Article: Characterization of Chlorine Induced Alterations on Daguerreotypes by SEM-EDS, XRF, and Raman Spectroscopy (Abstract)
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Topics in Photographic Preservation, Volume 14.
Pages: 227 - 228
Compilers: Camille Moore and Jessica Keister

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.

CHARACTERIZATION OF CHLORINE INDUCED ALTERATIONS ON DAGUERREOTYPES BY SEM-EDS, XRF AND RAMAN SPECTROSCOPY

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Presented at the 2011 PMG Winter Meeting in Ottawa, Canada

The daguerreotype was the earliest form of practical photography. It was presented in Paris in 1839 by Louis Jacques Mandé Daguerre and was practiced worldwide from the 1840s to the early 1860s. The original process described by Daguerre involves a polished silvered copper plate that is first sensitized with halide vapors, and then exposed to light in a camera. The latent image is developed with mercury vapors that condense preferentially in the areas struck by light, forming an amalgam with the silver. As a final step, the image is fixed and then washed to remove the unexposed silver salts. The resulting image is sensitive to environmental factors and as such must be bound behind glass for protection. Numerous forms of deterioration have been reported in the literature. More recently, it has been determined that some of these plates are sensitive to UV/Vis radiation due to the presence of silver chloride from unknown sources [1] and so exhibition of these unique works has been dramatically curtailed over the last few years.

In this project, alterations caused by chlorine contamination were studied. Samples were prepared to mimic 19th century daguerreotype image properties and chlorine was deposited on the surfaces. Furthermore, the impact of variations in the production steps like gilding or multiple sensitization were examined. The influence of environmental conditions such as temperature and light exposure on the formation of the silver chloride and on the redeposition of elemental silver was tested. For the analysis of the alterations, scanning electron microscopy-energy dispersive X-ray spectrometry (SEM-EDS), X-ray fluorescence (XRF), and Raman spectroscopy were chosen. These microscopic techniques are well suited as they are nondestructive and can be used in a non-contact mode. EDS, XRF and Raman spectroscopic measurements yielded elemental and molecular information. Details of the image topography were obtained by SEM. Additionally, Raman and XRF mapping experiments were performed to determine the spatial distribution of chemical compounds and elements on the surfaces of modern samples and of historic daguerreotypes [2].

[1] S. A. Centeno, T. Meller, N. Kennedy, M. Wypyski; *J. Raman. Spectrosc.*, **39** (7), 2008, 914-921

[2] F. Schulte, S.A. Centeno, A. Schrott, N.W. Kennedy. Proceedings of the 10th International Conference on non-destructive investigations and microanalysis for the diagnostics and conservation of cultural and environmental heritage (Art' 11), Florence, April 13th-15th, 2011.

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