

## STUDY OF SOME ALBUMEN PHOTOGRAPHIC PRINTS

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Photographic materials only recently have been considered cultural heritage that must be protected. Owing to this reason, scientific studies about their structure, composition, degradation and conservation have been till now rather few. Owing to the large variety and quantity of photographic materials in archives, libraries, museums research on them must be increased to obtain greater knowledge useful to preserve this cultural heritage.

This research is a study about some albumen prints and one salted paper of the Pinacoteca di Brera (Soprintendenza PSAE, Milano).

Albumen papers were invented in 1850 by Blanquart Evrart; their use lasted up to 1929. These papers were manufactured, before handmade and later industrially, applying one or more layers of albumen on a thin sheet of paper (primary support). This sheet of paper was sensitized using sodium (or ammonium) chloride and silver nitrate.

Photographic process, as salted paper, was a printing-out process: the image was revealed photochemically using incident light and a development treatment was not necessary.

Paper utilized as emulsion support was qualitatively good (cotton or linen fibres), thin and deprived of metallic impurities. To confer strength and stiffness to albumen prints, primary support was very often glued to cardboard (secondary support) which has often caused damage owing to bad quality.

Albumen prints have a light brown chromatic tone. Very often they undergo toning treatment using gold chloride, thiourea, tartaric acid and sodium sulphide to give darker chromatic tones. Toning agent is Au(I) which oxidizing metallic silver in the photographic emulsion (reaction  $Au^+ + Ag^0 \rightarrow Au^0 + Ag^+$ ) forms a protective coating on silver grains. Gold protects the image against oxidation avoiding possible fading. Gold quantity in the emulsion after toning depends on various factors: gold quantity in the treatment solution, stir way method and temperature of this solution and emulsion characteristics. An insufficient toning treatment

introduces in the emulsion a quantity of gold that is insufficient to guarantee an adequate protection of photographic image to increase its stability. In fact not all albumen prints subjected to toning treatment have the characteristic dark brown chromatic tone.

Albumen prints are subjected to different degradation processes owing to the materials used in their manufacture (thin papers, absence of barite that constitute a protective barrier against impurities deriving from secondary support), bad chemical treatments (exhausted or insufficient fixing-bath, incorrect washing, insufficient toning treatment) and incorrect conservation conditions (high relative humidity and its variations, atmospheric contaminants).

More common damage is:

- yellowing and loss of details in high lights
- image fading
- chromatic tone variation
- albumen layer crackings, detachments, abrasions
- various nature stains (usually foxing).

In this work we have used some non destructive analytical and diagnostic methods to characterize these photographic prints, to point out and to study damage. In particular:

- photographic recordings using high resolution scanners and digital photographic cameras to document the general aspects of these photographic prints before restoration
- stereomicroscopy observations that have shown damage to the albumen layer (crackings, detachments, abrasions, etc.)
- microscopic analysis of secondary support fibrous paste to identify fibres nature and their integrity. We have analyzed only the secondary support because this analysis requires the withdrawal of a very small fragment of material (microdestructive analysis)
- fluorescence UV recordings (light UV with wavelength at 360 nm, filter Schott 450) that has shown the presence of stains (for example foxing) impossible to see with visible light, residual materials used to glue the primary and secondary support (adhesives), marks of previous restoration treatment, marks of handwritings impossible to see with visible light
- reflectographic recordings in the near infrared region that have allowed to improve the visibility of handwritings or other materials
- X-rays fluorescence spectroscopy (XRF) that, allowing to detect chemical elements with atomic number superior to 13 in all thickness analyzed, has detected toning treatment with

gold, sulphuration processes of photographic image, and has allowed to state the chemical nature of mineral fillers in primary and secondary support and of some pigments

- Scanning electron microscopy (SEM) with energy dispersive spectroscopy (EDS) that has allowed to see and to measure the stratigraphy of photographic prints (primary support and photographic emulsion). Particularly to see the fibres of primary support and their integrity state and damage to the albumen layer (microcrackings, detachments, etc.). Images obtained with secondary electrons have given morphologic and structural information. Images obtained with backscattered electrons have given information about chemical composition of primary support and emulsion layer. We have observed crystals in the primary support (mineral fillers) and in the emulsion layer (silver and eventually gold).
- EDS microanalysis has allowed to determine quantitatively the percentage of elements having atomic number superior to 6 in the analyzed point and to create a false colours map about superficial distribution of various elements in the photographic prints.