



Faded shine.... The degradation of brass powder in two nineteenth century paintings

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Abstract

During the examination of two 19th century oil paintings by Swiss artists, the Reading pastor (ca. 1885) by Ferdinand Hodler (1853–1918) and Portrait of a young girl (ca. 1888) by Filippo Franzoni (1857–1911), it was observed that in particular locations, the surface had an unusually granular texture, given by the application of metallic particles and the presence of large translucent green agglomerates. In this paper we investigate the composition and origin of the metal particles and green agglomerates. A combination of bulk analysis (GC-MS and FTIR) and analytical microscopy techniques (X-ray tomographic microscopy, light microscopy, ATR-FTIR-FPA imaging and SEM-EDX) were used. It was concluded that the metal particles are composed of a lower quality brass (copper/zinc alloy) and ground from foil. The current appearance resulted from the reaction of the brass and its corrosion products with the fatty acids in the surrounding paint/varnish matrix. This has led to the formation of agglomerates of zinc and copper carboxylates, the latter responsible for their green colour.

Introduction

Microscopic observation of the painting „Reading pastor“ painted ca. 1885 by Ferdinand Hodler (1853–1918) revealed the presence of a combination of metallic pigment particles and green agglomerates in areas where increased luminosity is to be expected, i.e. where the light originates and where upon it falls (Figs. 1 & 2).

A comparable phenomenon was observed in the case of the „Portrait of a young girl“ by Franzoni (Fig. 3) dated from ca. 1888, where the metal powder was used in a less pictorial way and could only be seen in the background paint. In this case Franzoni himself had extensively reworked his painting using conventional paint, partially covering the layers with the metal powder. Additionally, significant areas of the background had later been overpainted. Where visible, the metal particles were closely associated with the green agglomerates (Fig. 4), as in the painting by Hodler.

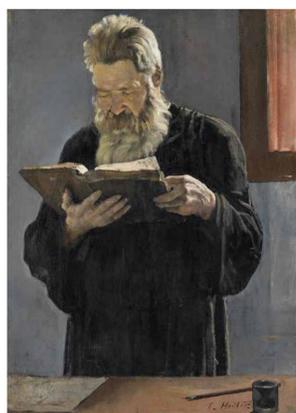


Fig. 1 Lesender Pfarrer (Reading pastor) (ca. 1885). Oil on canvas, 71 × 51 cm by Ferdinand Hodler, private collection [Photo SIK-ISEA, (P. Hitz)].



Fig. 3 Ritratto di giovane ragazza (Portrait of a young girl) (ca. 1888). Oil on canvas, 59 × 46 cm by F. Franzoni. (Fond. Filippo Franzoni, Locarno, Switzerland) [Photo SIK-ISEA, P. Hitz].

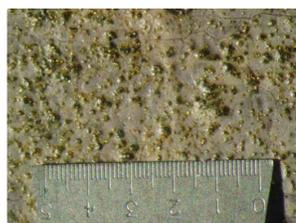


Fig. 2 Reading pastor (ca. 1885) by Ferdinand Hodler. Detail of the lower left edge of the painting. (smaller scale division 100 µm).



Fig. 4 Portrait of a young girl (ca. 1888) by Filippo Franzoni. Detail of the upper right area of the painting (smaller scale division 100 µm).

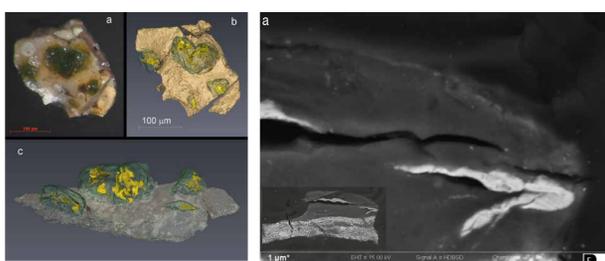


Fig. 5 **a** Light microscopy image of a sample taken from the lower left edge of the painting Reading pastor (1885) by F. Hodler. **b** Top view and **c** side view of SRXTM data reconstructing the sample surface and showing the distribution of the metal foil in the core of the soap agglomerate.

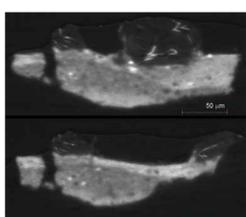


Fig. 6 Virtual cross sections extracted from SRXTM data.

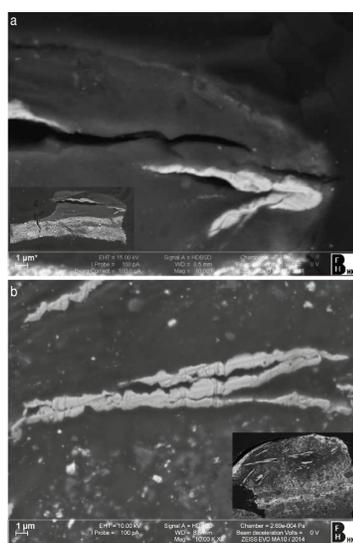


Fig. 7 SEM-EDX images (×10000 magnification) of the brass pigment surface in the cross sections of the samples collected from a Reading pastor by F. Hodler and b Portrait of a young girl (1888) by F. Franzoni. The rough and pitted nature of the metal foil surface could be due to a dezincification corrosion process.

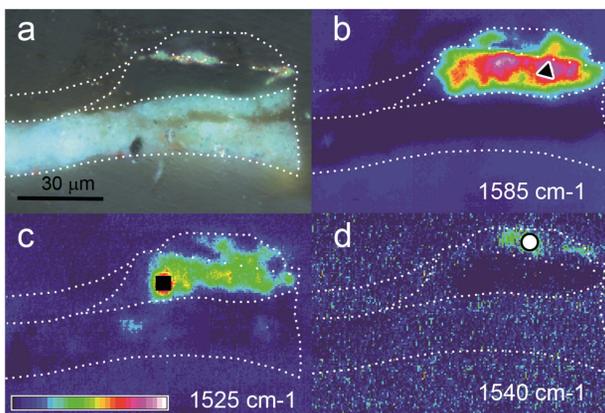


Fig. 8 Analytical microscopic analysis of the cross section of a sample taken from the lower left edge of the painting Reading pastor (1885) by F. Hodler: **a** light microscopy image in bright field mode with cross polarization, **b-d** ATR-FTIR-FPA distributions of Cu- (1585), Pb- (1525) and Zn-carboxylates (1540 cm⁻¹), **e** ATR-FTIR spectra of selected regions.

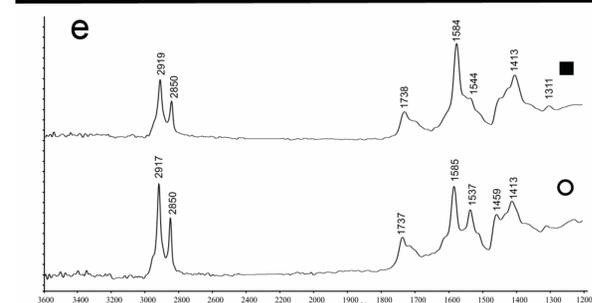
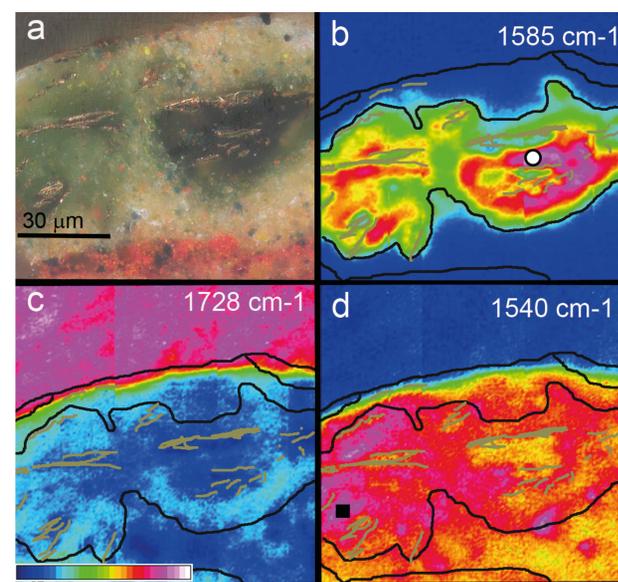


Fig. 9 Analytical microscopic analysis of the cross section of a sample taken from the lower left edge of the painting Portrait of a young girl (1888) by F. Franzoni: **a** light microscopy image in bright field mode with cross polarization, **b-d** ATR-FTIR-FPA distributions of Cu- (1585) and Zn-carboxylates (1540 cm⁻¹), **e** ATR-FTIR spectra of selected regions.

Conclusions

This pigment alteration phenomenon can be described as the formation of blueish-green Cu and Zn carboxylates at the surface of the brass pigment powder (Figs. 5 & 6) as a result of the reaction of the lipidic binding medium with the brass components Cu and Zn. The choice to use different materials on a contemporary replica by Hodler and extensive overpainting in the case of Franzoni strongly suggest fast appearance of the phenomenon - which may be one reason for the limited use of this metal pigment. The pitted structure of the edges of the brass pigment particles observed in SEM-BSE images (Fig. 7) and the heterogeneous distribution of Cu and Zn soaps within the agglomerates (Figs. 8 & 9) are suggestive of a progressing dezincification. The presence of chlorine, possibly originating from the pigment preparation method, might accelerate the formation of copper and zinc soaps.