METOX

Metal-oxalates in the 15th and 16th Century Southern Netherlandish oil paintings

DURATION
15/12/2016 - 15/03/2021

BUDGET
572 848 €

PROJECT DESCRIPTION

The Southern Netherlandish 15th and 16th century paintings by Jan and Hubert van Eyck, Robert Campin, Rogier van der Weyden, Hans Memling, Dirk Bouts and Bernard van Orley, to name just a few, are amongst the most importnt masterpieces in the federal collections of the Royal Museums of Fine Arts of Belgium, Brussels (RMFAB). They form a valuable part of our heritage and need to be preserved for future generations.

It is well known that over time, paint materials, such as pigments or binders, undergo numerous chemical transformations. These unwanted reactions are influenced by multiple environmental factors such as light and humidity but also by repeated cleaning, varnishing and/or retouching during restoration interventions. These transformations are highly complex, since paint layers contain mixtures of many different materials with different properties, and the ageing reactions happen over long periods of time.

The MetOx project will focus on one class of alteration products: metal-oxalates. They are formed either within the paint layers or precipitate on the surface as an optically disturbing crust. Unfortunately, no consensus has been reached on aspects that are fundamental to our understanding of this phenomena. For instance, it is unclear how they are formed and which environmental factors stimulate or inhibit their spontaneous formation.

The project proposes to develop and apply an analytical methodology that will lead to a full understanding of the formation of metal-oxalates and their accumulation on (and below) the paint surface. The following issues will be addressed in the specific context of a number of concrete paintings: (a) how degraded is the original layer, (b) which types of oxalates are present, (c) how are they related to other common alteration products such as metal soaps and (d) what are the causes of the chemical alteration ? In particular, the discoloration of transparent red, blue and green glaze layers caused by the formation of an opaque metal oxalates surface coating will be studied.

The question of the metal oxalates formation phenomenon needs to be studied at multiple length scales: i.e., at macro-, micro- and nano-level. For instance, methods recently developed for macroscopic chemical mapping of paintings will be used to localize and assess the relative abundance of the metal oxalates: macroscopic X-ray fluorescence (MA-XRF), macroscopic X-ray powder diffraction in reflectance mode (MA-rXRPD), and macroscopic Fourier transform infrared spectroscopy in reflectance mode (MA-rFTIR). At the micrometer level, the composition of original paint materials or of those applied during later interventions (overpaints, varnishes) and the degradation products will be determined in embedded paint micro samples by secondary ion mass spectroscopy (SIMS), micro-Raman spectroscopy (MRS) and Fourier transform infrared spectroscopy (FTIR). Because these organo-metal compounds sometimes form extremely thin crusts, they need to be also studied at the nano-scale level. Advanced methods such as Transmission electron-microscopy with Electron Energy Loss Spectroscopy (TEM-EELS), X-ray absorption near edge structure spectroscopy (XANES) and Synchrotron Radiation-based micro/nano-X-ray powder diffraction (SR-µ/n-XRPD) will be used.

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By bringing together conservation scientists, conservators-restorers and art historians, this truly interdisciplinary project will contribute to the thorough understanding of the ageing and alteration phenomena of oil-paint material. Furthermore, it will foster the further development and validation of novel, non-invasive chemical imaging methods for the study of 2D paint surfaces. In the end, it will contribute to the long-lasting preservation of Southern Netherlandish painting masterpieces by informing existing conservation policies on environmental and material factors that can trigger the formation of these organometallic compounds. It will also pave the way towards the development of conservation/restoration (C/R) procedures adapted to treat oxalates-affected paintings.

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