (from area shown in 11a), showing trace palladium obtained from sample.



11b

Several possibilities may explain the presence of trace palladium in these prints. No positively identified manufacturer's samples of these Japine Platinotype papers were available for study,³⁰ so it was impossible to firmly determine its source. The manufacturer may have added a palladium compound to the sensitizer to achieve a warm black image hue, or palladium may have been a component in the custom sensitizer formulation for the special double-coated Japine Platinotype paper. While the possibility exists that the palladium was introduced through a contaminated developer solution, it is unlikely, as Martin was not known to print in palladium and yet his Japine platinum prints also contain traces of palladium.

Japine and Cracking

Surface cracking is a problem that was identified soon after the Japine surface was introduced and is a feature observed in many of Strand's Japine prints (see fig. 9a). An article in the April 1916 issue of *Photo-Miniature* described Japine as "almost brittle when bone dry and will crack if bent sharply."³¹ Cracking in Japine papers can be caused by a number of factors, including flexing and stor-

age and handling in dry conditions especially if the papers are rolled. Strand noted in 1933 that "once the paper dries out, it is doomed to crack." To inhibit cracking, he suggested removing the Japine paper from the manufacturer's cylindrical metal tin and storing it in a can with a much larger diameter.³²

Category 4: Gold-Toned Platinum Prints

Accounts of Strand's working methods indicate that he sometimes toned his platinum prints with gold. Original wall labels from the Museum of Modern Art's 1945 exhibition identify select prints as "Gold-toned Japine platinum print."³³ According to Tomkins, "Strand experimented with ways to deepen and enrich the tones even further . . . gold-toning it to intensify the blacks."³⁴

Based on this information, it appears likely that this fourth category of Strand's platinum prints may exist. Some prints with inscriptions on the verso suggest that they were gold-toned (fig. 12). However, no print has yet been analytically confirmed to be gold-toned.³⁵

To establish a reference standard for the identification of gold-toned platinum prints, a recipe published by A.W. Dollond in 1894 was used to make test prints.³⁶ Gold-toning is done after the platinum print is fully processed, washed, and dried. The print is first wet out and coated with glycerine, and then a weak solution of gold chloride is applied. The platinum image material acts as a catalyst in the reaction in which gold ions are reduced to metallic gold and the glycerine is oxidized.³⁷ Once the photographer achieves the level of toning desired, the print is placed in an alkaline developer to remove all traces of excess gold chloride; then it is washed and dried. Depending on the extent of toning, the print can undergo subtle changes that intensify the blacks, or the image tone can shift completely to a purple-black (fig. 13). XRF analysis of the sample prints clearly identified the presence of gold in the image (fig. 14).



Figure 12. Paul Strand, *Garden, Iris, Maine*, 1928. Platinum print, 24.3 × 19.2 cm. J. Paul Getty Museum. ©Aperture Foundation Inc., Paul Strand Archive. This print is annotated on the verso, “gold toned.” This is a later annotation, made by someone other than Strand. Analysis by XRF in 2016 revealed that no gold is present in this print.

Category 5: Blue-Black Platinum Prints

Another type of platinum print to which Strand and others have referred is “blue-black” platinum prints. In July 1975 Strand described a print entitled *Winterscape* as a “blue-black platinum print, paper came that way.”³⁸ Montoya believes that only four or five blue-black platinum prints were created by Strand—all c. 1927 images of Maine.³⁹ While references in the historic literature sometimes



Figure 13. Platinum print step-tablets on vegetable parchment paper made by the Photograph Conservation Department, National Gallery of Art. (a) Not toned. (b) Toned with gold.

describe gold-toned platinum prints and blue-black platinum prints interchangeably, it appears that Strand considered these as two distinct categories.⁴⁰ It is possible that the blue-black platinum prints were made on papers manufactured and/or processed differently, but there are no clear visual or chemical signatures to distinguish them from other prints, and no analytical data were discovered during this study to verify the existence of this category.

Coatings

Strand’s obsession with achieving the perfect surface sheen led him to coat many of the prints he made in the 1920s and after. The pre-World War I platinum prints on plain, matte paper were usually “left in their natural matte condition . . . not altered, after the print was processed, by varnishing or waxing.”⁴¹ The majority of the Japanese platinum prints examined during this study were coated. According to Benson, Strand “varnished everything except his very early large platinum prints. To him a print was not acceptable unless it was varnished, so virtually every print was.”⁴² Many of Strand’s post-World War I prints were “invariably varnished to make their surface more transparent If the print was platinum it was varnished to make it shine with almost the luster of a gloss silver print.”⁴³ A 1947 article in *Popular Photography* explained that Strand

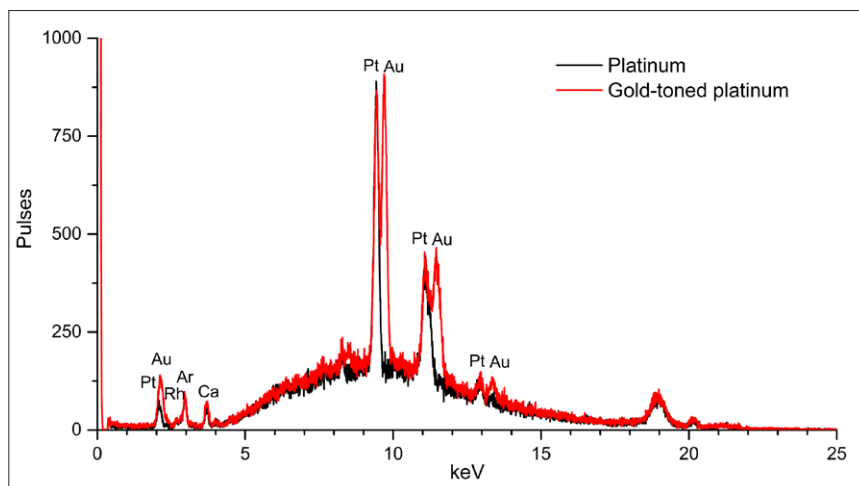


Figure 14. XRF spectra obtained from gold-toned platinum print reference sample created by the Photograph Conservation Department, National Gallery of Art.

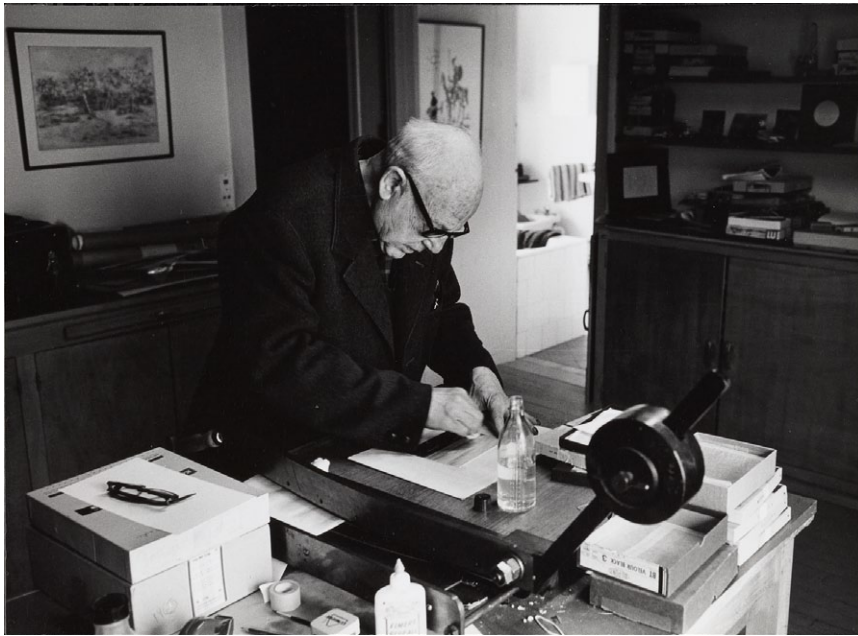


Figure 15. Paolo Gasparini, photograph of Paul Strand varnishing prints, n.d. Courtesy Paul Strand Collection, Center for Creative Photography, University of Arizona, AG 17:38. ©Aperture Foundation Inc., Paul Strand Archive.

“prefers a semi-glossy paper, does no ferrotyping, and finishes his prints with a varnish which adds brilliance and protection” (fig. 15).⁴⁴

Strand’s Varnish Recipe

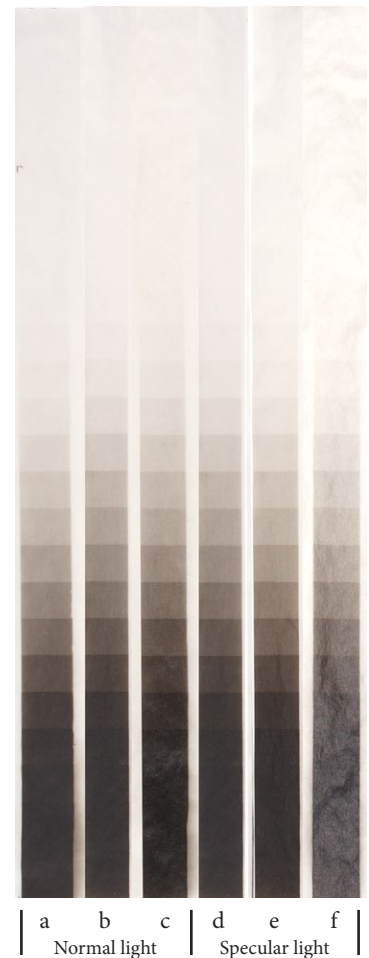
In 1949, Ansel Adams wrote to Strand asking permission to include Strand’s special varnish recipe in his forthcoming publication, *The Print*. “By all means, you are welcome to the formula,” Strand replied. “This varnish was suggested to me years ago by Henry Krendek of the New York Camera Club. I don’t believe he used it, but I did and still do.”⁴⁵ Strand’s varnish recipe was included in both the 1950 and 1967 editions of *The Print*:

Proprietary varnishes are entirely adequate. The prime requisites are purity of ingredients and good color—rather, lack of color when applied to the prints. Paul Strand has kindly given me his formula for surfacing prints (in his words): “First, one buys a small can of lithographer’s varnish no. 1. . . . This should last for years. Next one buys a bottle of Carbona (carbon tetrachloride), the solvent for the varnish. . . . A good way to get the varnish in to the Carbona is with a swab stick, letting it run off drop by drop until the Carbona is a lemon-yellow color after shaking. The varnish is then ready to apply with a piece of cotton. Cover the print thoroughly . . . then smooth the whole surface out by taking almost all the varnish off by rubbing briskly with a piece of dry absorbent cotton. . . . The varnish is slow-drying (3 or 4 days) . . . and I have never noticed any evidence of discoloration.”⁴⁶

The commercial lithographer’s varnish to which Strand refers is a heat-thickened linseed oil, or stand oil, available in a variety of viscosities for lithography. “Carbona” is carbon tetrachloride, packaged and sold commercially as a dry-cleaning fluid.

Careful examination and the aid of ultraviolet illumination reveal that coatings are often present on Strand’s prints from this period (see figs. 3, 4). The coatings have an influence on the print’s surface sheen and its overall image tone. Several platinum

Figure 16. Platinum print step-tablets on vegetable parchment paper made by the Photograph Conservation Department, National Gallery of Art. (a) Uncoated, normal light. (b) Coated with wax, normal light. (c) Coated with Strand’s varnish, normal light. (d) Uncoated, specular light. (e) Coated with wax, specular light. (f) Coated with Strand’s varnish, specular light.





17a



17b



17c

Figure 17. Examples of prints on Platinotype Japine.

17a. Uncoated: Ira Martin, *Flowers and Fruit by Zurburan*, 1934. Platinum print, 19.5 × 24.8 cm. Courtesy National Gallery of Art, Photograph Conservation Study Collection, donated by Frick Art Reference Library.

17b. Heavily coated with Strand's varnish: Paul Strand, *Dunes near Abiquiu, New Mexico*, 1931. Platinum print, 11.1 × 14.6 cm. Courtesy Paul Strand Collection, Center for Creative Photography, Purchase, 76.11.53. ©Aperture Foundation Inc., Paul Strand Archive.

17c. Lightly coated with Strand's varnish (likely the original coating was reduced through treatment): Paul Strand, *Rebecca*, New Mexico, 1931. Platinum print, 10.2 × 12.5 cm. Courtesy National Gallery of Art, Gift of Southwestern Bell Corporation Paul Strand Collection, in Honor of the 50th Anniversary of the National Gallery of Art, 1990.44.5. ©Aperture Foundation Inc., Paul Strand Archive.

prints by Strand in the National Gallery collection that were visually identified as coated were analyzed with ATR-FTIR by the authors, and the presence of a combination of cellulose and linseed oil was confirmed. To better understand the aesthetic quality and the aging characteristics of Strand's varnish recipe, several platinum test prints were coated following Strand's recipe.⁴⁷ Sample prints on plain, unmodified papers absorbed much of the varnish, but the surface of prints on parchmented paper, which mimics the Japine paper surface, allowed the varnish to set on the surface, saturate the blacks, and provide a subtle sheen (fig. 16).

A major drawback of Strand's stand oil varnish is that it yellows due to oxidation over time (fig. 17; see also fig. 16). Stand oil is less prone to yellowing than a normal linseed oil, but the yellowing is still a problem. After artificially aging the test prints, the varnish discolored significantly to a deep yellow color, completely altering the interpretation of the image tones (fig. 18).⁴⁸ Adams withdrew the recipe from the 1983 edition of *The Print*, writing, "It was once common practice to apply wax or varnish to the print for added brilliancy. . . . I hesitate to recommend such treatment, because it may reduce print permanence. Varnishes and lacquers may turn yellow in time."⁴⁹

By 1971 the discoloration became known to Strand. In the Paul Strand Collection at the Center for Creative Photography there is a working checklist of photographs for the Philadelphia Museum of Art retrospective, *Paul Strand Photographs*, that describes the condition of several prints as "yellow," "yellowed some," "yellowed but useable," and "stained—destroy." Several of these prints were also noted as "clean" or "clean or re-print," suggesting that the varnishes may have been removed and/or re-applied prior to their exhibition.⁵⁰ Even after Strand's death, it



Figure 18. Platinum step-tablets on vegetable parchment paper made by the Photograph Conservation Department, National Gallery of Art. (a) Uncoated print before aging. (b) Print coated with Strand's varnish before aging. (c) Print coated with Strand's varnish after artificial aging.

was not an uncommon practice at the Paul Strand Archive to remove old discolored varnish and recoat Strand prints before they were sold to institutions and private collectors. According to Montoya, staff would reduce the existing varnish using turpentine or ethanol applied with cotton. Prints were then recoated with a recipe similar to Strand's stand oil varnish or with Renaissance brand microcrystalline wax.⁵¹

Coatings on Strand's Photogravures

Strand's quest to obtain the optimal surface did not end with platinum paper, and he continued to use coatings to achieve this goal. He published two portfolios of twenty handmade photogravures depicting Mexico, as *Photographs of Mexico* in 1940 and reprinted as *The Mexican Portfolio* in 1967. A limited edition of 250 *Photographs of Mexico* was printed by master printer Otto Wackernagel at the Photogravure and Color Company in Manhattan.⁵² These prints were coated in a manner completely different from Strand's platinum prints. A 1940 letter to Strand from the Egyptian Lacquer Manufacturing Company states that a quart sample of Egyptian Clear Spray Lacquer and one quart of thinner were sent at his request for "conducting experiments on his reproductions of photographs."⁵³ In 1941 Strand applied for a Guggenheim Fellowship, and in his application he described his *Photographs of Mexico* portfolio as follows:

The process used, hand gravure, is not new but a new element, lacquer, has been added to the surface which completely changes the character of gravure—and results in a close approximation to the qualities of the original prints. . . . 95% of my photographic work exists in single prints on platinum paper. In 1938, this beautiful material became unavailable from any source when the Platinotype Co. of London went out of existence after fifty years.⁵⁴

When the portfolio was reprinted in 1967, production was done by the Aperture Foundation under the supervision of Michael E. Hoffman. The Photogravure and Color Company in Manhattan was no longer printing flat-plate hand gravures, so Strand turned to the Anderson Lamb Company of Brooklyn, and the firm's master printer, Albert Delong, made new prints from the original 1940 steel-face plates.⁵⁵ Strand recalled that the gravures were varnished by spraying the lacquer with an airbrush at a local furniture manufacturer's warehouse. The border areas of all the gravures were masked, and each print was sprayed with an overcoat of lacquer.⁵⁶

One photogravure from the 1967 *Mexican Portfolio* in the National Gallery collection was analyzed with ATR-FTIR. The spectra revealed the presence of a cellulose nitrate-based coating. Christopher McGlinchey, conservation scientist at the Museum of Modern Art, conducted similar analysis on photogravures from the 1940 *Photographs of Mexico* portfolio and also identified a cellulose nitrate coating.⁵⁷ Unfortunately, cellulose nitrate is susceptible to photochemical degradation that causes severe yellow-to-brown discoloration.⁵⁸ Due perhaps to their differences in age, many of the 1940 portfolio prints display severe yellow-brown discoloration, whereas only a slight yellowish discoloration is evident on the 1967 prints.

Aperture Foundation Limited Edition of Platinum-Palladium Prints

In 1976 Richard Benson and Sal Lopes worked for the Aperture Foundation to create a limited edition of platinum-palladium prints of Strand's most admired images. The edition, made after Strand's death and with no direct guidance or input from Strand, included *Wire Wheel, New York; Wall Street, New York; and St. Francis Church, Ranchos de Taos, New Mexico*. Benson used Strand's original lantern slides to make new enlarged negatives for this project because the original enlarged negatives are covered with a discolored varnish. Lopes produced the prints on Crane & Company papers, following Benson's and Lopes's platinum recipes and material preferences, and clearing with hydrochloric acid.⁵⁹ Other limited editions of Strand's images were later printed in platinum and platinum-palladium by the Aperture Foundation. These prints can be found in many collections and should be properly identified as posthumous prints.

Conclusions

The information gained through this research has provided new insights into the materials and methods Paul Strand used to attain the aesthetic qualities that his platinum prints exhibit. This study was initiated in response to questions and observations regarding the unconventional appearance of Strand's platinum prints and their condition issues. Careful examination, research, and analyses have shown that Strand made deliberate decisions based on his strong aesthetic preferences and, in particular, sought to obtain deep rich blacks and a subtle surface sheen. Throughout the 1920s and 1930s Strand predominantly used the Platinotype Company's Japine Platinotype papers in combination with a linseed oil-based coating. Japine papers are inherently susceptible to cracking, and the oil

varnishes are prone to yellowing. The research from this project can be used to inform strategies for the preservation, exhibition, and treatment of these significant prints and others that may be similar.

The discoloration of many Strand platinum prints from the 1920s–30s is due largely to oxidation of their oil-based coatings. This discoloration could have been promoted by cycling between dark storage and exhibition or examination lighting and could increase if exposed to light greater than conservation illumination standards. The results of initial microfadeometry studies carried out during this study support this conclusion.⁶⁰ On the other hand, the discoloration of the cellulose nitrate coatings applied to the photogravures from *Photographs of Mexico* and *The Mexican Portfolio* is due to photodegradation, and the progression of discoloration of these prints can be slowed by reducing their exposure to light, especially avoiding the ultraviolet range of the spectrum.

Japine platinum prints are inherently susceptible to cracking. However, the cracking of the parchment layer is usually stable, not friable or loose, and does not require consolidation treatment as long as the prints are handled and housed properly. Any treatment of Japine platinum prints that requires physical manipulation, such as unmounting, may increase the risk of cracking. The coatings on these prints must also be carefully tested and considered prior to treatment. Some prints have Strand's oil-based coating and others have wax coatings present on top of the oil varnishes. If aqueous or solvent treatment approaches are employed, blanching could result and/or low-molecular weight degradation products could move farther into the paper fibers. Discolored varnish could also settle into cracked areas of Japine prints, resulting in uneven staining. For these reasons, the risks of treatment may outweigh the benefits. These prints can best be preserved through careful storage and handling and limited display.

This research has provided new insights into the materials and methods Paul Strand used to make his platinum prints. Several of the initial inquiries that gave rise to this work have now been elucidated. The unconventional appearance of Strand's platinum prints and their condition issues are explained. There are still many questions remaining, however, and some new queries have also been identified. For example, it would be helpful to analyze a larger selection of prints in order to confirm if gold-toned and blue-black platinum prints were in fact created by Strand.

Acknowledgments

The research for this project was conducted by Alisha Chipman and Matthew L. Clarke, who were employed as assistant photograph conservator and photographic materials scientist, respectively, at the National Gallery of Art, thanks to generous funding provided by The Andrew W. Mellon Foundation. This work would not have been possible without the constant assistance, support, and guidance from the National Gallery of Art colleagues in the Departments of Photograph Conservation (Constance McCabe, Caroline Minchew, Sarah S. Wagner), Scientific Research (Christopher A. Maines), and Photographs (Sarah Greenough, Sarah Kennel, Andrea Nelson, Leslie Ureña). Alisha Chipman owes a debt of gratitude to current supervisors (Elmer Eusman, Andrew Robb) for allowing the time to complete this project and write the final draft of this chapter while employed at the Library of Congress. Many dedicated staff members at the Philadelphia Museum of Art (Nancy Ash, Peter Barberie, Amanda Bock, Scott Homolka), the Center for Creative Photography (David Benjamin, Jennifer Jae Gutierrez, Katharine Martinez, Leslie Squyres), the Paul Strand Archive at the Aperture Foundation (Anthony Montoya), the Frick Art Reference Library (Sally Brazil, Stephen Bury, Susan Chore, Don Swanson), and the Museum of Fine Arts, Boston (Annette Manick, Patrick Murphy, Katrina Newbury, Margaret Wessling) were extremely helpful and generous with lending time, expertise, and enthusiasm while allowing access to their resources. The discoveries published here would not have happened without their support! We would especially like to thank Katharine Martinez of the Center for Creative Photography for appreciating the value in this project and miraculously finding a way to fund our research trip to Tucson. We cannot thank Sally Brazil and her colleagues at the Frick enough for their many contributions, including donations of Ira Martin collection materials, and their eager willingness to assist with this project. Much appreciation is owed to Saori Kawasumi Lewis, The Nelson-Atkins Museum of Art; Lisa Barro and Katie Sanderson, The Metropolitan Museum of Art; and Lee Ann Daffner and Christopher McGlinchey, The Museum of Modern Art, for sharing their analysis reports and expert knowledge regarding Strand materials in their collections. Many thanks to Richard Benson and Mike Ware for sharing their wisdom on platinum printing and their knowledge and experiences regarding Paul Strand. Thank you to Andre Bernard of the John Simon Guggenheim Memorial Foundation for sharing copies of all of Strand's many Guggenheim Fellowship applications.

Notes

The epigraph is from notes taken by Calvin Tomkins during an interview with Paul Strand, 1973, Calvin Tomkins Papers, folder IL.A.45, Museum of Modern Art Archives, New York City.

1. Stieglitz 1917, 36.
2. Lavédrine 2009, 156.
3. Richard Benson to Alisha Chipman, personal communication, August 29, 2012.
4. Paul Strand, interview by Jon Goell, January 1973, sound recording on audio cassette, Archives of American Art, Washington D.C.
5. Naomi Rosenblum, "Paul Strand: The Early Years, 1910-1932" (PhD diss., City University of New York, 1978), 247.
6. Rosenblum, "Paul Strand," 250.
7. Paul Strand, application for a Guggenheim Fellowship, 1941, John Simon Guggenheim Memorial Foundation Archives, New York City.
8. Stettner 1972, 55.
9. Rosenblum, "Paul Strand," 249.
10. Benson 1990, 104.
11. Benson 1990, 105.
12. Paul Strand, audio interview by Milton Brown, November 1971, Archives of American Art, Washington D.C.
13. Rosenblum, "Paul Strand," 248; Paul Strand, interview by Naomi Rosenblum, July 1, 1975, notes in Naomi Rosenblum Collection, AG226, Center for Creative Photography, University of Arizona, Tucson.
14. Strand, interview by Rosenblum. XRF analysis conducted by Saori Kawasumi Lewis, assistant conservator, Nelson-Atkins Museum of Art, Kansas City, Missouri, confirmed the presence of platinum, mercury, and lead in the image material of this print.
15. For more information on Japine, see Mike Ware, "The Technical History and Chemistry of Platinum and Palladium Printing," in this volume. Also see Clarke et al. 2014; Clarke et al. 2015.
16. Paul Strand and Nancy Newhall, text panels for the exhibition *Paul Strand: Photographs, 1915-1945*, Museum of Modern Art, New York City, April 25-June 10, 1945, Paul Strand Archive, Aperture Foundation, Lakeville, Conn.
17. Clarke et al. 2014, 167; Clarke et al. 2015.
18. Clarke et al. 2014, 151.
19. Newhall 1964, 117.
20. Tomkins 1976, 21.
21. Quoted in Fleischmann 1987, 142.
22. Rosenblum, "Paul Strand," 248.
23. Strand, interview by Brown.
24. Alhstrom Specialties 85 g/m² release white vegetable parchment was used to prepare these simulacra. For more information on the specifics regarding the chemistry and processing times used to make the reference prints at the National Gallery of Art, see Matthew L. Clarke, "Characterization, Degradation, and Analysis of Platinum and Palladium Prints," and Erin L. Murphy, "Overview of Historical Practices for Postprocessing Toning and Intensifying Platinum Prints," in this volume.
25. Strand, interview by Brown.
26. Ira Martin to Platinotype Company, April 9, 1931, Central Correspondence Collection, Frick Art Reference Library, New York City.
27. Multiple letters, orders, inventories, and invoices at the Frick Art Reference Library show that Martin regularly ordered "Warm Black Japine Platinotype paper with special coating" from the Platinotype Company at an average of five rolls every three months for six years, beginning in 1931 and continuing until the Platinotype Company went out of business in 1937.
28. Trace metals can be difficult to detect by XRF analysis. For this reason analysis was performed using both the rhodium and the tungsten tube. Very small palladium peaks were observed in both cases.
29. SEM-EDS analysis was also performed on a c. 1910 sample of a Platinotype Company Japine for Sepia platinum paper, and palladium was definitely not present in that sample.
30. A unopened "Tin Canister of Warm-Black Japine Platinotype Photographic Paper, by The Platinotype Company, Penge, London, 1936," inventory number 71733, is in the collection of the Museum of the History of Science, Oxford University. However, sampling and analysis of this paper were not possible at the time of this study.
31. Brown 1916, 166.
32. Paul Strand to Ned Scott, October 1, 1933, Ned Scott Archive, www.thenedscottarchive.com.
33. Strand and Newhall, text panels for the exhibition *Paul Strand*.
34. Tomkins 1976, 21.
35. XRF analysis conducted by Sarah Freeman, associate photograph conservator, J. Paul Getty Museum, confirmed the presence of platinum, palladium, and the lack of gold in the image material of this print. Art Kaplan and Sarah Freeman, personal communication, June 1, 2016.
36. For more detailed information on gold-toning of platinum prints, see Murphy, "Overview of Historical Practices," in this volume.
37. Mcintosh 1905, 480-85.
38. Strand, interview by Rosenblum.
39. Anthony Montoya, personal communication, March 19, 2014.
40. Strand, interview by Rosenblum.
41. Benson 1990, 105.
42. Quoted in Fleischmann 1987, 146.
43. Benson 1990, 105.
44. "From a Student's Notebook" 1947, 56.
45. Ansel Adams to Strand, March 8, 1949, and Strand to Adams, March 21, 1949, in Center for Creative Photography 1990, 75-76.
46. Adams 1950, 118; also Adams 1967, 118.
47. One exception is that the somewhat safer methylene chloride was used instead of carbon tetrachloride.
48. For more information on artificial aging conditions, see Clarke, "Characterization, Degradation, and Analysis of Platinum and Palladium Prints," in this volume.
49. Adams 1983, 45.

50. Checklist, c. 1970–71, for Philadelphia Museum of Art retrospective exhibition *Paul Strand Photographs*, Paul Strand Collection, AG17, box 9, folder 21, Center for Creative Photography.
51. According to Montoya, some prints at the Paul Strand Archive at the Aperture Foundation were “stripped,” or had their original coatings reduced with solvents (turpentine and ethanol), and were then recoated with 1 part stand oil to 7 parts rectified turpentine followed by buffing with cotton balls. Anthony Montoya to Constance McCabe, personal communication, September 21, 1995. In later years prints were recoated with microcrystalline wax. Anthony Montoya to Alisha Chipman, personal communication, March 16, 2014.
52. Krippner 2010, 266.
53. Egyptian Lacquer Manufacturing Company to Strand, March 21, 1940, Paul Strand Archive, Aperture Foundation.
54. Strand, application for a Guggenheim Fellowship, 1941.
55. Krippner 2010, 266.
56. Strand, interview by Brown.
57. Christopher McGlinchey to Alisha Chipman, personal communication, August 28, 2012.
58. Selwitz 1988, 22.
59. Benson to Chipman, August 29, 2012.
60. Matthew L. Clarke, analysis report, September 30, 2015, National Gallery of Art, Conservation Files.

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