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Scientific Analysis and Treatment of a William Sawyer Photograph Album

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1. ABSTRACT

The Queen’s University Archives has a collection of artifacts that belonged to William Sawyer, a 19th century painter and artist from Kingston, Ontario. One of those items is a photograph album that Sawyer assembled as a study album, which has been little examined. The album contains a variety of photographs which may represent Sawyer’s experimentations with these processes and photography in general. In addition, there is an accompanying journal of Sawyer’s notes on various photographic processes with which he experimented during the same period in which the photographs in the album were produced. The condition of the photographs and the album as a whole is compromised and an appropriate treatment proposal is necessary to ensure the safety of the album. In order to devise a safe and appropriate treatment plan for the album, the photographic processes that were used to create the photographs needed to be identified. This project used a variety of analytic techniques, including stereomicroscopy, X-Ray Fluorescence, and Fourier Transform Infrared spectroscopy, to identify the photographic process used to create each photograph and to develop a treatment approach based upon the type and the condition of each photograph. The photographs were identified as follows: 36 were albumen, 13 were salted paper and two were silver gelatin. One photograph of the 52 was unidentifiable, but an analysis of notes from the accompanying journal which Sawyer kept suggested a possible, but unusual, method for the production of this photograph. In addition, the project discussed the comparative utility of each of the analysis methods including, stereomicroscopy, and X-Ray Fluorescence and Fourier Transform Infrared spectroscopy, in the identification of photographic processes.

2. INTRODUCTION

William Sawyer is primarily known for being a painter in Canada centered largely in Kingston, but he was also a photographer. Sawyer painted many of the portraits that hang on the walls of Kingston City Hall. While his photographs are less well known, he did seem interested in photography as a form of art and he experimented with it. The Queen’s University Archives has a small collection of papers that belonged to him, as well as several photograph albums and a journal in which he records some of the photographic processes he experimented with and the steps he took to create them.

William Sawyer was born in 1820 and died in 1889 (Bell 1978, 21), which puts the start of his career right around the time that photography was invented in 1839 (Coe and Haworth-Booth 1983, 27). He started by painting portraits of the various mayors of the city of Kingston at the time, which are now on display in the City Hall (Bell 1978, 17). Like many artists, he started to experiment with various art forms, and photography could be an interesting alternative to portrait paintings in that photographs could be produced much more quickly than paintings and could be
used to produce portraits as well. The photographs could also be used to cut the sitting time for
painted portraits (Bell 1978, 24).

At this time in Kingston, William Sawyer was not the only photographer and probably not nearly
as well known as the photographic company Sheldon and Davis. Sawyer actually worked with
Henry K. Sheldon (Bell 1978, 13), which is clear from the fact that one of the photographs in this
album is labeled as being taken by Sheldon (McKendry 1998, 97). There are also several
notations with Sheldon’s initials in Sawyer’s journal, possibly because these were Sheldon’s
ideas (Sawyer 1838, 32). This suggest that, at least, the artists were reasonably well acquainted
and did work together.

The photograph album has 52 photographs, most of which can be assumed to have been taken by
Sawyer although at least one of them is known to be by Sheldon. Most of the photographs in the
album are adhered to the pages, but there are fifteen photographs at the end that have been stuck
into the pages and are loose. The album appears to be a personal study of the capabilities of
photography, based on the casual way the photographs were put together in the album and also
the inclusion of some photographs of paintings. Sawyer has included some photographs of
Kingston, Watertown, NY, and Bellville, as well as some group photographs of soldiers,
including a composite photograph of at least fifty people. The photographs of paintings are
joined by a few photographs of sculpture.

The journal that is included with the William Sawyer collection at the Queen’s University
Archives includes some of the recipes that he might have used to produce photographs as well as
a very few personal notes. There are also some other photograph albums, which are in much
better condition than the one that this research will focus on, which mainly contain photographs
of Sawyer’s wife and children.

There are a number of problems with the album studied here. There is no binding anymore,
leaving the pages, and especially the first page, vulnerable to damage of various kinds. The pages
of the album have become brittle over time and there are many losses along the edges, as well as
a severe amount of foxing on every page which is caused by the presence of corroding metals in
the paper fibers which were distributed throughout the paper during the papermaking process.
Most of the photographs within the album are in reasonably fair condition, but several of them
appear to have been crumpled at some point. Many have flaking emulsion at the edges and
especially the corners, and some have silver mirroring. While some of these photographs could
have been studies by Sawyer, others are important to the history of Kingston and Toronto. The
first photograph in the album is of Sheriff Jarvis, the mayor of Toronto, who was in office from
1827 to 1856. There is another photograph in this album that is of the Kingston Courthouse and
it is unfortunately one of the photographs that is in worse condition than the others.

3. HISTORY SECTION

William Sawyer was an artist in Canada in the 19th century. He was a native of Montreal but he
lived for many years and eventually died in the city of Kingston in Ontario. Sawyer is most well-
known for his paintings, especially for the portraits he did of the mayors of Kingston, which
hang on the walls of the Kingston City Hall today. However, he was also a photographer. Sawyer
seems to have been a somewhat experimental photographer, which is not unusual for the field, at the time, sometimes combining his knowledge of painting with that of photography. He left behind a small study album of over fifty of his photographs which will be the subject of this study.

3.1 WILLIAM SAWYER’S LIFE AND CAREER

William Sawyer was born in Montreal, Canada on November 9, 1820, to John Sawyer and his wife, Agnes Brown Sawyer. Some time after that, his mother died and his father remarried a woman named Ann Sutherland. They had a child shortly afterward, named Elizabeth Sarah, who was apparently very close with William (Bell 1978, 8).

There is little information available about his early life and especially about his early education, but it seems that he received a good one (Bell 1978, 8). It does appear that he did not receive any formal training or education in art. Also, he might have been influenced by the artist activity that he could have seen around him while he was growing up in Montreal (Haynes 2006, 3). It is possible that William Sawyer taught himself how to paint and then later how to create photographs. This was a known path that some artists have taken at the start of their careers, so it is not unreasonable to assume that, based on the lack of knowledge about Sawyer’s education, he might have taken this route as well. It is also possible that he learned to draw and paint through copying great works such as drawings, engravings, casts used to draw from, and possibly real-life studies (Bell 1978, 8).

He started his career in the arts in Montreal with a studio in the Moyer Building but, being new to the art scene, he took to traveling around the area in search of commissions (Bell 1978, 8). William Sawyer had his first studio in Montreal around 1845, where he was able to create his paintings. He lived and worked in Montreal until he was no longer able to support himself as a young artist. He then decided to travel around the Ontario and Quebec provinces looking for commissions of paintings, mostly around the northern shore of Lake Ontario, including Port Hope, Belleville, Cobourg, Toronto, Brockville, Ottawa, Kingston, and Peterborough (Bell 1978, 13).

William Sawyer married Eliza Jane Baxter in Kingston, Ontario in November of 1851. William and Eliza had their first child, John, in 1852 and would eventually have nine more children (Bell 1978, 13). After he met his wife, Eliza Jane Baxter in Kingston in the 1850s, they moved to New York for a while to see if they could make a living there. When the newly married couple decided that the city was too busy for them, they went back to Canada. Sawyer and his family moved back and forth between Montreal and Kingston several times over the next several years. A few years later, Sawyer set up his studio in Kingston in the Gas Office Building, but he almost always kept a foothold in his birth city of Montreal (Bell 1978, 13).

In 1856, Sawyer finally decided to make Kingston his home but continued to travel to nearby cities for work mostly along the north shore of Lake Ontario and even as far as Quebec. His growing family created an even greater pressure on him to earn money which motivated him to finally set up a studio and photography business in Kingston (Bell 1978, 13). He worked and
lived in Kingston for the rest of his life with only brief periods of travel in search of work sporadically placed throughout the rest of his career (Bell 1978, 94).

From 1856 onward, Kingston was his base of operations and this is also when we begin to see evidence of Sawyer’s experimentation with photography. He was able to use contacts and personal friends to secure commissions of portraits for members of the business and legal class (Bell 1978, 13). Sawyer was able to get commissions to paint portraits of members of the Canadian government, the city of Kingston, and other established leaders of the community. He was also able to exhibit his work in a couple of shows but he was not a member of the local art societies. He did lecture about art and his theories on the subject to the local Anglican church and Young Men’s Christian Association in Kingston and he received some awards for his art (Bell 1978, 14).

Sawyer was also able to paint many of the portraits of the mayors of Kingston, which is how most people know of him today. The portraits that he painted still hang in City Hall and the earliest one is dated 1851, which is before he is known to have been living in Kingston, so it must have been commissioned during one of his many trips to the area. He also painted a full-length portrait of John A. Macdonald. This portrait was seen by several important figures in Ottawa and lead to more than one commission for Sawyer (Bell 1978, 17).

By the 1860s, he had established himself in the area as a portrait painter. Little is known about his career as a photographer but he is known to have worked with some local photographers, coloring their photos or adding the figurative details in coats of arms and emblems for Thomas Doane of Montreal and Henry Sheldon of Kingston (Bell 1978, 13). Sawyer placed an advertisement in the Montreal Pilot Newspaper from 1858 that advertised his skills as a photographer which would seem to imply that by this time at least, he was beginning to work with photography. It is noted that he had a photo and art studio in Montreal in 1871 but that he had also started to travel for work again in the 1870s, which means that he was continuing to focus on expanding his financial base throughout the region (Bell 1978, 19-20). By the 1880s, he was working with a Kingston ornamental painter, Thomas Robinson, painting portraits, and giving lessons. The money he received from painting the portraits of past mayors of Kingston seems to have been the major source of his income in his later years. He did continue to paint up until his death at the end of 1889 (Bell 1978, 21). His obituary said that he died at the age of 69 in his home on Earl Street in Kingston (Bell 1978, 94).

While there is not much known about his photographic career, it can be assumed that, based on the few dates that are provided in the Sawyer photograph album, he was at least experimenting with photography as early as 1857. For someone who thought of himself more as a painter, and did not think very highly of photography as an art form to begin with, he was working with the medium soon after it was invented in 1839 on another continent. He is known to have used photography as a preliminary image for some of his portraits (Bell 1978, 24). This was actually a good business model because he would be able to cut down the length of time a subject would have to sit for a portrait by more than half. He is also known to have combined the two mediums, in a crayon portrait or enlargement, such as one Sawyer painted of Dr. James Sampson (Bell 1978, 23). In this portrait, coloration was added with charcoal in the shading and in a faded-out area around the bottom of the bust.
3.2 PHOTOGRAPHIC PROCESSES USED IN THE SAWYER ALBUM

There were three photographic processes that were identified in the process of the analysis described below in the Results section of the photographs in the William Sawyer photographic album, including salted paper photographs, albumen photographs, and silver gelatin developing-out-print (DOP) photographs.

3.2.1 Salted Paper Photographs

The salted paper print is the earliest form of a positive photograph and its invention is most often credited to William Henry Fox Talbot in 1839 when he published his process, but he first started experimenting with this process five years earlier (Coe and Haworth-Booth 1983, 27). However, the concept for the salted paper print was first conceived before 1802, by a Briton, Thomas Wedgwood, and by Joseph Nicéphore Niépce, a Frenchman, in 1816. Talbot is credited with the invention of the salted paper print because although Wedgwood and Niépce could create an image, they had no way of fixing their images to the paper to make them permanent. Talbot used John Herschel’s method of stabilizing his images with sodium thiosulfate or hypo (Stulik and Kaplan 2013, 4). The development of the salted paper technique arose from the desire, during the early days of photography, to create a permanent positive image (Stulik and Kaplan 2013, 4).

However, there are several important discoveries in science and photography that came first, allowing Talbot to create this process. The first came in 1727, from a German physicist and professor names Johann Heinrich Schulze, who, through several experiments, was able produce geometric images on a glass bottle that contained a mixture of calcium carbonate, dilute nitric acid, and a small amount of silver. He proved that the darkening of the mixture when exposed to light was not a thermal effect but a photochemical effect. He went on to create stencils, with which he would cover the glass bottle, creating the first examples of a photogram (Stulik and Kaplan 2013, 4). In 1777, Carl Wilhelm Scheele, a Swedish chemist, discovered that a solution of ammonia could dissolve an insoluble silver chloride precipitate in water. Around that same time, a Swiss scientist Jean Senebier experimented with the darkening of silver salt compounds under different colors of glass. This meant that when silver chloride-coated paper was exposed to different wavelengths, it produced different levels of darkness or tones (Stulik and Kaplan 2013, 4-5).

Without these important discoveries in science, Talbot would never have been able to invent the salted paper print or the later, and somewhat improved, Calotype (also known as the Talbotype (Stulik and Kaplan 2013, 6)). Talbot’s experiments and inventions became the basis for several other processes, such as the direct positive printing process developed by Hippolyte Bayard and the waxed paper process created by Gustave LeGray (International Center of Photography 1984, 443).

In the early 1850s Louis Blanquart-Evrard developed a way to mass-produce salted paper prints. This was significant, because he could produce hundreds of prints in one day from one single negative. This was possible because he created a method for chemically developing positive photographs that uses a gallic acid-based developer chemical, which replaced the slow and
unreliable method for developing photographs in the sun. This advancement in the salted paper process helped it remain a popular printing technique until the 1860s, when the albumen printing process became popular, replacing salted paper printing. Salted paper prints stopped being used and the practice of creating them was lost until the 1960s when photographers revived this process, calling it an alternative process and began using it again (Stulik and Kaplan 2013, 7-8).

3.2.2 Albumen Photographs

The albumen photographic printing process was invented by Louis Blanquart-Evrard in 1850. While he is the person who is credited with the invention, it should be noted that there were several previous experiments from other people involving albumen positives, but that Blanquart-Evrard made the substantial contributions to the process that made it what we know today (Stulik and Kaplan 2013, 4). The albumen process quickly became the major photographic printing process, replacing any processes that came before it and it was popular until the end of the nineteenth century (Lavédrine 2009, 112). A high percentage of photographs from the 1800s are probably albumen photographs (Hill 2016, 5). Albumen photographs are an important point in the progression and advancement of photograph technique and development (Lavédrine 2009, 112).

This is understandable when we look at the characteristics of albumen photographs, that previous processes were not able to accomplish. Albumen photographs normally have a high resolution, good reproduction of details, and a warm brown overall tone. Due to the increasing popularity of albumen photographs, companies started to produce more and more pre-made paper that was already sensitized with the albumen salt, only requiring the user the coat the paper with a silver nitrate bath before it would be ready to photograph on. With the high availability of this paper, albumen photographs were being used in many formats; some of them were newly created, such as carte-de-visites and cabinet cards. These new formats allowed for portraits to be produced at a lower cost, which meant that a greater proportion of the population could afford to get a portrait taken of themselves or their family, who had not been able to do so previously (Lavédrine 2009, 112). In 1872, the production of fully pre-sensitized albumen photographic paper with a longer shelf life began to occur, which also made albumen photographs more accessible and popular (Stulik and Kaplan 2013, 5). The albumen process was the main photographic process in use and was very popular between 1850 ((Lavédrine 2009, 112) and 1890. It was phased out somewhat by the invention of collodion and gelatin printing-out-prints, but the albumen process was still being used into the late 1920s (Stulik and Kaplan 2013, 4).

3.2.3 Silver Gelatin DOP Photographs

Silver gelatin developing-out-prints (DOP) were created around the 1880s, in response to the deficiencies and problems that silver gelatin and collodion printing-out-prints (POP) had (Lavédrine 2009, 138). The advantages that silver gelatin DOP photographs had over POP photographs was that they did not need to be exposed outside to the sun (requiring a sunny day or an extended exposure time), the detail was slightly sharper, an image could be made through contact printing or through a projection of the negative in an enlarger, and these new DOP photographs required a chemical developer to make the exposed image visible (Lavédrine 2009,
Silver gelatin DOP photographs do have to be exposed, developed and put through a stop bath and a fix bath, all in a darkroom, with no more than a red light.

Silver gelatin DOP photographs were originally made with silver chloride as the light-sensitive salt. This was an effective salt in the beginning, however it was very sensitive to light, so sensitive that it acquired the nickname “Gaslight Paper” because it could even record an image in the faint light produced by a gas lantern. This early chloride paper could, however, be developed in low lighting without the need for a darkroom, which would be somewhat more convenient for some people. However, with the advances in photography in terms of the cameras, plates, and the use of film negatives, the silver chloride papers were less useful. These advances meant that the camera, plates, and film negatives were getting smaller and smaller. A new light-sensitive salt was also starting to be used: silver bromide. This new paper was not as sensitive to low lighting situations, like gaslight, and it could now be used in a darkroom with an enlarger (Lavédrine 2009, 138).

Silver bromide paper could be used to contact print an image or to project an image from a negative through an enlarger, which was, and is, more practical, to this day. The downside to the new silver bromide paper was that the development process now needed to be conducted in a light-sealed room, with no more than a red light (Lavédrine 2009, 138). Another important step in the history of silver gelatin DOP photographs was that the original paper did not have a baryta layer (barium sulphate). This layer is responsible for the ultra-smooth surface texture that we know of today in modern silver gelatin photographs. The baryta layer is also capable of taking on many textures, if so desired. Those original papers without the baryta layer were also not as sharp in terms of detail as they were after the addition of this layer, in the 1890s. The baryta layer was also added to the commercial manufacture of silver gelatin photographic paper in 1894 by a German company and then in 1900 by Kodak (Weaver 2008, 6).

4. PHOTOGRAPHIC PROCESSES IN THE ALBUM AND THE DESCRIPTIONS IN THE JOURNAL

The photograph album from William Sawyer is a part of a collection of photographs, papers, and various other items that were donated to the Queen’s University Archives. One of the items that is included in this collection is a journal that was hand written by Sawyer and contains some of his photographic process recipes, notes, and instructions for creating various photographs. The original journal is at the Archives, as well as a transcription of his handwriting made by a staff member at the Archives after the donation. A reading of the journal makes it clear that this was meant to be personal notes. It is very rough and he used a kind of short hand that was clearly specific to him. Sawyer also references, on several occasions, other resources such as other names, presumably of photographers, as well as some printed sources of information such as a photography newsletter, which seemed to discuss many photograph processes and how to create them. He discusses several photographic processes including albumen; collodion (both paper and plate); gold, lead, iron, and uranium toning; adding color (paint, watercolors) to photographs or plates; Calotype; and Opal plates (Sawyer 1838, 1, 6, 12, 16-17, 20, 22, 24-28, 30, 33-35). Sawyer even mentions how to clean a tarnished Daguerreotype using the cyanide method (Sawyer 1838, 36), which was replaced by another method in the 1950s (Houseman 2016, 15).
While investigating this photographic album, it was realized that the fact that he died in 1889 means that the silver gelatin DOP photographs that he made and put in the album (one of which is a portrait of Sawyer) had to have been created entirely by him. These photographs have a baryta layer, but that was not added to the commercialized manufacture of silver gelatin DOP photographs until the 1890s, so Sawyer must have coated the paper with a baryta layer that he made himself. There are several recipes with instructions on application in his handwritten journal that include some variant of a baryta layer. Traditionally this layer is made of barium sulphate, but in one recipe, Sawyer includes chloride barium as well as silver, water, acetic acid, arrowroot and cornstarch which are combined and coated on paper (Sawyer 1838, 25, 35).

It is also clear from reading the journal, that Sawyer experimented quite a bit with photography and sometimes used ingredients that might seem unusual or used more in paintings. For the first recipe, he discussed for albumen photographs, the ingredients include fresh egg whites, strained honey, iodide potassium, bromide do (sic.), and “clean” salt. Sawyer also included instructions on mixing, filtering, and pouring on the plate. He then wrote about a bath of silver nitrate, water, and acetic acid, which the plate was dipped in, as well as a developer recipe and a substitute for the honey in the albumen coating (Sawyer 1838, 1-4). There are no obvious recipes or instructions for creating a salted paper photograph or a full silver gelatin DOP photograph. This was not unusual because, of the few dates that are written in the journal, the latest date in 1885 (Sawyer 1838, 34). Although the silver gelatin DOP process had been invented by then, that entry in 1885 is for a collodion process. His earlier entries might have been too early to have addressed silver gelatin techniques. Additionally, he might have chosen not to write down a recipe or instructions for a salted paper photograph perhaps because he was not as uncertain about the process and how to make it work.

5. EXPERIMENTAL

There were three steps to the experimental part of the research. These steps included a visual examination, x-ray fluorescence (XRF), and Fourier transform infrared spectroscopy (FTIR) for the purpose of determining the type of photographic process represented by each photograph. Additionally, the photographic data was analyzed in comparison to the information from Sawyer’s journal containing information about his recipes for his photographic work to explore relationships between his notes and the photographs in the album. The final step of the process involved development of a treatment approach for the photographs in the album. A visual examination using microscopy was conducted on each of the 52 photographs in an attempt to identify the photographic process used to produce each image. The second step, XRF analysis, was also conducted on every photograph to support the photographic process identification of the photographs. The third step, FTIR analysis, was only performed on those photographs that already had flaking emulsion on them and would be able to give a good representation of the album and to limit the harm to the photographs since FTIR is a destructive analysis. The XRF would permit the identification of some metals while the FTIR would identify any proteins present in the photograph, like egg whites in albumen and gelatin in silver gelatin.

For the visual examination, a Leica no. M655 electromedical stereomicroscope was used in conjunction with a fiber optic light source. To prevent confusing one photograph for another, they were all numbered. The number was written next to each photograph on the photograph.
documentation images that were taken at the beginning of this project. The pages in the album with photographs were documented using a Nikon D500s camera. The examination was specifically looking at the surface of the photographs to identify the process as well as the current condition of each photograph. By looking at the surface of the photographs at a magnification of x40, it was possible to more accurately assess the surface of the photograph. A description was made for each photograph that included the surface texture, whether paper fibers were visible, the size and the location on the page, the condition of the photograph and the page it is on, and the content of the photograph, as well as the photographer if known. Each photograph was also spot tested with a small drop of water and again with ethanol. The interaction of the solution and the photographic surface was observed under the microscope. This test can be useful in differentiating between albumen, collodion, and silver gelatin. Water will sink into the surface of albumen and collodion while, when in contact with gelatin, water will cause the emulsion to swell into a small bump. Ethanol will also sink into the surface of gelatin and albumen but it will dissolve the emulsion, which contains the image, at the spot where it is tested on a collodion photograph.

The XRF analysis that was performed on each of the photographs in the album was done using a Bruker Tracer III Hand-held X-Ray Fluorescence Analyzer. The album was placed on a flat surface and a piece of 3/8” thick Plexiglas was placed under the page in the album that was to be analyzed. This sheet of Plexiglas was used to attempt to prevent any of the x-rays from penetrating the page and hitting a photograph on the next page. A thin sheet of Mylar was placed on top of the photograph to be tested and then the XRF unit was placed on top of the photograph. The thin sheet of Mylar was used in an attempt to protect the surface of the photograph from abrasion. The settings used for the XRF unit were 40 kV and 30 mA. No filter was used and the duration of the scan was 90 seconds each. While some sources recommend a filter be used when doing XRF analysis of photographs (Stulik and Kaplan 2012, 88), the current settings were recommended by Dominique Duguay, a conservation scientist at the Canadian Conservation Institute. The filter that is often suggested to be used with photographs is one that filters out the silver peak that is sometimes produced by XRF units. However, when there is only a small trace of silver present in a photograph, the filter will also filter out that small trace. Therefore, as some photographs in this collection were expected to have such a peak, the filter was not employed. A spectrum was produced with peaks indicating the metals present in the photograph. All scans were recorded for both light and dark areas of each photograph and the peaks on the spectra were labeled with their corresponding metal element and recorded into a data record which collected all data for each photograph.

For the FTIR analysis, five photographs were chosen: the two silver gelatin photographs (39 and 45), photograph 28 which had been difficult to identify visually, an albumen photographs (photograph 38), and a salted paper photograph (photograph 44). These photographs were chosen for several reasons: these photographs are a good representation of the photographs in the album, they already had flaking emulsion so there would be no unnecessary damage done to them, there were only two silver gelatin so it would not be unreasonable to analyze both, and this analysis might provide more information about the identity of the process used for photograph 28. This way a comparison could be made between the processes. This meant that only a small number of the photographs in the album were analyzed. A small flake of the emulsion of the photograph
was extracted under a stereomicroscope, placed between microscope slides, which were taped together, and labeled.

The instrument that was used to do the FTIR analysis was a Nicolet Avatar 320 FTIR with a Golden Gate, single pass diamond Attenuated Total Reflectance (ATR) attachment was employed, operating with 32 scans and at a resolution of 4cm$^{-1}$. The sample was taken from the vial and placed on the platform of the instrument and pressed in the Golden Gate ATR. After several minutes, the scan was complete and a spectrum was produced. This instrument was used because it is able to detect proteins in a sample, such as the egg white in an albumen photograph or the gelatin in a silver gelatin photograph.

Data from these investigations were subjected to a qualitative analysis. The aim of the analysis was to verify the photographic process of each photograph so as to support the most appropriate treatment for each photograph. The microscopic examination provided a detailed examination of photographic structure and visual appearance while the XRF and the FTIR data gave more information on the chemical make-up present in the photograph to help reinforce the visual photographic process identification from the microscopic examination. The data from all three analyses was used together to help identify the photographic processes from the album. In addition, the information from Sawyer’s notebook was consulted in reference to the processes and the metals identified in the analyses in order to understand any possible relationship between the types of experimentation that Sawyer was conducting with his photographic processes and the products of that experimentation as represented in the album.

6. RESULTS

6.1 MICROSCOPIC EXAMINATION

The subjective nature of microscopic examination and the reliance on the examiner’s previous experience in identifying photographs adds an element of subjectivity to this component of the research, however, standards are available for identification of photographs using microscopy.

- Salted paper prints are expected to show the following characteristics: visible paper fibers, no binder, no baryta layer, less surface gloss, and yellow to brown tone. An example of what the surface of a salted paper photograph should look like under microscopic examination is in figure 1. Their response to tests with water and ethanol is usually the same and involves the solutions sinking into the paper.
Fig. 1: Salted Paper Photograph surface, under 30x (Reilly 1986, 62).

- Albumen photographs should show the following characteristics: some surface gloss but usually matte, a binder layer, no baryta layer, a distinctive yellow hue, and a characteristic cracking pattern. The cracked pattern is due to exposure to high humidity and temperatures, so not all albumen photographs will have this pattern, but this cracking pattern is only on albumen photographs. Figure 2 is an example of what the surface of an albumen photograph should look like. Albumen photographs reaction to water and ethanol is the same, both solutions sink into the paper.

Fig. 2: Albumen Photograph surface, under 30x (Reilly 1986, 63).

- Silver gelatin photographs should have the following characteristics: glossy surface, sharp detail, baryta layer present, binder layer present, and no paper fibers visible. An example of what the surface of a silver gelatin DOP photograph should look like is in Figure 3. When spot tested with ethanol, the solution sinks into the surface of a silver gelatin DOP photograph, but with contact to a drop of water, the gelatin swells into a small bump on the surface of the photograph.
Thirteen photographs were identified as salted paper prints. The photographs that were identified as salted paper prints are: 1-2, 6-8, 42-44, and 46-50. All of the salted paper photographs have visible paper fibers, no binder, and no baryta layer. This lack of binder and baryta make salted paper photographs a one-layer process. Most of these photographs also have a surface gloss, which is less common for a salted paper photograph. There are two photographs that do not have this gloss; photographs 7 and 43, which have a matte surface texture. The salted paper photographs all have a yellow-ish tone to them, which is characteristic for this process and helpful in ruling out one of the other one layer photographic processes. The photographs were all spot tested with water and with ethanol, to make sure that they were not another process and to keep the testing of all the photographs consistent. Both solutions soaked into the paper, which was further confirmation that these photographs were salted paper.

There were two photographs that were identified as silver gelatin DOP: photographs 39 and 45. Both of these photographs were spot tested with water and with ethanol. In the presence of water, the gelatin in both of these photographs swelled, which is a classic indication of gelatin. However, they did not react to the ethanol. Silver gelatin DOP photographs have a binder and a baryta layer, which was visible under microscopic examination. The presence of binder and baryta on top of paper make silver gelatin DOP photographs a three-layer process. Photograph 39 has less surface gloss than a typical silver gelatin DOP photograph, but it is not enough to doubt the identification. Photograph 45 has significant surface gloss. Both of these photographs have extremely sharp detail, which is even more noticeable under a microscope.

When the photographs that were identified as albumen were spot tested with water and with ethanol, both of the solutions sunk into the paper which is characteristic of albumen photographs. The photographs identified as albumen include 3-5, 9-27, 29-38, 40-41, and 51-52. All of the photographs that were identified as albumen during the microscopic examination stage had visible paper fibers or, at the very least, some of the paper fibers were still visible, except for photographs 31 to 33. The paper fibers in these three photographs were either obscured by cracks in the emulsion or a clear coating on the photograph such as gelatin or a varnish. All of the albumen photographs displayed some surface gloss, except photographs 12, 13, 38, and 41, which is unusual for albumen photographs because they normally have a more matte surface. This presence of surface gloss on many of the albumen photographs but not all, suggests that these photographs might have been coated with something that would give a glossy appearance. This was a common practice among photographers. The coating could be a varnish or gelatin. Gelatin would be a logical conclusion because photographs 15 to 19, which all appear glossy, are
albumen photographs, and appear to have some mirroring. All five of these photographs are on the same page. If they were coated with gelatin, then the silver particles in the albumen emulsion could have traveled up through the gelatin coating, due to fluctuating temperatures and humidity, to appear as mirroring. One of the major commonalities between all of the albumen photographs was that they did not have a baryta layer, but there was a binder layer present, which can also contribute to obscuring the paper fibers. The presence of a binder makes albumen photographs a two-layer process. Some of the albumen photographs exhibited classic micro-cracking of the binder, which is one identifying characteristic of albumen photographs. However, not all of the albumen photographs had these cracks, which is not out of the ordinary, because the cracking is usually due to the fluctuations in the surrounding environment. If those photographs without cracks were not in fluctuating temperatures and humidity, then they would not have developed cracks. It is also possible the clear coating of gelatin or varnish of many of those photographs have might have been thicker on some and that could have prevented the cracks from forming. The ones that have this cracking are photographs 9, 21, 31-38, 41, and 51-52. Albumen photographs also have a yellowish tone, but the presence of a binder helped to identify them as albumen and not salted paper.

Photograph 28, proved very difficult to identify and the process remained unidentified after visual examination. When doing microscopic examination on this photograph it was instantly apparent that this process was different from the other photographs. There are no paper fibers visible, except in several minute areas in the top right corner. It also appears that the front side of the paper is a saturated black color and the back is pure white. There also appears to be a coating or emulsion layer on the photograph but it is difficult to determine what it is. The surface of the photograph almost resembles that of a charcoal drawing, because the black material on the front of the paper is the same color and resembles a friable media like charcoal. The problem with this assessment is that it is not friable enough and the particles are not the right shape to be charcoal, even man-made charcoal. There are areas of what appears to be deterioration but those areas look more like the kind of deterioration on a tintype. It is difficult to fully describe what this kind of deterioration looks like, so figure 4 shows a magnified image of one of these areas on photograph 28. This assessment would correspond to this photograph being a copy of a tintype, which had this deterioration on it, at the time of copying. If this is not the case, then this photograph was processed very badly during development, because it is much darker than expected.

Fig. 4: Magnified image of the surface of photograph 28 with raking light.
6.2 XRF

The XRF analyses of all the photographs were somewhat helpful in supporting the identifications of the photographic processes. The photographs that were identified as salted paper all showed traces of silver (Ag), calcium (Ca), and iron (Fe). This is typical of salted paper photographs because there is no binder or baryta layer, so the elements that the instrument are detecting are in the paper (Ca and Fe) and the light-sensitive salt (Ag). The peaks for silver for the photographs in the spectra were either very small or shoulders of other peaks from the instrument. The XRF was also able to detect some other elements in the salted paper photographs. Photographs 1, 42, 44, and 47-50 all had a trace of sulfur (S) present in the spectra. Photographs 2, 6, 8, 47, and 49-50 had small amounts of gold (Au) in the spectra. Photographs 44, 46, 47, and 49-50 had traces of lead (Pb) in the spectra. It was a common practice, and still is today, to tone photographs with various chemicals including gold. Lead is also often found when doing XRF analysis of salted paper photographs. Figure 5 is an example of an XRF spectrum for one salted paper photographs (47) from the Sawyer album. It also shows a photograph with gold and lead traces on it.

![XRF Spectrum of a Dark Area in Photograph #47.](image)

The two silver gelatin DOP photographs also had calcium and iron in their spectra, which is understandable because they were both made on paper in which calcium and iron would normally be found. There was also barium (Ba) present in the spectra for the silver gelatin photographs, which is from the barium sulphate that makes up the baryta layer. In addition, like some of the salted paper photographs, both of these silver gelatin photographs have sulfur. Photograph 39 also showed the presence of strontium (Sr). According to the Getty Atlas of Analytical Signatures for Photographic Processes for Silver Gelatin photographs, strontium is a common element to detect in silver gelatin photographs and is often found in the baryta layer. Figure 6 shows one of the XRF spectra for one of the silver gelatin DOP photographs (45). It shows both the barium and the strontium peaks.
The albumen photographs had similar XRF spectra in that they all showed the presence of silver, calcium, iron, and sulfur. There were other elements that were detected in the Albumen photographs, including gold (Au), lead (Pb), mercury (Hg), and uranium (U). Not all of the albumen photographs had these elements. Gold was in all of the albumen photographs except 9, 15-19, 22-23, 26, 29, 31, and 40-41. The albumen photographs that showed traces of lead were 1-2, 6-11, 13-16, 18-19, 24, 26-28, 32-33, 35-37, 39-40, 42-50, and 52. There was also a very small trace of uranium (U) detected in two of the albumen photographs (13 and 20). It is not uncommon for albumen photographs to have been toned with uranium and there is an entry in William Sawyer’s journal of photographic recipes that discusses how to tone a photograph with uranium. Figure 7 shows one of the XRF spectra for one of the albumen photographs (13). It is also one of the photographs that had a trace of uranium, as well as gold and lead.
Lastly, the photograph 28 showed peaks on the XRF spectrum for silver, calcium, iron, and lead. Whatever the photographic process used to create this photograph, it contains many of the same elements that are found in albumen and salted paper photographs. Figure 8 shows the XRF spectrum from a dark area on photograph 28. It shows traces of silver, sulfur, calcium, iron, and lead. The peak for calcium is unusually high, but this spectrum does not help to clarify the identity of the photographic process of photograph 28.
6.3 FTIR

Only five of the photographs from the album were sampled for FTIR in order to limit the damage to the photographs from the sampling necessary for FTIR analysis. The first photograph where a sample was taken was photograph 28, and this was in an effort to identify the photographic process. The FTIR analysis showed the presence of a kind of gum, with a spectrum closely related to that of gum arabic. This could have been a coating on the photograph or perhaps a binder. This does not serve to identify the process, but it is interesting information and it does rule out some processes. There was no protein detected so it is not albumen or silver gelatin. Figure 9 shows the FTIR spectrum that was obtained from the sample of photograph 28. The line for the photograph is the one that has the most variation and starts on the left side of the spectrum with the highest absorbance number. The next line underneath that is the line for gum arabic and the light grey line starting at the bottom of the spectrum is for gelatin. It is clear from the spectrum that the proteins in the photograph more closely resemble gum arabic than gelatin.

![FTIR Spectrum from Photograph #28](image)

Fig. 9: FTIR Spectrum from Photograph #28.

The next photograph that was sampled for analysis was photograph 38. The photograph was identified as an albumen photograph through the microscopic examination step and the FTIR spectrum did show a protein, but it more closely resembled that of gelatin and not albumen. However, it could have been a combination of the two proteins, gelatin and albumen. The surface of this photograph was noted as somewhat glossy, which is less common for albumen photographs and, as previously mentioned, it was probably coated with something. The analysis suggests that it was gelatin. This photograph did not have a baryta layer so it could not be a silver gelatin photograph, but a gelatin coating is a logical explanation for the detection of protein by the FTIR. Figure 10 shows the FTIR spectrum obtained from the sample from photograph 38. It shows the photograph line (the top line which starts on the left side with the highest absorbance number and some variation), a new spectrum for the photograph after the linen paper has been
subtracted from it (the second line from the top with large variation), a line for the spectrum for gelatin (the third from the top in light grey), and a line for the spectrum for albumin (the bottom line in medium grey). This shows that the protein present in the photograph is similar to both gelatin and egg white (albumin), which supports the suggestion that this is an albumen photograph with a gelatin coating.

Photograph 39 was also sampled for analysis. The process used to make this photograph was identified as silver gelatin DOP through the microscopic examination step and the FTIR spectrum confirmed the presence of gelatin. Figure 11 shows the FTIR spectrum for photograph 39. It clearly shows that the proteins that are present in the photograph (top line starts on the left side with the highest absorbance number, dark grey) are more similar to a spectrum of gelatin (second line from the top, light grey) than to a spectrum of egg white or albumin (bottom line and ends abruptly on the right side, light grey). There is a segment of the egg white spectrum that does not match that area of the photograph spectrum (1500 – 1000 cm\(^{-1}\)). This spectrum further supports the identification of this photograph as silver gelatin DOP.
Fig. 11: FTIR Spectrum from Photograph #39.

The fourth photograph that was sampled for FTIR analysis was photograph 44. This photograph was identified as a salted paper photograph during the microscopic examination step. The FTIR spectrum showed the presence of gelatin as well. This could be from a gelatin sizing or, like many of the other photographs in this album, it could be a gelatin coating on top of the photograph. The gelatin coating would be a reasonable explanation because it was noted that the surface of this photograph is glossy, which is less common for salted paper photographs. Figure 12 shows the FTIR spectrum for the proteins present in photograph 44. The photograph spectrum (line is second from the top, some variation and dark grey) and the spectrum of the photograph with a subtraction for the linen paper (top line starts on the left side with the highest absorbance number, large variation and dark grey), as well as a comparison with a spectrum of a high quality alpha cellulose (bottom line, light grey) are shown below. There are some areas of the spectrum for the photograph that differed from the paper spectrum, so a comparison was made with gelatin (third from the top line, light grey and ends abruptly), which supported the suggestion that this salted paper photograph was coated with gelatin.
The last photograph that was sampled for FTIR was photograph 45. This was the other photograph that was identified as a silver gelatin DOP photograph during the microscopic examination step. Two samples were taken from this photograph: one from the emulsion and one from the baryta layer. The spectrum of the emulsion proved that it was gelatin and it also showed the presence of a small amount of barium sulphate. The barium sulphate is understandable because that is what baryta is made of and since this sample of gelatin had flaked off from the baryta layer underneath it, there could very well be traces of baryta on it. Figure 13 shows the FTIR spectrum for the sample that was taken from the emulsion (top line starts on the left side with the highest absorbance number, large variation and dark grey) of this photograph. It supports that this is a silver gelatin DOP photograph because it has a similar spectrum to that of gelatin (second line from the top, no variation in line and light grey). It also shows that there is a trace of barium sulphate (bottom line, no variation and dark grey), specifically the barium sulphate from the baryta layer in this same photograph (third form the top line, large variation and dark grey).
The sample of the baryta layer found barium sulphate and a small trace of gelatin. Again, this could be from transfer from when the baryta was in direct contact with the gelatin emulsion layer, but it is also possible that gelatin was used as the medium when the baryta layer was applied to the paper. Figure 14 shows the FTIR spectrum for the sample of the baryta layer (second line from the top, some variation and dark grey) in photograph 45. The spectrum shows that the baryta layer is made of barium sulphate (top line starts on the left side with the highest absorbance number, fairly even across and dark grey) and that there is a trace of gelatin in the sample (bottom line, no variation, ends abruptly and light grey). There is also a line for the baryta layer with a subtraction for barium sulphate (third from the top line, large variation and dark grey) so that the traces of gelatin can be somewhat more visible. This supports that either there are traces of the gelatin from the emulsion in this layer that were deposited there when the gelatin emulsion was coated on top of the baryta layer, or the baryta layer is held together with a gelatin binder, or both.
6.4 JOURNAL RECIPES COMPARED TO PHOTOGRAPHS IN THE ALBUM

The journal of William Sawyer’s, contains his notes on photographic recipes and instructions for different processes and techniques with which he either wanted to or did experiment. It is not clear that the photographs in the album were directly addressed in the journal’s lists of techniques and approaches, but since the journal and the album were both made by the same person and compiled around the same time, it is at least possible that some of the recipes in the journal could have been used in the photographs from the album. After an analysis of Sawyer’s journal, there are over a dozen recipes in the journal that could have been used in the album. There is no way to know for sure whether these photographs were produced using the recipes in the journal, but the XRF and FTIR analyses may be able to confirm or deny the use of some of the recipes. These recipes can be grouped into categories: toning procedures, developers and fixers, nitrate silver recipes, and two other recipes that might have been used to create photograph 28 (the unknown photographic process).

There were several toning recipes mentioned in the journal: two with gold, two with uranium compounds, and one with a lead compound. All three of these elements were found in the XRF spectra of one or more of the photographs. The first reference to a gold toning recipe seems to be a set of instructions that are from someone else. It is a recipe titled “Sarony’s toning bath” and it includes:

Nitrate silver 60 grs, water 1 oz…
Kaolin to clear silver after using…
Chloride gold 15 grs
Water 2 oz, whiting 1 teaspoonful…
Saturated solution Chloride lime…
Fix with 4 oz hypo, 30 oz water (Sawyer 1838, 30-31).

These are the ingredients that were used to make this toning bath. Also included on these two pages are the step-by-step instructions for how to tone a photograph using this method. The second reference to a gold toner is a few pages after the first and includes: “17 oz water, 1 oz gold solution…Pinch of whiting…4 drops chloride lime [or] acetate of soda” (Sawyer 1838, 33).

It is impossible to determine for sure which, or even if, either of these recipes were used to tone the photographs in the album that showed traces of gold in the XRF spectra. However, the fact that there are 34 photographs from the album that have traces of gold in the XRF spectra and that Sawyer made two different notes in his journal about gold toning is an indication that one or both of the recipes might have been used to tone these photographs.

There were only two photographs that showed traces of uranium in their XRF spectra and there are two recipes in the journal for toning with uranium. While it might seem extreme given our modern understanding of radiation, this was not an uncommon practice in many areas. The first recipe for uranium toning included: “½ gall water, 15 grs chloride uranium, gold solution neutralized with carb magnesia.” The recipe also mentions Sheldon, indicating that Sawyer might have gotten it from his fellow photographer. There is also a note for adding “Calomel for decolorizing collodion,” which is another name for mercury (I) chloride (Sawyer 1838, 24). The recipe then continues on to list the ingredients and steps involved if the photographer wishes to enlarge the print: ½ oz saturated solutions gallic; 20 grs chloride barium; 40-50 grs silver; 1 oz water; a few drops of acetic acid; 1 oz Irish moss arrowroot and 1 oz cornstarch mixed with baryta. There is another notation at the end of this entry reading “Dion,” which might, again, indicate that this recipe is from another photographer and Sawyer copied it down in his journal to experiment with (Sawyer 1838, 24-25). There are also a few instructions that accompany this recipe. The second recipe for uranium toning is the next entry in the journal. It is mostly just a list of ingredients, with very few instructions for how to actually tone a photograph using this method. The recipe includes:

Water 210 oz
Acetate soda 1 “
Bicarb soda ¾ “
- (or magnesium said to be best)
Nitrate uranium 16 grs or 8
Chloride gold 12 “…
½ lb hypo soda 48 oz water (Sawyer 1838, 26)

On this same page, underneath this recipe are two more recipes for a developer and a redeveloper. The second recipe for uranium toning seems like a more plausible method of toning than the first for both photographs because both showed traces of uranium in the XRF spectra (photograph 13 and 20) and because they both also had traces of gold and, further, this recipe does not include baryta. Both of those photographs were identified as albumen, so a baryta layer would not be present, which was confirmed by their XRF spectra because of the lack of barium.
The last recipe for a toner that Sawyer wrote about in this journal is for lead. This recipe is merely titled “Lead Toning Bath” and includes: “¾ lb. Hypo;” soda dissolved in water; “chloride of lead;” “acetate of lead in water” (Sawyer 1838, 6). The fact that this is the only recipe for lead toning in his journal might mean that he did not experiment much with alternative recipes, perhaps because he was satisfied with how this one worked on his photographs and did not feel the need for adjustments. Sawyer mentions on the following page that this toning solution could be mixed with a gold solution (Sawyer 1838, 7). There are 20 photographs in the album that had both traces of lead and gold in the XRF spectra, so it appears he may have used such a combination of lead and gold as a toning method.

There are several developer recipes and fix recipes mentioned in the journal. The first developer recipe is a list of ingredients including:

- D. water 20 oz
- Alcohol 840 1 “
- Gallic Acid ½ “
- Silver for developer
- N. Silver fused 30 grs
- D water 1 oz (Sawyer 1838, 9)

This recipe is directly followed by a fix recipe that includes 8 oz of hypo and 20 oz of water (Sawyer 1838, 9). There is no way to know definitively if either of these recipes were used to develop the photographs in the journal. The inclusion of this recipe in the journal makes this, at the very least, a possibility. The second recipe for a developer is much simpler than the first one and includes 30 grs Iron, 1 drop of Acetic 8, and 1 oz of water. This recipe is also followed by a recipe for redeveloper which includes 1 ½ grs of pyrogallic, 1 grs citric acid, 1 oz water, and 40 grs of silver bath. There is also a notation at the end of this entry that reads “Natman,” which could indicate that this recipe for the redeveloper might have come from another photographer named Natman, whom Sawyer has mentioned before (Sawyer 1838, 26). Because of the lack of specificity of the included metals, it is not possible to ascertain which photographs might have been created with these recipes.

There are two recipes that are called “Nitrate silver” and they both include many instructions for how to perform the process. The first recipe begins with the name “Bach” which might be the person that Sawyer got the recipe from and includes: 60 grs nitrate silver, 1 oz water, and fumed ammonia. Sawyer then notes that the photograph can be toned with gold, washed, and fixed with hypo (Sawyer 1838, 28). The recipe continues with instructions for how to create a developed out print using this method and includes citric acid, 40 grs of silver, water, a couple of drops of ammonia, 1 gr pyrogallic, and 1 gr citric (Sawyer 1838, 29). There are quite a few instructions that accompany this recipe and the inclusion of silver means that this recipe should not be extended as a possible photographic process from the album, possibly for photograph 28 (the unknown photographic process). The second recipe is unusual in that it uses a silver coin that is rolled out to a thin sheet and then reduced down to a solution for making a photograph in a jar of chloride. Once the silver is obtained from the coin, the recipe continues with:

Silver 1 oz nitric 1.42 7 dss
D water 2 oz
Dissolved 11 drs 20 silver foil
In 14 drs nitric with 28 water if used
Evaporate slowly on a sand bath
Product of 14 drs S. coins (Sawyer 1838, 46)

This recipe is unique because it seems that Sawyer was able to produce his own silver from coins that he dissolved into the silver salt solution needed to produce a photograph. Before this the source of the silver was never explained, although the expense in obtaining pure silver may have been a problem for photographers. With a process dependent upon ubiquitous silver coins, it becomes more feasible.

The last two recipes of note that might have been used in the album related to photograph 28. The first one is a subsection for one of the ingredients in an albumen photograph recipe with an ingredient list including honey. The albumen recipe appears to be for a plate instead of for a paper photograph, but the substitution recipe includes: “light brown sugar 5 lbs 15 oz, soft water 1 ½ [lbs] 4 ½ [oz], and gum arabic ¼ [lbs] 30 grs” ((Sawyer 1838, 4). The inclusion of gum arabic in this recipe means that this recipe should at least be considered for the possible photographic process used to create photograph 28, because gum arabic was found on this photograph using FTIR. The second recipe that should be considered, and is somewhat more likely, is called “Transfer varnish gage” and it seems like a possible candidate because it mentions the use of black paper. The paper that photograph 28 was made with is black on the front, which is rare so this mention should at least be considered. This recipe also includes: “Asphaltum ¼ oz 72 grs, Canada balsam ½ c 40 [grs], chloroform 5 c 1 oz, alcohol, and nitric acid. This mixture is flowed over the black paper and then it is laid over a picture, pressed to remove excess water and air, warmed, and then removed from the picture (Sawyer 1838, 14-15). Based on the title and the instructions, this seems like a process that creates a photograph by copying or transferring from another photograph. As mentioned in a previous section, photograph 28 appears to have areas of deterioration that are similar to that on a tintype, but the fact that this photograph is on paper, means it cannot be a tintype. A transfer photograph is a logical supposition and this method might have been how Sawyer achieved that, given the unusual findings associated with photograph 28 as described above in the section on visual inspection and FTIR.

7. CONDITION

Some of the forms of damage are more common than others. Only two photographs have accretions on them. Three photographs have pieces missing from their corners and only six photographs have missing pieces of or flaking emulsion. These numbers seem low, based on the overall state of the album and given the fact that there is no binding anymore and the pages of the album are very brittle and spotted. The majority of the photographs were adhered to the pages (69%) and only 13% of that number have damage due to the adhesion. Some of that damage is due to the photographs having wrinkled with the adhesive and the page. Others were only adhered to the page at each of the four corners and with changes in humidity, this has caused some dimensional changes to the photographs and has caused the photograph to tent around the adhesive. All but two of the photographs that were loose in the album have wrinkling.
Only 36% of the albumen photographs have characteristic cracking of the binder, which would indicate that most of the photographs have been in relatively good environmental conditions. There are ten photographs that have tears or holes in them. Also 13 photographs have corners that have been folded or “dog-eared.” There are quite a few photographs that have some kind of spotting on them (28%), which could be from the paper they are in contact with, processing stains, or some other cause. It is interesting though that only one of the silver gelatin DOP photographs has silver mirroring present while the other does not. Mirroring is usually very common in older silver gelatin photographs. Also, one of the salted paper photographs has some mirroring and five of the albumen photographs do as well. These numbers would back up the theory that there is a gelatin coating on many of the photographs. Figure 15 gives a visual summary of the major types of damage on the photographs in the album and the number of photographs that exhibited the kind of damage.

![Damage on Photographs](image)

Fig. 15: Summary of Damage on Photographs.

8. **TREATMENT PROPOSAL**

There is minimal treatment needed for this photograph album from William Sawyer.

- Those photographs that have tears should have repairs made with Japanese tissue and wheat starch paste for the salted paper and silver gelatin photographs and 4% Klucel G for the albumen photographs. Photographs that have puncture holes from tacks or pins could be reinforced with the same materials as the tears, to prevent them from getting worse and turning into tears.

- Each of the photographs could be lightly surface cleaned with a brush or eraser crumbs. This is not a necessity though and should be done with care.

- Any accretions should be removed, carefully, while examining under a microscope.
Any of the gelatin that is flaking on the silver gelatin photographs could be consolidated with a 2% solution of photographic grade A gelatin.

The silver mirroring could be addressed if it was deemed necessary. This can be an invasive treatment, so if the mirroring is not completely obscuring important information or areas of the image then this treatment would not be recommended.

The tears and losses around the edges of the pages, especially the top pages and any others that are brittle or tattered, could be mended with Japanese tissue and wheat starch paste, to help stabilize the album.

The album itself should have a new binding and covers made for it, to better protect the album as a whole. If a new binding and covers are not an option, then the album should at least have new housing. A new folder cover similar to the current folder but with a more supportive backing board would be suitable. Then house the whole album and any accompanying material in a new box.

The photographs in the album should all be scanned and users should be required to use digital images when requesting to study this album.

9. CONCLUSION

William Sawyer, a little studied painter and artist who was prominent in city life in Kingston in the late 1800’s, was best known for his portraits of well-known leaders of the area but he also experimented with photography during an era when photographers were self-made men and had little research or technology to support their work. It was an era of much experimentation and photographers shared approaches and techniques with each other in an effort to solve the many problems in bringing photographic subjects to enduring and satisfying production. Sawyer made a study album of some 52 photographs in the late 1800s and at the time, he also kept a journal of photographic recipes. These have not been much studied.

The results of a study of these photographs indicate that the majority of the photographs were albumen (36), while 13 were salted paper, a somewhat older technique, two were silver gelatin which must have just been coming into use during the latter part of the 1800s, and one was not able to be associated with any common photographic processes. Three techniques were used to identify the photographs including visual examination under a stereomicroscope as well as use of XRF and FTIR. The visual examination proved to be quite accurate and cost efficient in identifying all but one of the photographs. Even the addition of data from XRF and FTIR did not add meaningful information to the identification of the photographic process of the one photograph that could not be identified visually.

Sawyer’s journal provided a glimpse into an era of experimentation in the use of ingredients in making photographs. He records the use of everyday substances such as honey, salt, Canada balsam, chalk, Irish moss, arrowroot as well as more exotic ingredients such as uranium acetate. He also described how to obtain silver from flattening a silver coin to extract the silver using chloride. The journal provides a picture of early photographers as self-made, kitchen-sink chemists as well as artists, a spirit that modern artists would recognize with their modern installations using every conceivable type of material except traditional artist materials.
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