

Lead white blackening on graphic art

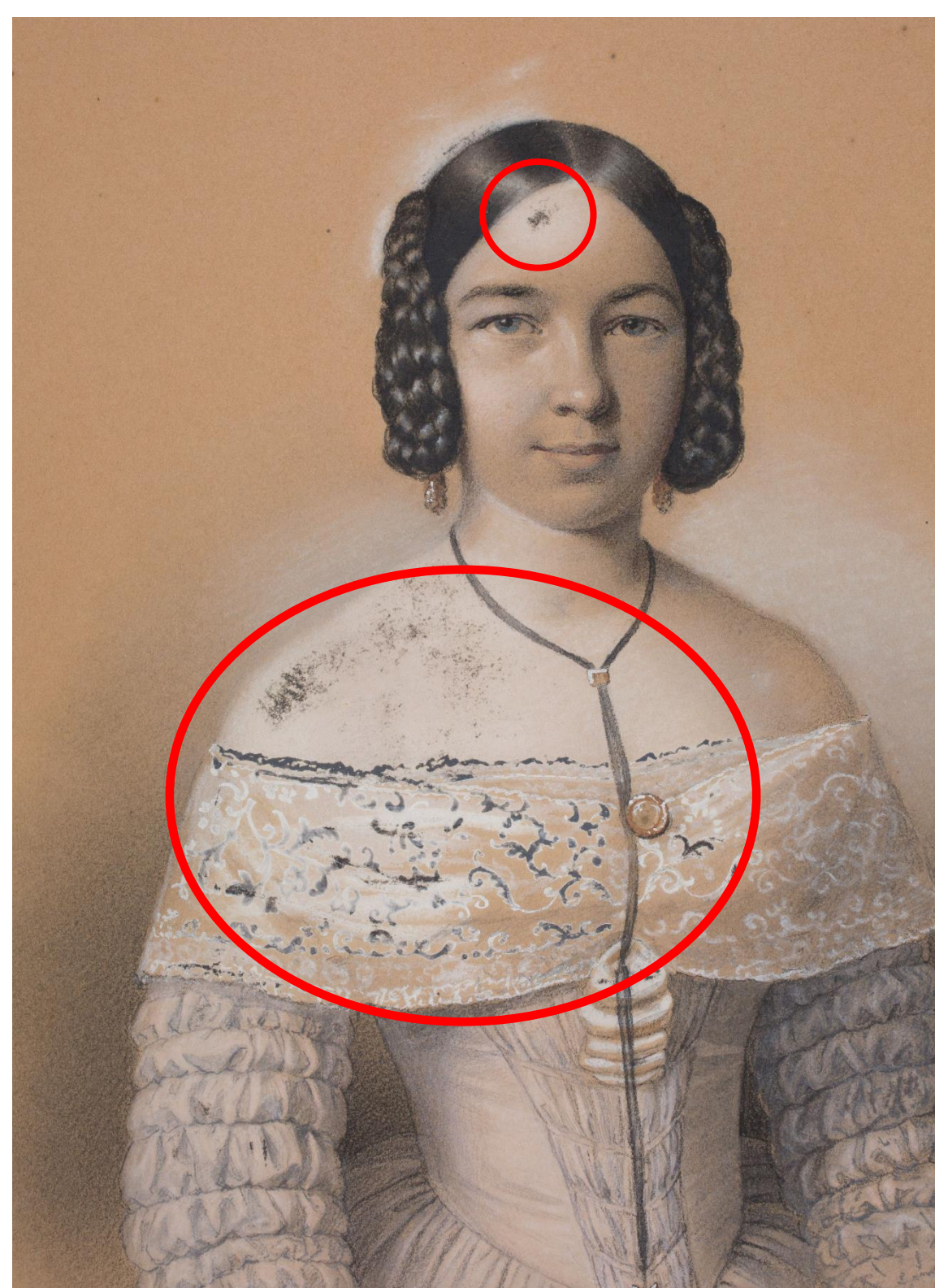
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Introduction

The blackening of lead white pigments is a well-known degradation phenomenon, which previously has been reported for paintings, murals, illuminated manuscripts, prints and drawings.

However, since the discovery of many master drawings in the Statens Museum for Kunst (Denmark) collection, which has blackened within the last 10-20 years, we are in the process of investigating the extent and source of this problem. Our survey also included parts of the print and photograph collection of The Royal Library.

We found the occurrences of darkened lead white on artist drawings, lithographs, and, surprisingly, even on historic photographs, where the white pigment has been used as a retouch in the highlight areas. At Statens Museum for Kunst about half of all the master drawings, which contain lead white pigment, may be affected. At the Royal Library about 200 cases have been identified.



Lithograph with blackened lead white highlights (in red circles).
Collection of The Royal Library, inv.no. 1976-233/2

Lead white blackening

For modern indoor environments the darkening of lead white (basic lead carbonate) is mainly attributed to the action of hydrogen sulfide (H_2S) present in the atmosphere, resulting in the formation of PbS (black galena).

Pollution levels

The level of H_2S in collections areas of the museum and the library is being monitored by passive sampling for one year (ongoing). Both buildings are located in the city of Copenhagen. The outdoor level varied between **0.2 – 0.8 ppb** (highest in Spring). This outdoor background level may affect the indoor environment when air infiltrates the building. No chemical air filtration is used at any of the locations.

However, at all locations the indoor concentration was higher than outdoors, which indicates that additional indoor sources are present:

- Museum storage rooms: **0.7 - 1.4 ppb**
- Museum gallery: **1.2 - 1.3 ppb**
- Reading room at library: **1.4 - 2.0 ppb**



Drawing with blackened lead white highlights. Collection of Statens Museum for Kunst, Attr. to A. Bloemart, inv.no. KKSGb12821

The survey

This project is ongoing. We are now examining artworks for the two collections, and pigment samples from drawings, prints and photographs will be taken from deteriorated areas and analyzed by spectrometric methods; XRF, XRD, Raman, FTIR (FIR), and compared with laboratory model samples.

These results will be reported at the forthcoming **IRUG**, **ChemCH2016**, and **ICOM-CC Graphic Documents** conferences in May-July 2016.

Sources of H_2S

The outdoor H_2S may be due to organic decomposition in nature, as well as car exhaust. Indoors, bioeffluents from people is a known source of H_2S , and there is a considerable load of visitors in both the museum gallery and the library reading room. In storage areas only few people are present on a daily basis, however, low-quality cardboard and archival boxes may emit sulfur compounds.



Salted paper print (photograph), with blackened lead white retouch.
Collection of The Royal Library, inv.no. Fot. Hist. Bl. °4, 266.

Results – so far

Archival housing materials from the two collections were tested for the emission of sulfur products, by accelerated corrosion tests (using silver coupons), and the azide-test. Several cardboard materials were found to test positive for sulfur by both tests.

The highest level of H_2S (up to 2 ppb) was found in the library reading room, where high amounts of archival cardboard and paper materials are present, combined with many visitors each day.

We attribute the degradation to a combination of poor archival housing materials, infiltration of unfiltered outdoor air, and in some locations the presence of many people.

Chemical filtration may solve the problem on a room scale, while on a microenvironment scale the identification and removal of poor cardboard materials will be necessary.

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The project is supported financially by the Danish Ministry of Culture (Kulturministeriets Forskningsudvalg)

