The Surface and Subsurface of a Historic Platinum Print

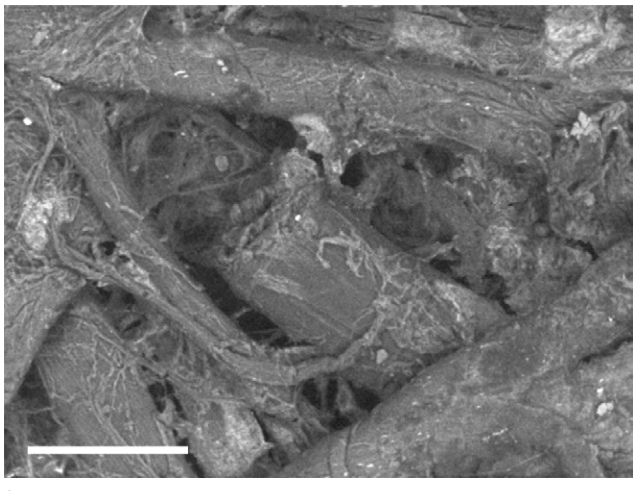
Patrick Ravines, Natasha Erdman, and Rob McElroy

Variable pressure scanning electron microscopy (VP-SEM) with energy dispersive x-ray spectroscopy (EDS) was used to study the size and distribution of the metallic platinum particles that form the image and otherwise characterize the inorganic components found in a historic platinum print (fig. 1). Secondary electron (SE) and backscattered electron (BE) scanning electron microscopic (SEM) microphotographs show the nature of the platinum image deposition and inorganic fillers within the paper matrix. These invasive and destructive analytical techniques require taking minute samples of the photographs, so their use is appropriate only with expendable objects. Figures 2–4 illustrate submicroscopic and nanoparticle details of the photograph's D-Max, and figure 5 provides information regarding inorganic fillers in the D-Min–D-Mid region of the historic platinum print.[1]

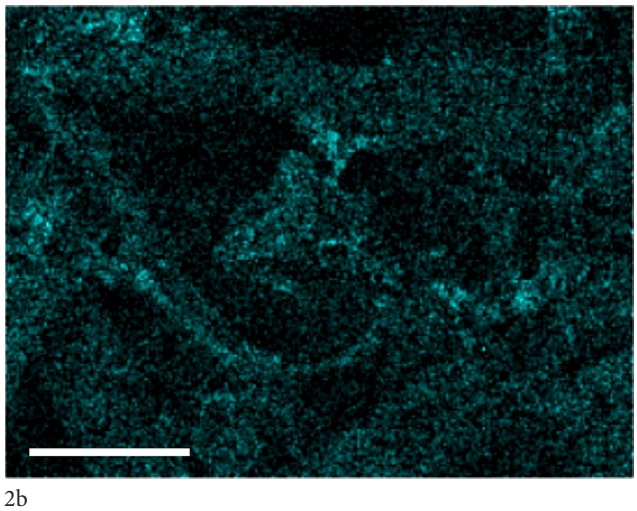
Figure 1. Smith Curry Studio of Rochester, New York, [*portrait of a woman*], late 19th–early 20th century. Platinum print, image 13.35 × 18.70 cm. The print was donated by Rob McElroy for this study. The two locations analyzed were in the dark image area (D-Max) at the lower left and highlight to middle-tone areas (D-Min–D-Mid) in the subject's hair.

Note

1. An in-depth investigation of this object is found in Patrick Ravines, Natasha Erdman, and Rob McElroy, "An Examination of the Surface and Sub-Surface of Modern and Historical Platinum Photographic Prints Using Low Vacuum High Resolution Scanning Electron Microscopy," *Microscopy and Microanalysis* 22, no. 4 (August 2016): 857–64. All figures reproduced by kind permission of Cambridge University Press.



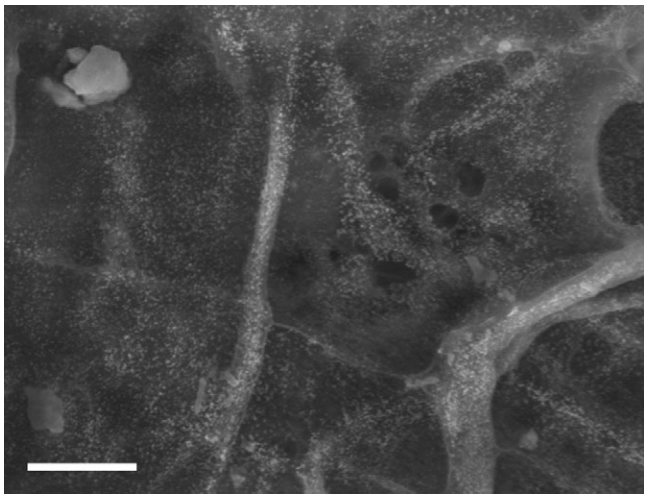
2a



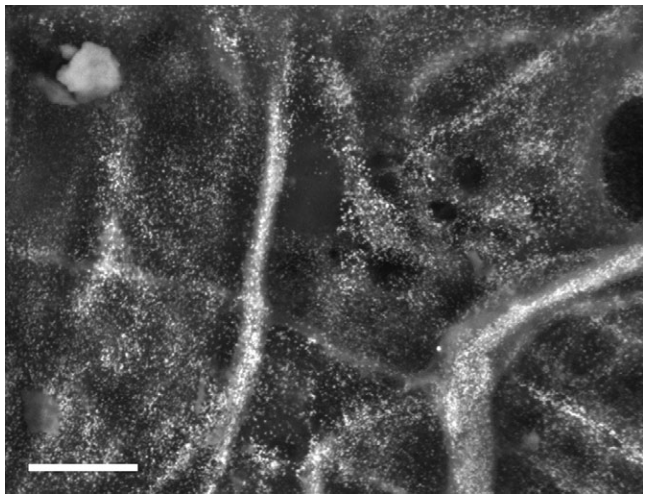
2b

Figure 2. SE image and EDS elemental maps of the D-Max region of the photograph shown in figure 1. Scale bar = 25 µm.
2a. SE image of the paper surface, showing the intertwined paper fibers.
2b. Corresponding EDS element map, confirming the presence of platinum (seen as blue), which follows the contours of the paper fibers.

Patrick Ravines, Natasha Erdman, and Rob McElroy in *Platinum and Palladium Photographs: Technical History, Connoisseurship, and Preservation*, ed. Constance McCabe (Washington, D.C.: American Institute for Conservation of Historic and Artistic Works, 2017), 116–117.



3a

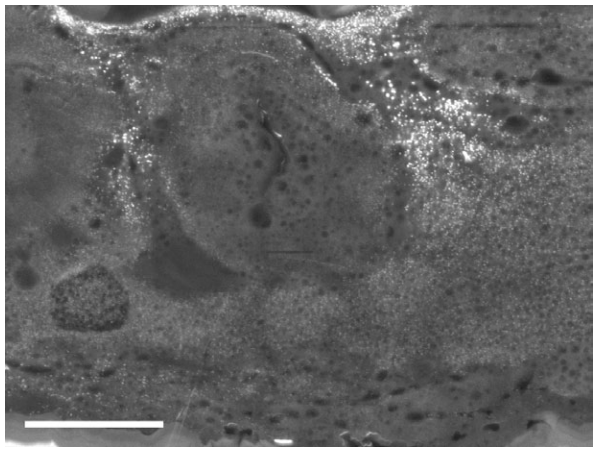


3b

Figure 3. SE and corresponding BE image of the D-Max of the photograph at higher magnification, allowing the size of the platinum image particles to be estimated at below 100 nm. Scale bars = 1 µm.

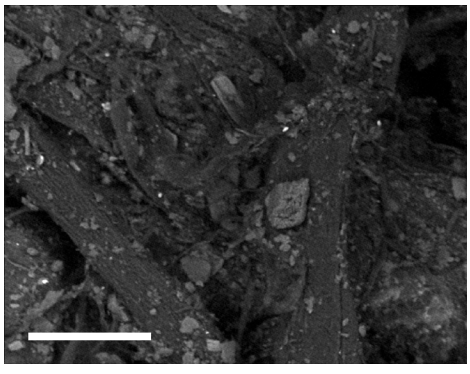
3a. SE image.

3b. Corresponding BE image. The particles are seen as bright white. The platinum nanoparticle deposition follows the exterior contours of the cellulosic fibers and the smaller fibrils that create a web bridging the fiber interstices.

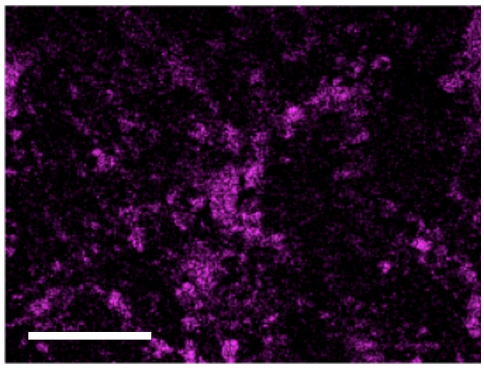


4

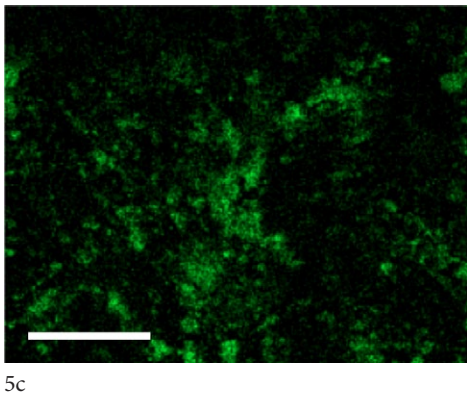
Figure 4. High-resolution BE cross section image of the D-Max of the photograph, revealing the internal distribution of the nanoparticles in the D-Max. There is a greater concentration toward the paper surface, with a distribution of nanoparticles extending into the paper matrix as deep as ~10 µm. Scale bar = 5 µm.



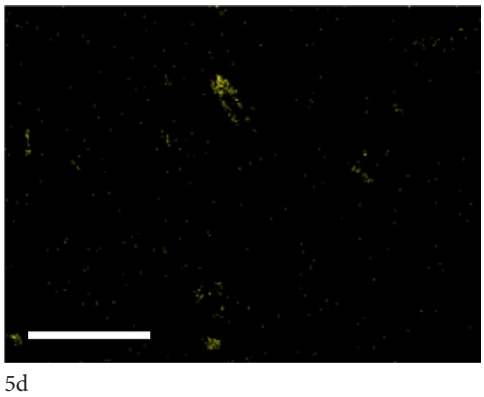
5a



5b



5c



5d

Figure 5. SE image and corresponding elemental maps of the D-Min–D-Mid region of the photograph. Numerous irregularly shaped particles were scattered across the paper surface in the D-Min–D-Mid area, congregating along the fibers and also in between fibers, as seen in 5a. EDS mapping indicate these particles are composed of silicon (5b) and aluminum (5c), with a small concentration of calcium (5d). This finding is consistent with various common papermaking components, such as clays used as fillers. Scale bars = 25 µm.

5a. BE image.

5b. EDS element map for silicon.

5c. EDS element map for aluminum.

5d. EDS element map for calcium.

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