Early Paper Photographic Processes:
The Calotype
Le Gray's Waxed Paper Negative Process

Inquiry into the techniques and apparatus of historic photographic processes is considered an important component of the body of knowledge of the history of photography and an integral part of the Advanced Residency Program. A more intimate knowledge of the materials utilized may be gained by the recreation some of these early photographic processes. The processes recreated in this inquiry are the Calotype Process and the Le Gray Waxed Paper Process. This project was undertaken in collaboration with Francoise Ploye, Master's Degree Candidate of the *Institut de Formation des Conservateurs-Restaurateur d'Oeuvres d'Art,* Paris.

The Calotype Process was invented by English Scientist and Mathematician William Henry Fox Talbot. He presented samples of his *Photogenic Drawings* [1] before the Royal Institution in London in January of 1839. In 1840, he made improvements upon another process which he named the *Calotype* but it also came to be known as the Talbotype. The paper is rendered light sensitive by an application of silver nitrate solution to the surface followed by treatment in a potassium iodide bath. The reaction precipitates light sensitive silver iodide on the surface of the paper. Prior to exposure, the paper is given added sensitivity by applying a solution of acetonitrate of silver and gallic acid to the paper surface. An exposure of a few minutes in camera is sufficient to render a latent image that can then be developed out with a silver nitrate and gallic acid solution. The remaining light sensitive materials are removed through immersion of the paper in a bath of sodium thiosulfate. The image obtained shows the tones in reverse with the shadows of the image light and the highlights dark. It was thus named the *negative*. Another image could be obtained with the tones reversed once more by placing the negative in contact with a sensitized piece of paper and exposed to light, creating a *positive* image. The negatives were often waxed to impart upon them greater transparency, facilitating the printing of the positive.

The process used to obtain the positive is a simpler process that is less sensitive to light. The paper is rendered sensitive to light by treatment of the paper with a solution of sodium chloride followed by an application of silver nitrate on the surface, hence the name *Plain Salted Paper* or *Salt Print.* This reaction precipitates light sensitive silver chloride onto the surface of the paper. The image is obtained solely by the action of light, requiring no chemical development. The remaining light sensitive salts are removed by immersion of the paper in a solution of sodium thiosulfate.

Soon after Talbot had made the announcement of his process public, many sought to employ and improve upon his process. The accomplished photographer Thomas Sutton, professor at King's College, Robert Hunt professor of Mechanical Engineering at the Royal

[1] The light sensitive component of a photogenic drawing or salt stabilized print is silver chloride. At this time Talbot had not yet found an adequate solution to fixing the image obtained on paper. After exposure of the paper to light, he treated it with a saturated solution of sodium chloride, which rendered the paper insensitive to light to a certain degree but was not sufficient enough to prevent the image from darkening over time upon further exposure to light. The salt print is essentially a photogenic drawing which has been rendered insensitive to light by removal of the light sensitive salts in a solution of sodium thiosulfate.

School of Mines in London, chemist Frederick T. Hardwich, and French photographer Louis Desire Blanquart-Evrard were early practitioners of the Calotype Process, all of them published treatises and manuals with improvements to the process. The removal of gallic acid from the sensitizing solution is one such improvement on Talbot's process employed in this project. It is well documented in the literature that gallic acid contributes to the browning of the image during development. This and similar processes were most popular between 1840-1855 but were supplanted by other processes such as the wet collodion negative and the albumen print in the 1850's.

Photogenic Drawing

From the Garden of M. Medina
January 2000

Calotype Negative

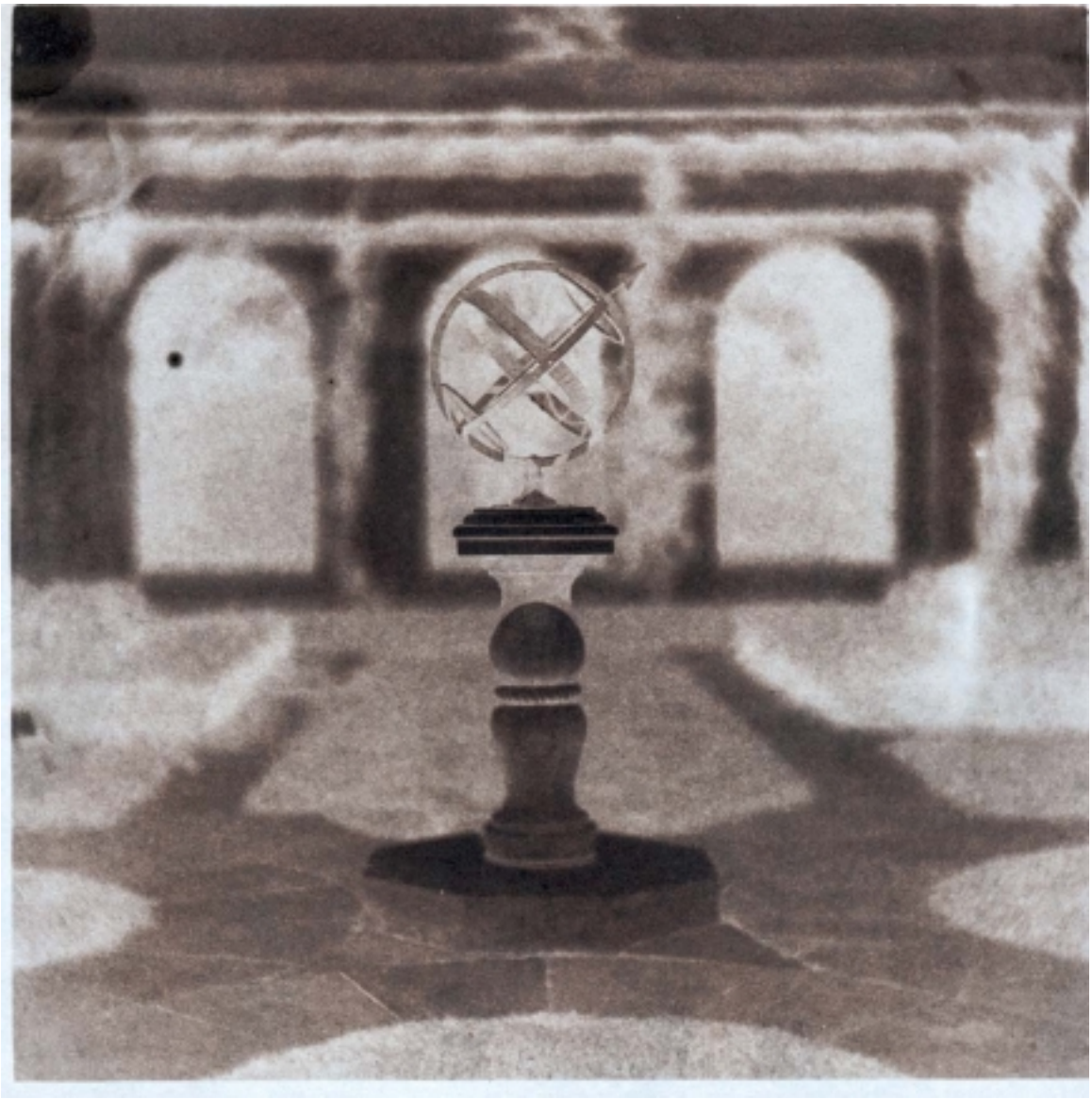
C-Negative no. 1 The Eastman House Garden, Large White Urn. Taken June 8, 2000 at 2:30 pm EST. Bright, Sunny Day approximately 70° F. Exposure time: 50 seconds
Development time: 50 minutes, underexposure in camera resulting in overdevelopment producing a slightly contrasty negative. Despite the long development time, no browning was observed.
Unwaxed negative

Salt Print

Print no. 1 The Eastman House Garden, Large White Urn
Printed from an unwaxed Calotype Negative with a Metal Halide light source
Printing time: approximately 4 hours

The Le Gray Waxed Paper Negative Process was developed by Gustave Le Gray, painter, photographer and pupil of Delaroche. He made significant improvements to the Calotype Process by first treating the paper in melted beeswax then removing the excess with a hot iron prior to salting and sensitization. The wax acts as a barrier preventing the reaction of the silver nitrate with organic materials in the paper and provides a more uniform surface upon which the chemicals are absorbed. In addition, he introduced a mixture of salts, mainly potassium ferrocyanide with potassium fluoride in lieu of coating the paper with potassium iodine alone to enhance the sensitivity of the paper. Fabre, Davanne and Monckoven replace the cyanide and fluoride salts with potassium bromide; it is the latter salt that was used to produce the example below. The introduction of a water bath after sensitization removes the excess silver nitrate allowing the sensitized paper to be conserved for several days or weeks prior to exposure. Le Gray's treatise outlining these improvements was first published in June 1850.

Le Gray Waxed Paper Negative



L-Negative no. 1 The Eastman House, East Garden, Sun Dial
Taken July 25, 2000 at 11:00 am EST
Bright, Sunny Day approximately 80 F
Exposure time: 5 minutes
Development time: 40 minutes
Slightly contrasty due to addition of too much acetonitrate of silver to the gallic acid during development.

SOURCES CONSULTED

Blanquart-Evrard, Louis Desire. Procedes Employes pour Obtenir les Epreuves de Photographie sur Papier Presenter a l'Academie des Science. Paris: Charles Chevalier, 1847.

Davanne, Alphonse. *La Photographie.* Vol. I & II, Paris: Gauthier-Villars, 1886.

Fabre, C. *Traite Encylcopedique de Photographie.* Paris: Gauthier-Villars, 1890.

Hardwich, T. Frederick. *Manual of Photographic Chemistry.* London: John Churchill, 1855.

Hunt, Robert. *A Popular Treatise on the Art of Photography.* Glasgow: Richard Griffin and Company, 1841.

La Blanchere, H. de. *Repertiore Encyclopedique de Photographie.* Paris: Bureau de Redaction, D'Abonnement et de Vent, 1863.

Le Gray, Gustav. *Traite Pratique de photographie sur papier et sur verre.* Paris: Germer Bailliere, 1850.

Monckoven. *Repertoire Generale de Photographie Pratique et Theorique.* Paris: A. Gauthier Frere, 1859.

Sutton, Thomas. *The Calotype Process A Hand Book To Photography On Paper.* London: Joseph Cundall, 1855.