Article: The Deterioration of Paul Strand's Satista Prints
Author(s): Lisa Barro
Topics in Photographic Preservation, Volume 10.
Pages: 37-54
Compiler: Brenda Bernier

Topics in Photographic Preservation is published biannually by the Photographic Materials Group (PMG) of the American Institute for Conservation of Historic & Artistic Works (AIC). A membership benefit of the Photographic Materials Group, *Topics in Photographic Preservation* is primarily comprised of papers presented at PMG meetings and is intended to inform and educate conservation-related disciplines.

THE DETERIORATION OF PAUL STRAND'S SATISTA PRINTS

Lisa Barro

Presented at the 2003 PMG Winter Meeting, San Juan, Puerto Rico

During the most exceptional period of his career around 1916, Paul Strand produced a small group of photographs on Satista paper, a commercial silver-platinum paper. While his platinum prints maintain their rich densities and broad ranges of tone, several of Strand's Satista prints have deteriorated as manifested by fading, orange-yellow discoloration, and the appearance of fingerprints. The goal of this study was to investigate the photographic papers used by Strand and to determine how and why the appearance of the Satista papers has changed through deterioration.

Part of the motivation for this research was that the Metropolitan Museum of Art has a particularly rich group of Strand's platinum and Satista prints from 1915-17. Strand's platinum print *Blind* (figure 1) and other works in this group—most of them unique prints—are among the Met's most prized photographic treasures. The Met presented a major loan exhibition with an accompanying catalogue of this period of his work, "Paul Strand: Circa 1916" in 1998 (Hambourg 1998). Alfred Stieglitz showed this body of work in 1916 and published it as the final issue of his great, influential journal "Camera Work". The curators at the Met consider these photographs to be the best in Strand's career and among some of the most important photographs in the first part of the twentieth century. There is no other artist for whom so important a body of work coincided precisely with the very brief window during which these Satista papers were used. No other instance has been noted to date of an artist's best works being printed in this medium.

STRAND'S AESTHETIC INTENT

Around 1916, Strand was producing strong geometric compositions with crisp shapes and subtle gradations, emphasizing the unique capabilities of the photographic medium. Stieglitz, a former proponent of a painterly, pictorialist style of photography, had begun to change his outlook by the 1910's. He advocated a straight or direct style in which the prints were not manipulated during processing and the product was a pure representation of the photographic method. This aesthetic shift appears to have profoundly influenced Strand.

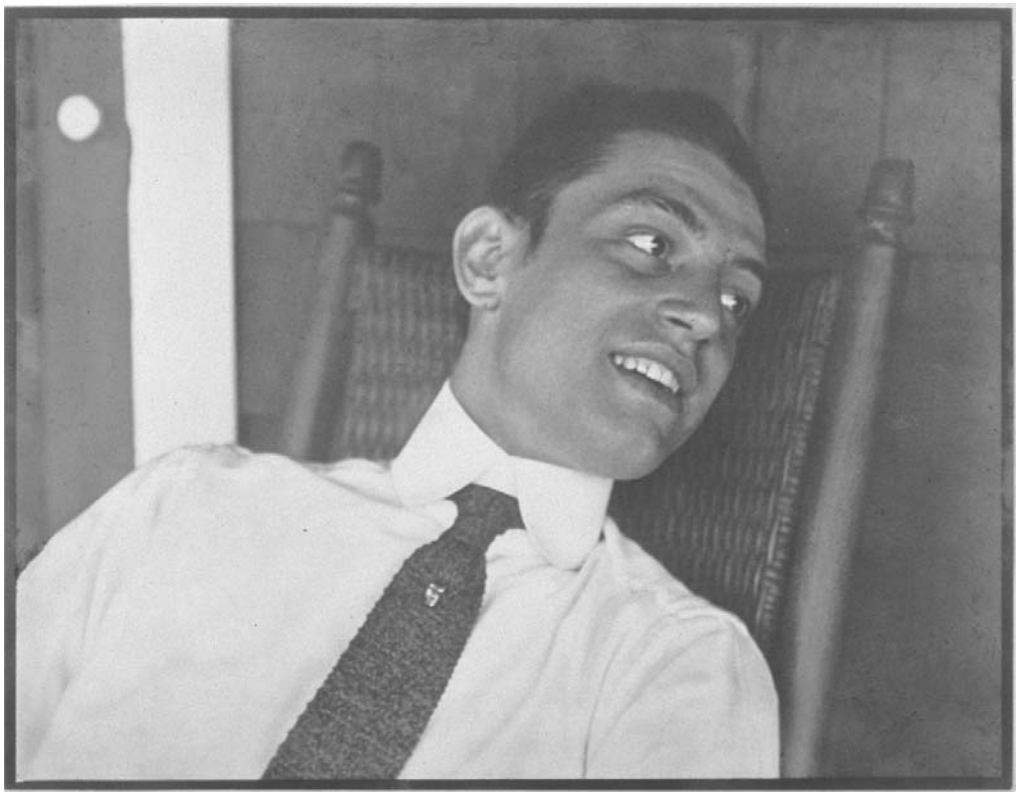
Strand voiced his support for the "straight" photographic style. In his 1917 essay, "Photography and the New God," Strand opposed the use of manipulative techniques such as gum printing or local developing of platinum prints that borrowed the painter's tool, the brush. He argued:

> The full potential power of every medium is dependent upon purity of its use, and all attempts at mixture end in such things as color-etching, the photographic painting and in photography, the gum-print, oil-print, etc., in which the introduction of hand work and manipulation is merely an expression of an impotent desire to paint (Strand 1917, 142).

1. *Blind*, 1916, platinum print, 34 x 25.7 cm

The Metropolitan Museum of Art, New York, Alfred Stieglitz Collection, 1933 (33.43.334) . ©Aperture Foundation Inc., Paul Strand Archive.

The essence of the photographic medium, according to Strand, was its ability to represent "chiaroscuro…through a range of almost infinite tonal values which lie beyond the skill of human hand" and these effects were achieved "without tricks of process or manipulation, through the use of straight photographic methods" (Strand 1917, 142). How Strand defined "manipulation" is not obvious; local brush development was certainly not acceptable, but it is unclear how he viewed toning of the entire photograph. One would assume that the overall toning does not conflict with the photographic medium's unique ability to represent tonal ranges and is consistent with the goals of "straight" photography. Like many photographers, Strand continued to spot and retouch his photographs and negatives during this period (Benson 2003). Photographers probably



2. *Harold Greengard,* 1916, Satista print, 25.4 x 33 cm

The Metropolitan Museum of Art, New York. Ford Motor Company Collection, Purchase, Joseph Pulitzer Bequest and The Horace W. Goldsmith Foundation Gift, and Gift of Ford Motor Company and John C. Waddell, by exchange, 1997 (1997.25). © Aperture Foundation Inc., Paul Strand Archive.

viewed retouching of the image and spotting of dust marks and other flaws to be an inevitable step in the photographic process. They were intended to be invisible and photographers did not consider them part of the aesthetic message.

Platinum Image Tonality

Since Satista papers were substitutes for platinum papers, understanding Strand's goals for the image tonality of his platinum prints is critical. The image tonality of platinum prints can be altered with the salts of metals such as gold or mercury during the sensitization, toning or development stages. It is uncertain whether or not Strand toned his platinum papers. It has been said that in later years he gold-toned his gelatin silver prints, but the two practices are not necessarily related. Richard Benson, a master printmaker who worked with Strand in his later years, stated that he did not know "when the [gold] toning started, but it seemed to have been a constant in his habits as a silver printer" (Benson 1990, 106-7). Beaumont Newhall and Calvin Tomkins have both stated that Strand gold-toned his platinum prints (Newhall 1964, 21; Tompkins 1976, 117).

To investigate the gold-toning of Strand's platinum prints, elemental analysis was conducted using X-ray fluorescence (XRF) spectrometry. Identifying the toning metal based only on visual examination can be inaccurate as there can be a significant variation in image tonality for each metal. XRF is the ideal method for non-destructively determining the toning metal. No gold was identified in the six platinum prints by Strand in the Metropolitan Museum's and the Gilman Paper Company's collections. Platinum was the only image material found in *Blind* (1916) (figure 1), *Conversation* (1916), *Office Buildings from Below* (1917), and *Geometric Backyards* (1917) (see technical section). Possibly Strand's supposed gold-toning of his platinum prints was based on his later technique for his gelatin silver prints. To complicate the matter, two of Strand's gelatin silver prints from the Met's collection, from 1928 and 1939, were analyzed and no gold was identified. Perhaps, the gold-toning occurred even later in Strand's career.

Mercury was identified in addition to platinum as an image material in *Winter, Central Park, New York* (c.1915) and *From the El* (1915). Strand may have added mercury to his developer to adjust the tonality of the final image. It is also possible that he purchased warm-toned papers such as Platinotype Sepia papers that were manufactured with mercury in the sensitizer (Ware 1996). Either way, Strand clearly intended for these platinum images to have a warm tonality.

Image tonality was an important component in Strand's prints. In the *Paul Strand: Circa 1916* catalogue, Maria Hambourg, curator of photographs at the Metropolitan Museum, described a few rare instances where Strand printed multiple photographs from one negative and the tones could be compared: *City Hall Park* (1915), *Fifth Avenue* (1915), and *Wall Street* (1915). She argued that the tonality of the photograph is an essential part of the message in Strand's prints. For example, *Wall Street* exists in two prints, Hambourg states that the version with a warm sepia tone has "a charge of high energy, as of sunshine or morning urgency" and the one in a neutral black platinum tone has "a perceptibly slower tempo and a solemn, ominous mood" (Hambourg 1998). Hambourg's analysis illustrates the significance of the subtle tonality of Strand's prints and how it affects the reading and interpretation of the photograph. In platinum prints, a deteriorated paper can give a photograph the appearance of a warm image tonality, so it

is important to distinguish these deteriorated prints from those that contain mercury as a means of intentionally altering the image color. The importance of tone in Strand's work underscores the need to identify deteriorated Satista prints, as well, where the tonalities may have changed.

PAUL STRAND'S POTENTIAL MATERIALS—PLATINOTYPE AND SATISTA PAPERS

A detailed description of Platinotype and Satista papers including their availability, cost, and unique characteristics is essential in order to introduce the factors that played into Strand's choices and artistic intentions. In the past, it has been assumed that Strand may have chosen Satista papers around 1916 because of the shortage of platinum papers. In order to elaborate on this argument, the availability of the papers and their similarities are discussed.

Platinum Papers

William Willis invented platinum photographic papers in 1873. He called them "Platinotype" papers and in 1879 he began manufacturing them at his London-based company of the same name. Platinum photographic papers from the early twentieth century are typically coated with solutions containing iron and platinum. During exposure the iron salts react with light and through development these exposed iron salts convert the platinum salts into metallic platinum, the final, black image material. Subsequently, all of the iron salts are cleared from the paper with an acid. The platinum particles reside in the paper fibers creating a rich, matte surface. Artists appreciated the velvety effects in addition to the paper's ability to represent a range of tones and a long scale of lights and darks. The stability of platinum metal makes these photographic papers more desirable than silver papers, although the acid clearing step can produce a more vulnerable paper if the paper is not washed thoroughly.

The Platinotype Company manufactured papers in a variety of permutations. The Willis & Clements Company in Philadelphia imported and sold Platinotype papers in the United States. By 1885, photographers could purchase both the prepared papers and the chemicals to produce their own sensitized photographic papers (Platinotype pamphlet, 1885). In 1890, they introduced Sepia Platinum papers which were made with mercury in addition to platinum salts in order to produce warmer tonalities (Ware 1996). By 1901, Eastman Kodak was also offering platinum papers (Nadeau 1998, 34). In a 1908 Platinotype Company price list, twelve types of black and sepia papers were listed with variations in surface, weight, tonality and contrast (The Platinotype Company, 1908). In 1913, photographer Paul Anderson listed a group of preferred platinum papers on the market including papers by Eastman Kodak and Willis & Clements stating that the Kodak papers had a longer scale and less contrast than the Willis & Clements papers (Anderson 1913). At that time price and availability did not merit mention and photographers had a choice of products.

Availability of Platinum Papers

The availability of platinum papers presumably would have factored into Strand's decision to use Satista papers. Since its introduction in the late nineteenth century, the cost of platinum papers gradually rose until it escalated during World War I. This increase in cost led to a decrease in demand for and therefore production of platinum papers (Nadeau 1998, 40-41). A periodical search was conducted to investigate the availability and usage of platinum papers

during the years 1915 to 1918. Advertisements and correspondence published in the American journals *American Photography* and *Photo-Miniature* were reviewed for their advertisements and discussions on platinum and Satista photographic papers. What they reflect is the rise in the price of platinum during the second half of the wartime period. In the "Question and Answer" section of a 1915 edition of *American Photography,* a photographer asked: "Where can I get platinum paper? "Are the necessary chemicals very expensive?" and "Can they be bought ready to use?" In response the writer states that any dealer can order "several varieties of platinum paper manufactured by the Eastman Kodak Company or the original 'Platinotype,' imported by Willis & Clements, Philadelphia." The writer then indicates that the chemicals are not expensive and that the papers can come prepared by manufacturers which, according this author, was half as expensive as preparing papers (American Photography 1915, 53).

By the end of 1915, the real platinum paper shortage began. In correspondence from December of 1915, Alfred Clements from the Willis & Clements Company wrote to Alfred Stieglitz: "I want to tell you about Satista and send you samples. We only have a little Plat. Some JJ Sepia & Japine buff. We have no black. (Clements 1915)" At this point, Satista was the only option for a matte, black photographic paper. In May of 1916, an author for *Photo-Miniature* commented: "The scarcity of platinum and the consequent difficulty of obtaining supplies threaten to take all platinum papers off the market" (Photo-Miniature, May 1916, 229). Kodak stopped making platinum papers on June 1, 1916, presumably due to the high costs of production (Nadeau 1998, 34). In October of 1916, *Photo-Miniature* described prepared platinum papers as "either difficult to obtain or not at all gettable," although the materials were apparently available for photographers to sensitize their own papers (Photo-Miniature, October 1916, 418).

During 1917, platinum papers appear to have largely dropped from view. Willis & Clements printed four small ads in the twelve issues of *American Photography* published that year: the first three ads were for matte surface Satista paper; in the final advertisement "Platinotype Matt Sepia," "Palladiotype Sepia," and "Satista Black (rough and smooth)" were advertised (American Photography, January 1917). Satista and Palladiotype were cheaper replacements for the Platinotype paper, which was still being sold in 1917. In January 1918, the following statement appeared in *Photo-Miniature:* "A supply of platinotype (sepia), palladiotype and satista papers has been received by Willis & Clements of Philadelphia, and those who favor these beautiful papers should lose no time in acquiring sufficient for their needs"(Photo-Miniature, January 1918, 460). This comment suggests a previous shortage of papers. The period of severe shortage appears to have occurred during 1916. By late 1917 or early 1918, Willis & Clements still provided sepia Platinotype papers. However, if the photographer desired a black tone, Satista papers may have been their only option.

Japine Papers

The Platinotype Company introduced Japine papers in 1907 (Nadeau 142, 1998). Strand may have used Japine platinum papers and some Satisa papers may have had Japine surfaces (Newhall 1964, 117). "Japine" was a proprietary term indicating a glossier or "semi-matte" paper in comparison to the competing matte papers, independent of the process. References in two contemporary photographic journals refer respectively to "Japine Silver Print-Out Paper" (*Photographic Journal,* December 1915, 282) and "Japine Platinum"(*Photo-Miniature*, April

1916, 165). Some references indicate that Japine papers may have had a gelatin emulsion or coating (Nadeau, 1998, 33). This is contradicted by the following sources: E.A. Salt wrote in 1929 that "'Japine' Platinotypes…present a semi-matt surface. This is not an applied coating but is integral with the paper" (Salt 1929, 509-513). Captain Owen Wheeler conquered: "[Japine] is not a coating, but exists as an integral part of the paper itself, giving maximum detail and shadow transparency" (Wheeler 1930, 138-39). In 1915, a representative from the Platinotype Company described "a Japine Silver Print-Out-Paper without gelatin that could be rubbed off" (The Photographic Journal, 1915, 282) which could mean either that gelatin was integral to the paper like a sizing or that this paper had no gelatin at all.

Mike Ware has suggested that the Japine surface might involve a parchmentizing process using concentrated sulfuric acid applied to the paper's surface (Ware 2002). In a 1916 publication that described Satista paper as Japine, the author stated that the Satista sensitizing layer "can well be applied to paper surface-hardened or parchmentised with sulfuric acid"(Brown 1916, 470). William Willis mentions the possibility of using this technique in the Satista patent:

> …particularly advantageous results can be obtained in the [Satista] process by using paper the surface of which has been parchmentised by treatment with acid or by other well known means. The paper is coated or treated on each side with sulphuric acid sufficiently strong to attack the paper; the paper is well washed in water to free it from acid and is then dried (Willis, British Patent N°20,022, September 4th , 1913, 50).

According to a 1916 comment in *The Photo-Miniature,* Japine Platinotypes had "a hard surface" and were "almost brittle when bone dry and crack if bent sharply"(The Photo-Miniature April 1916, 165). A definite characterization of Japine papers has not yet been pursued and would be extremely valuable.

Satista Paper

In 1913, Willis introduced the combined silver and platinum Satista paper to provide an economical substitute for Platinotype paper. The derivation of the name is unclear although one Willis & Clements product guide included the catch phrase "Satista (Meaning 'It Satisfies')" (Willis & Clements, date unknown). The low cost of Satista paper figured prominently in Platinotype and Willis & Clements advertisements for Satista paper and appeared in discussions in photographic journals. Prior to the manufacture of Satista papers, silver and platinum photographs would have been created by the platinum-toning of silver prints. The predominant example was Artisto-Platino paper, a silver print-out paper that was commonly toned with platinum and gold in the early twentieth century ("Printing Processes Described", Photo-Miniature 1907, 266). However, the Artisto-Platino paper contained a baryta layer and would not be confused with the Strand prints in this study. Essentially any silver photograph could be toned with platinum. Even with the absence of a baryta layer, one cannot determine the type of paper based solely on the identification of silver and platinum. Furthermore, a 1916 article mentioned another Platinotype brand silver-platinum paper called Satoid Paper. This was a matte-surfaced paper similar to Satista, but produced brown tones (Photographic Printing Papers, Photo-Miniature 1916,154). The Satoid paper may in fact be the same as the warm-toned Satista paper.

In Satista photographs silver and platinum particles are deposited in the paper fibers similar to a platinum print. According to the patent, the paper was first coated with silver chloride followed by a coating with a small amount of platinum and iron salts (Willis, British Patent N°20,022, September 4th, 1913, 45-51). The image formation mechanism of Satista papers is complicated and has not been completely determined. The process combines the kallitype, salted paper print, and platinum print photochemical mechanisms. When exposed to light, the silver chloride alone would have produced a printed-out image as in a typical salted paper print. A paper coated solely with platinum and iron salts, like a platinotype paper, would utilize the light sensitive iron salts to convert platinum salts to the metallic platinum image material during development. A paper with only the silver and iron salts would be similar to a kallitype paper where—in a mechanism similar to the platinum paper—the silver image would be formed through conversion of the silver salts by the exposed iron during development. The combination of the silver, iron and platinum salts likely complicates matters because the salts may interact with each other and change the order of conversion in the presence in light. According to the patent, the silver in the Satista paper is similar to kallitype silver and the platinum acts to accelerate the reaction. The platinum image is created in the same manner as in a platinum print. After exposure and development, the silver and platinum are cleared in different ways. The unexposed silver salts are removed with hypo or sodium thiosulfate. The iron and platinum salts are removed with acid, as is common in a platinum print process.

According to the advertisements and discussions in journals, Satista papers were available in black and warm tones like Platinotype papers. In a 1916 British photographic journal, an author described black and sepia varieties of Satista paper, the latter being processed in a warmer bath (Brown 1916, 297). The brown or black appearance also may be related to the ratio of platinum to silver in the manufactured paper; based on experiments in creating Satista papers, a lower proportion of platinum resulted in a warmer tonality.

Photographers could also tone Satista papers. According to a 1914 discussion in the British *Photographic Journal***,** "the manipulation [of Satista prints] is very simple, either black or warm tones are producible at will." Specifically, "If warm tones, ranging from warm black through brown and chocolate to Barlotozzi red, are required they may be obtained by treating the fixed and washed prints with uranium and ferrocyanate solution" (The Photographic Journal 1914, 224). Photographer James Thomson, in his 1915 article on his own recipes for silver-platinum papers, mentions an even wider range of tones: uranium solutions for reds, iron for blue, and copper for colors from red to violet (Thomson 1915, 636). *The British Journal Photographic Almanac and Photographer's Daily Companion* from 1915 also mentions the option of sulfur toning, a common technique for silver bromide prints that involved bleaching the image and redeveloping with sulfur (Brown 1915, 696). A year later in the same journal, W.H. Smith from the Platinotype Company mentioned the use of uranium or sulfide toning to make the sepia prints even warmer and that "very fine shades were obtained on the sepia paper by toning with gold and formate of soda" (Brown 1916, 471). So the same range of materials available for toning platinum prints was also available for Satista papers.

The Platinotype Company may have manufactured a Satista paper with a Japine-type surface. In 1916, *The British Journal Photographic Almanac and Photographer's Daily Companion,* stated "of the two grades of 'Satista,' black and sepia, both were coated on semi-matt [*sic*] hard-

surfaced paper similar to Japine" (Brown 1916, 471). However, an October 1916 advertisement in *Photo-Miniature* described "Satista and Satoid papers" as "matt-[*sic*] surfaced papers giving rich lustrous prints by development" (Photo-Miniature, October 1916, 412). Possibly, both matte and semi-matte surfaces were available like in Platinotype papers.

When the shortage of Platinotype papers occurred in 1916, Satista papers were available as substitutes. Satista papers were available in warm and black tonalities to replace the sepia and black Platinotypes. In addition, they were almost certainly available with the Japine-like, semi-matte surfaces. The end date for Satista is probably in the late twenties or early thirties. The papers were still advertised in 1923 (*Photographic Journal of America*) and mentioned by Captain Wheeler in 1930. They were no longer on the market in London by 1932 (Bayley, 1932, 186).

Palladiotype papers were introduced by the Platinotype Company in 1916. Based on the same iron chemistry as in platinum papers, the Palladiotype was a much more stable alternative to Platinotype papers although they typically produce a warmer image tonality. The introduction of the more stable Palladiotype paper, reduced the demand for Satista papers.

Strand's Use of Satista Paper

During the period from 1916 to 1917, Strand produced silver-platinum photographs. The *Strand: Circa 1916* catalogue lists 17 silver and platinum prints. Most of these, with the exception of the six prints in this study and those from the National Gallery of Art (Glinsman 2002), have probably been identified through their characteristic deterioration rather than through XRF analysis. According to Benson, these silver-platinum papers were Platinotype brand Satista papers: "The early large prints Strand made are either on platinum paper or on an obscure material called Satista made by the Platinotype company" and the motivation for using the paper was economical (Benson 1994, 105). Satista was the only manufactured silver-platinum paper available to Strand. The closest alternative characterization would be platinum-toned Japine Silver (Photo-Miniature, May 1916). However, the very matte surfaces of these prints reduces this possibility. A scientific comparison with known Satista and Japine papers would be the ideal method of confirming their characterization as Satista.

In 1917 Stieglitz also used Satista paper (Thompson 2002). A letter from December of 1916 from Stieglitz to Alfred Clements of Willis & Clements indicates that he had received the Satista paper:

> As for the Satista papers, I am going to try them out. I am a pretty busy man and I have to steal the minutes for my photographic experiments. I am so home with platinum, having used it since 1883, virtually to the exclusion of anything else, that I hate the idea of having to find a substitute. Still I am going to try the Satista papers to see what they do. (Stieglitz 1916)

Strand, who used the Satista papers earlier than Stieglitz, had probably been in a similar predicament. While the platinum papers almost disappeared, the photographers tried Satista papers which were advertised as the visually indistinguishable alternatives. Presumably additional Satista papers from this period exist in photographic collections but have been

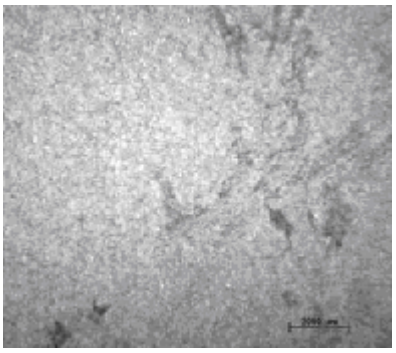
misidentified as platinum prints because they do not exhibit deterioration and have not been identified with XRF.

STRAND'S SATISTA PRINTS—AESTHETICS AND DETERIORATION

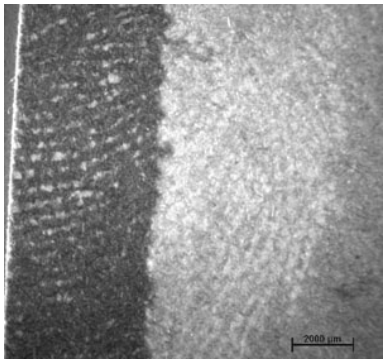
Paul Strand spent the summer of 1916 in his family's cottage in Twin Lakes, Connecticut. His goal throughout this period according to Calvin Tompkins was to learn "how to build a picture, what a picture consists of, how shapes are related to each other, how spaces are filled, how the whole thing must have a kind of unity"(Tompkins 1976, 48). Five of the six Satista prints in this study—*Bowls, Harold Greengard* (figure 2)*, Abstraction,* (figure 3) from the Met's collection and *Jug and Fruit* and *Pears and Bowls* from the Gilman Paper Company's collection—were taken during this summer (Hambourg 1998, 32-34). The sixth print, *[Wire Wheel],* was made in 1917. All six prints exhibit deterioration in the form of fading and discoloration, most visible in

3. *Abstraction, Twin Lakes, Connecticut*, 1916, 32.8 x 24.4 cm

The Metropolitan Museum of Art, New York. Ford Motor Company Collection, Gift of Ford Motor Company and John C. Waddell, 1987 (1987.1100.10). © Aperture Foundation Inc., Paul Strand Archive.



4. Detail of retouching from lower right quadrant of *Abstraction, Twin Lakes, Connecticut* .



5. Detail of the light fingerprint on the lower left edge of *Abstraction, Twin Lakes, Connecticut*.

the mid-tone areas. Where retouching is present, it appears dark and more neutral against the faded and discolored image emphasizing the photograph's changed appearance. When the deterioration occurred is unclear, but according to Benson, Strand knew that they had

faded and he was disappointed that the retouching had become so visible. Thus, some fading already must have occurred prior to Strand's death in 1976 (Benson, 2003).

There are two types of discoloration in the Satista prints: an overall subtle orange-yellow discoloration that is visible in mid-tone areas, or isolated discolored fingerprints. The broader areas of discoloration are made more evident by contrast with the neutral and darker spotting. This contrast makes once smooth tonal areas appear mottled and uneven. The fingerprints do not sit on the surface of the photograph. Rather, they are evident as transformed image material, appearing negative or positive, i.e. as patterns of lost or discolored image material.

The deterioration is most severe in *Abstraction*, *Twin Lakes, Connecticut* (figure 3) one of Strand's four existing abstract photographs of porch railings and shadows. The abstract composition consists of railing shadows on a smooth white table that provide a rhythmic series of crisp, parallel rectangular forms juxtaposed with triangular shapes. The deterioration manifested by the fading of the image material and the unveiling of the extensive retouching, detracts from the flat and geometric shapes, especially the round tabletop in the foreground (detail, figure 4). The discoloration and fingerprint shapes along the edges also interrupt the strong dark black border (detail, figure 5).

The photograph of Harold Greengard (figure 2) is one of Strand's exceptional portraits from this period. Much like the composition of *Blind,* Strand uses the geometric surroundings to complement the subject. As with the other Satista prints, *Harold Greengard* exhibits fading and discoloration most visibly in areas along the right edge and in the mid-tone areas where the retouching is quite distinct. The thin vertical and horizontal lines in the back wall now appear mottled with the faded and discolored image and the dark retouching.

Satista Print Deterioration: Possible Causes

When Satista papers were first marketed, the Platinotype Company and their American distributor Willis & Clements made a concerted effort to convince photographers that the papers were stable. The manufacturers maintained that the prints were "permanent in the sense that the detail is not destroyed by time or atmospheric influence" (The Photographic Journal, December 1915, 282). The Platinotype Company was aware that the silver image material was more vulnerable than platinum and stated that Satista paper contained:

> sufficient platinum to form the image even if all the silver is removed. Actually the highlights are formed of platinum so that a picture with very delicate tones will be composed almost entirely of platinum, and in the shadows the silver is in the best form for permanence… Everyone knows that in the case of a fading bromide, it is the highlights that go and not the shadows. In Satista, therefore, one has a picture which may be regarded as permanent. (The Photographic Journal, December 1915, 282-286)

This disclaimer fails to address discoloration or density loss in the mid-tones, two of the changes that occurred in Strand's Satista prints.

Most notably, a brief comment in a 1916 edition of *Photo-Miniature* indicates an early awareness of Satista and Satoid papers' potential to deteriorate if poorly processed: "fix [the papers] by immersion for fifteen minutes in hypo, 4 ounces, water 40 ounces, turning prints

frequently and separating them to avoid uneven fixing and stains" (Photo-Miniature, October 1916, 413). Isolated from context, this advice may not seem unusual or indicate a particularly vulnerable paper. But this article surveyed the range of printing papers available on the market and the author chose to apply these careful words only to Satista and Satoid papers. In 1919, the author of a discussion on permanence in another photographic journal states that platinum and palladium prints are inherently more stable than the Platinotype Company's Satista and Japine Silver papers. He presumes that these papers would be as stable as a silver bromide print (Amateur Photography & Photographer 1919, 166).

The most plausible explanations for the discoloration in the Satista prints are iron staining or conversion of the silver image to silver-sulfide. Iron stains occur occasionally in platinum prints due to incomplete clearing of iron salts during processing. Silver-sulfiding is a problem found in silver prints where vulnerable silver reacts with sulfur, either from atmosphere or from residual hypo retained from processing. The shape of the silver particles plays a large role in their propensity to react with sulfur. The printed-out silver in a salted paper print or photolytic silver is finely divided and therefore provides a greater surface area open to oxidation. In the kallitype process—which involves the printing out of an iron salt and its conversion during development to metallic silver—the final silver image is also finely divided (Williams 1999). Kallitype photographs were notoriously unstable due to their particle size and susceptibility to oxidation from residual iron salts (Ware, The Argyrotype Process, 1996). In 1913, Paul Anderson described the kallitype image as initially similar to platinum but "so unstable that the process should be used only for the most ephemeral work"(Anderson 1913, 342). In addition to the platinum component, Satista paper presumably combined the salted paper and kallitype processes and therefore adopted the vulnerabilities of these two silver mechanisms.

XRF spectrometry was conducted to confirm the image material and to investigate the deterioration in the six Satista prints by Strand. The analysis found that all six photographs contained platinum, silver and sulfur associated with the image material indicating that silver-sulfide is present along with the platinum image material. In the analysis of individual stained areas, higher quantities of sulfur were not detected, however, the XRF may not be sensitive enough to detect these variations in the quantity of sulfur. No iron stains were detected. Trace amounts of mercury were possibly found overall in four of the Satista prints: *Jug and Fruit; Abstraction, Twin Lakes, Connecticut; Harold Greengard, Twin Lakes, Connecticut;* and *[Wire Wheel]*. However, the peak that may indicate mercury is too small for a positive identification.

Silver-sulfide formation appears to be the cause for the fading and discoloration. Sulfur may have been used as a toner in the original photograph, but the irregular deterioration and the susceptibility of Satista silver makes unintentional silver-sulfide formation the more likely explanation. The deterioration mechanism for the fingerprints is unclear. One hypothesis is that accelerated sulfiding was caused by fingerprint oils. A second possibility is that Strand may also have had some residual chemistry on his hands while handling the prints that accelerated the sulfiding.

Conclusion

In 1916, faced with a shortage of his preferred platinum papers, Paul Strand turned to Platinotype brand Satista papers. His aesthetic intent in the early years of straight photography was to produce strong geometric compositions with crisp shapes and subtle gradations, emphasizing the unique virtues of the photographic medium. Although the Satista papers' may have originally resembled platinum prints, deterioration in Strand's works over time has altered their appearance. The geometric effect is lost in many areas where the deterioration has changed flat tonal areas into variegated surfaces. Finally, the discoloration has changed the image tonality, a key factor in the prints' final aesthetic. With an understanding of the deterioration that has occurred, the artists' efforts to obtain at all costs a crisp and precise composition can be better appreciated and photograph conservators can be better informed to identify and preserve these extremely important works in the future.

Technical Results: X-Ray Fluorescence Spectrometry of Paul Strand's Platinum and Satista Photographs

Purpose

1. Determine the elemental composition of the image materials in six platinum, six Satista and two gelatin silver prints by Paul Strand.
2. Analyze discolored areas in the Satista prints to determine if they result from iron stains or silver sulfiding.

Procedure

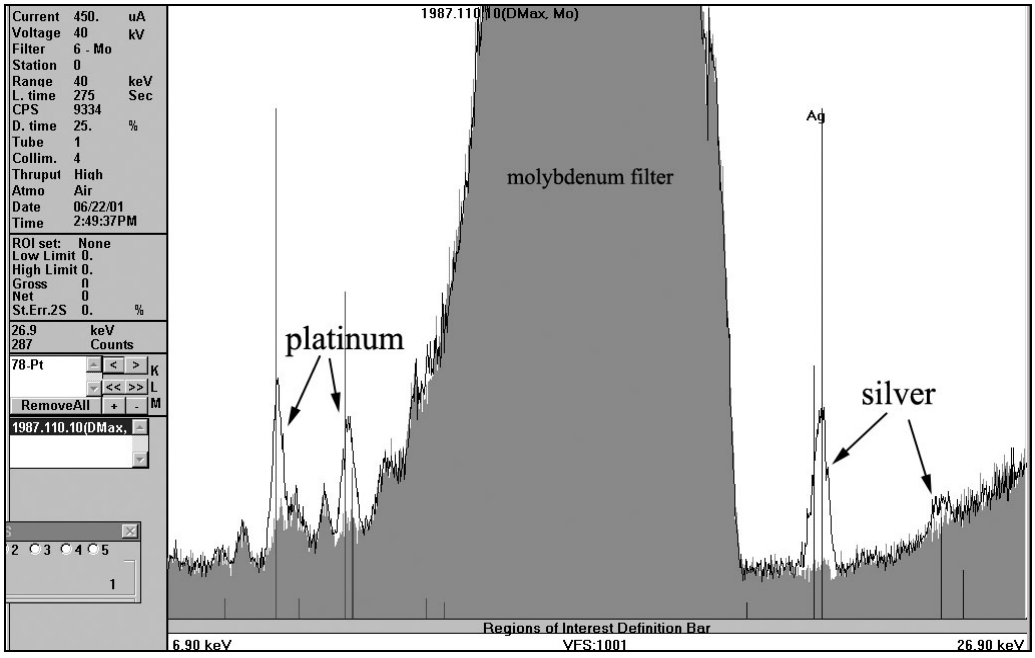
Elemental analysis was conducted with the Jordan Valley ExWIN Series energy dispersive Ex 3600 X-ray fluorescence unit at Metropolitan Museum of Art. The area analyzed is approximately 1.0 cm in diameter. Each sample area was analyzed for 275 live time seconds with direct rhodium radiation with high throughput (10μA, 40kV), molybdenum filtered rhodium radiation with high throughput (450μA, 40kV) and when more peak separation was necessary with direct radiation with low throughput (10μA, 25kV). One set of results is shown below for *Abstraction, Twin Lakes, Connecticut,* 1916. Each image includes two spectra: the dark gray represents a light image area in the photograph and the black line represents a dark area. These areas were selected visually to approximate the minimum (D-min) and maximum (D-max) densities of the photographs, but no densitometric readings were conducted. The differences between the two spectra indicate the presence of image material. In the first set of spectra, the difference between the D-max and D-min indicates the silver and platinum image material (figure 6). In the second set, the difference between the two spectra indicates that sulfur is also associated with the image material (figure 7). The same D-max and D-min areas were analyzed in both sets of spectra.

Results

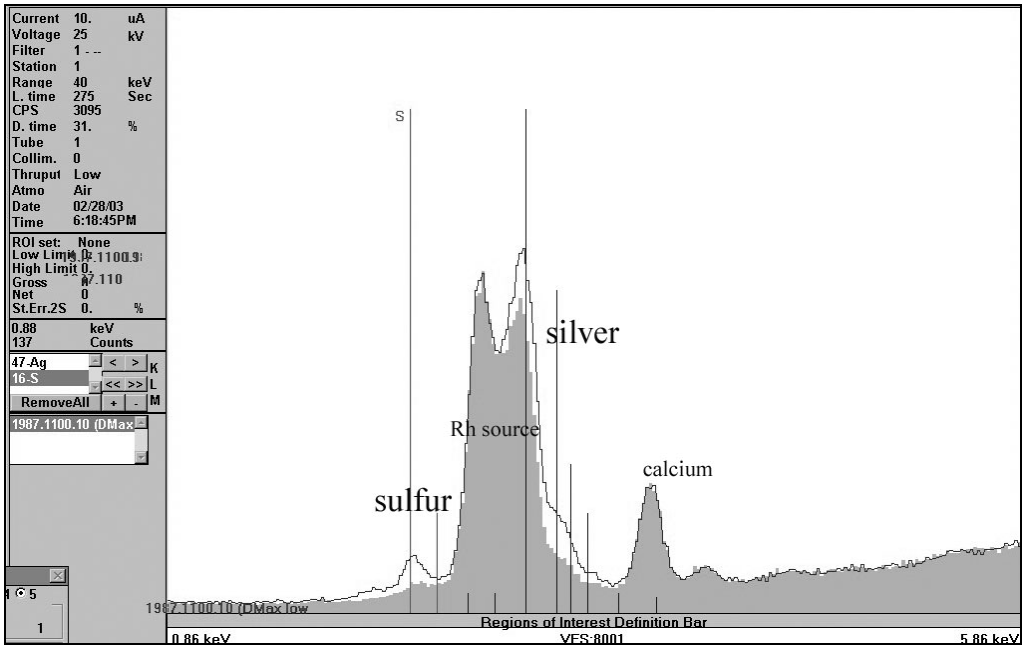
The following table lists the media determination of the fourteen photographs in this study. Six of the prints contain only platinum as the image material: *Blind* (1916), *Conversation* (1916), *[Office Buildings from Below]* (1917) and *Geometric Backyards* (1917). Two of the prints contain mercury and platinum as the image material: *Winter, Central Park* (c.1915) and *From the El* (1915). Six of the prints contain silver, platinum and sulfur as the image material: *Pear and Bowls* (1916), *Bowls* (1916), *Jug and Fruit* (1916), *Abstraction, Twin Lakes, Connecticut* (1916), *Harold Greengard, Twin Lakes, Connecticut* (1916), and *Wire Wheel* (1917). Non-image materials from either the photographic paper or mount are also indicated. There may be a trace of mercury overall in *Abstraction, Twin Lakes, Connecticut* (1916); *Harold Greengard, Twin Lakes, Connecticut* (1916); *Wire Wheel* (1917) and *Jug and Fruit* (1916). Since mercury has peaks that overlap with platinum and lead peaks, the determination depends on the questionable Lβ1 peak at 11.84 keV. A minor quantity of iron (larger than in the other prints) was detected overall in *Blind,* not associated with the image material. Trace amounts of copper, zinc, iron and lead were detected in several of the silver-platinum and platinum prints, but may be artifacts from the equipment and should be cautiously interpreted.

Two gelatin silver prints, *Garden Iris—Georgetown, Maine* (1928) and *Alfred Stieglitz* (1939) were analyzed to determine whether they were gold-toned. Silver was identified as

the image material and barium, sulfur and strontium were identified overall in the baryta layer. No gold was identified.



6. D-max spectrum over D-min spectrum indicating silver and platinum image materials in *Abstraction, Twin Lakes, Connecticut* .



7. D-max spectrum over D-min spectrum indicating sulfur as an image material in addition to silver and platinum in *Abstraction, Twin Lakes, Connecticut.*

Elemental Data from Fourteen Photographs by Paul Strand

TITLE	ACCESSION #	DIMENSIONS	DATE	ELEMENTS IN IMAGE MATERIAL*	ELEMENTS IN PAPER AND/OR SUPPORT*
From the El	49.55.221	33.6 x 25.9 cm (13 1/4 x 10 3/16 in.)	1915	Pt, (Hg)	Ca, (Fe),(Zn),(Cu),
[Winter, Central Park, NY]	L1995.2.174**	25.7 x 28.4 cm (10 1/8 x 11 3/16 in.)	c.1915	Pt, (Hg)	(Ca), (Fe), (Cu), (Zn), (Pb?)
Blind	33.43.334	34 x 25.7 cm (13 3/8 x 10 1/8 in.)	1916	Pt	Ca, Fe,(Cu),(Zn), (Pb)
Conversation	49.55.316	26.5 x 30.7 cm. (10 7/16 x 12 1/16 in.)	1916	Pt	Ca, (Fe),(Pb)
Abstraction, Twin Lakes, Connecticut	1987.1100.10	32.8 x 24.4 cm (12 15/16 x 9 5/8 in.)	1916	Ag, Pt, (S)	Ca, (Fe), (Cu), (Zn), (Pb), (Hg?)
Jug and Fruit	L2003.18.2 **	34 x 24.6 cm (13 3/8 x 9 11/16 in.)	1916	Ag, Pt, (S)	Ca, (Fe), (Zn),(Pb) (Hg?)
Bowls	49.55.317	33.9 x 25.0 cm (13 3/6 x 9 13/16 in.)	1916	Ag, Pt, (S)	Ca, (Fe), (Cu), (Zn), (Pb)
Harold Greengard, Twin Lakes, Connecticut	1997.25	25.4 x 33 cm (10 x 13 in.)	1916	Ag, Pt, (S)	Ca, (Fe), (Cu), (Zn?), (Pb), (Hg?)
[Pears and Bowls]	L1995.2.209**	25.7 x 28.8 cm (10 1/8 x 11 5/16 in.)	1916	Ag, Pt, (S)	Ca, (Fe),(Cu),(Zn), (Pb)
[Wire Wheel]	49.55.318	33.1 x 26.1 cm (13 x 10 1/4 in.)	1917	Ag, Pt, (S)	Ca, (Fe),(Cu),(Pb), (Zn?), (Hg?)
[Office Buildings from Below, New York]	33.43.335	34.1 x 24.4 cm (13 7/16 x 9 5/8 in.)	1917	Pt	Ca, (Fe), (Cu), (Zn)
[Geometric Backyards, New York]	1987.1100.12	25.4 x 33.3 cm (10 x 13 1/8 in.)	1917	Pt	Ca, (Fe), (Cu), (Zn)
Garden Iris—Georgetown, Maine	55.635.1a	24.3 x 19.3 cm (9 9/16 x 7 5/8 in.)	1928	Ag	**Ba, S,** Sr, (Cd), (Cu)
Alfred Stieglitz	55.635.2	24.1 x 19.2 cm (9 1/2 x 7 9/16 in.)	1939	Ag	**Ba, S,** Sr, (Cu)

* **Major,** Minor, (Trace)

**from the Gilman Paper Company Collection

References

Anderson, Paul. July 1913. The Choice of a Printing Paper, with Special Reference to Platinum. *American Photography* VII (7): 384-392.

Anderson, Paul. June 1913. The Choice of a Printing Paper, with Especial Reference to Platinum. *American Photography,* VII (6): 336-344.

Bayley, R.Child. 1932. *The Complete Photographer.* London: Methuen & Co., 10th ed..186. [Referenced by Nadeau, *History and Practice of Platinum Printing,* 44.]

Benson, Richard. 1990. Print Making, In *Paul Strand: Essays on his Life and Work.* New York: Aperture. 103-108.

Benson, Richard. 2003. Personal communication.

Bishop, L.C.. May 1915. Warm Tones on Black Platinum Paper. *American Photography*, IX (5): 398-400 .

Brown, George F. editor. 1915. *The British Journal Photographic Almanac and Photograher's Daily Companion.* London. 496-97.

Brown, George F. editor. 1916. *The British Journal Photographic Almanac and Photograher's Daily Companion,* 396-98; 468-71.

Fleischmann, Kaspar. 1987. Interview with Richard Benson, Photographer, New York, March 1987. In *Paul Strand.* Zürich: Zur Stockeregg. 136-154.

Glinsman, Lisha Deming. 2003. Scientific Research Department, National Gallery of Art, Washington, D.C.. Personal email communication.

Hambourg, Maria Morris. 1998. *Paul Strand: Circa 1916.* New York: Harry N. Abrams.

Nadeau, Luis. 1998. *History and Practice of Platinum Printing.* New Brunswick, Canada: (149) 229-30. *Atelier* Luis Nadeau, Third Edition. 1998.

Newhall, Beaumont. 1964. *The History of Photography from 1839 to the Present Day.* New York: Museum of Modern Art.

The Platinotype Company. Revised price list of Platinotype Paper. June 1, 1908. Copies of this list provided by Mike Ware.

[Satista Paper Patent] *British Paten N° 20,022,* September 4th, 1913, Improvements in or relating to Photographic Printing Paper therefor. In *History and Practice of Platinum Printing,* by Luis Nadeau. New Brunswick, Canada: *Atelier* Luis Nadeau, Third Edition, 1998. 45-51.

Smith, W.H.. December 1915. [discussion of Japine Silver and Satista papers], *The Photographic Journal*, 282-286.

Stieglitz, Alfred. 1899. Pictorial Photography. In *Classic Essays on Photography.* ed. Alan Trachtenberg. New Haven, Conn.: Leete's Island Books, 1980. 115-124.

Strand, Paul. June 1917. Photography and the New God. *Camera Work 1916/17* 49/50 reproduced in *Classic Essays on Photography* ed. Alan Trachtenberg. New Haven, Conn.: Leete's Island Books, 1980. 140-151.

Thompson, Julia. 2002. Chronology of Processes and Techniques. In Sarah Greenough. *Alfred Stieglitz/ The Key Set.* Washington, D.C.: National Gallery of Art, 2002. 943-948.

[Unknown Author]. 1907. Printing Processes Described. *Photo-Miniature,* February, 1907, Vol. VII, No. 78: 263-271.

[Unknown Author]. July 1913. Notes and Comment. *Photo-Miniature* XI:128, 465.

[Unknown Author]. May 1914. Materials Section. *The Photographic Journal,* 224.

[Unknown Author]. January 1915. Question and Answer Section. *American Photography:* 53.

[Unknown Author]. May 1916. Notes and Comment Section. *The Photo-Miniature* XIII

[Unknown Author]. February 1919. In Reply Section. *American Amateur Photographer & Photography* (47):166.

Ware, Mike. 1996. Alternative Printing: A Conspectus. http://www.mikeware.demon.co.uk/conspec.html

Ware, Mike. 1996 The Argyrotype Process. http://www.mikeware.demon.co.uk/argy.html

Ware, Mike. 2002. Personal email communication about Japine.

Wheeler, Captain Owen.1930. *Photographic Printing Processes.* London: Chapman and Hall, 138.

Williams, Scott A..1999. The Chemistry of Iron Salt and Dichromated Colloid Photographic Systems. Presentation notes, Workshop in Photograph Conservation: Pictorialist Processes of the Photo-Secession, funded by the Andrew W. Mellon Foundation, 21-25 June 1999.

[Willis & Clements advertisement for Platinotype, Palladiotype, and Satista]. May 1923. *Photographic Journal of America.* (60):5.

Willis & Clements. March 1914.[A short paragraph introducing Satista paper]. *American Photography* VIII (3):179.

Willis & Clements. 1885. *The Platinotype (patented)//Willis's Process.* [Pamphlet in the collection of the Library of Congress]. Second Edition. Philadelphia: Chambers Printing House.

Willis & Clements. date uknown [Platinotype, Palladiotype, Satista product guide from the collection of the Smithsonian Institution Libraries—Trade Literature Collection]

SUGGESTED READING

Art Historical

Duncan, Catherine. 1994. An Intimate Portrait. *The World on My Doorstep: Paul Strand.* New York: Aperture Foundation. 8-23.

Greenough, Sarah. 1990. *Paul Strand: An American Vision.* Washington: National Gallery of Art, in association with Aperture Foundation.

Homer, William Innes. 1998. Paul Strand: Circa 1916. *American Art Review,* X(3): 136-191.

Rosenblum, Naomi. 1990. The Early Years. *Paul Strand: Essays on his Life and Work.* Maren Strange, ed..New York: Aperture. 30-51.

Tomkins, Calvin. 1976. *Paul Stand: Sixty Years of Photographs excerpts from correspondence, interviews, and other documents*. Millerton, N.Y.: Aperture. 15-25.

Conservation and Technical References

Danzig, Rachel. 1991. Alfred Stieglitz: Photographic Processes and Related Conservation Issues. In *Topics in Photograph Preservation.* American Institute for Conservation of Historic and Artistic Works, Photographic Materials Group, Washington, D.C.. 57-79.

Eremin, Katherine, James Tate and James Berry. 2002. Non-Destructive Investigation of 19th-Century Scottish Photographs. In *Conservation Science 2002*. ed. Joyce H. Townsend, Katherine Eremin, and Annemie Adriaens. London: Archetype. 201-208.

Gent, Meghan and Jacqueline Rees. 1994. A Conservation Treatment to Remove Residual Iron from Platinum Prints. *The Paper Conservator* 18: 90-95.

Gottlieb, Adam. 1995. Chemistry and Conservation of Platinum and Palladium Photographs. *Journal of the American Institute of Conservation* 34: 11-32.

Khanjian, Herant P., Dusan C. Stulik. 2002. Insight into Early Photographic Processes: Quantitative XRF Approach. In *Conservation Science 2002*. ed. Joyce H. Townsend, Katherine Eremin, and Annemie Adriaens. London: Archetype. 195-200.

McCabe, Constance and Lisha Deming Glinsman. May 1995. Understanding Alfred

Stieglitz' Platinum and Palladium Prints: Examination by X-ray Fluorescence Spectrometry. In *Research Techniques in Photographic Conservation: Proceedings from the Copenhagen Conference*. Eds. Koch et al. Copenhagen: Royal Danish Academy of Fine Arts, 31-39.

Pénichon, Sylvie. 1999. Differences in Image Tonality Produced by Different Toning Protocols for Matte Collodion Photographs. *Journal of the American Institute for Conservation* 38(2): 124-143.

ACKNOWLEDGMENTS

This project would not have been possible without the generous support of the following people, institutions, and organizations: Nora W. Kennedy; Margaret Holben Ellis; Tony Frantz; Malcolm Daniel; Andrew Robb; Julie DesChamps; Mike Ware; Connie McCabe; Lisha Glinsman; Doug Nishimura; Chris Cottrill; The Department of Photographs in the Metropolitan Museum of Art; The Gilman Paper Company; The Conservation Center at the Institute of Fine Arts, New York University; The Conservation Division, The Library of Congress; The Andrew W. Mellon Foundation, The Foundation of the American Institute of Conservation; The National Gallery of Art and the Smithsonian Institution Libraries.

Papers presented in *Topics in Photographic Preservation, Volume Ten* have not undergone a formal process of peer review.

Lisa Barro
Assistant Conservator of Photographs
The Metropolitan Museum of Art