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Highly-specific mapping of oil paintings to detect anachronistic pigments

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The Ghent Altarpiece (1420s-1432) is the masterpiece of the south-Netherlandish painters Jan and Hubert van Eyck. This polyptych has been subject to an extensive restoration by the Royal Institute of Cultural Heritage (KIK-IRP, Brussels) during the last decade, a process that is not completely finished. On the panels of the polyptych that were already conserved [the outer wing panels during phase I of the restoration) and the lower register of the inner panels during phase II)] a very high degree of overpainting covering the original 15th c. paint of the *van Eyck* brothers was observed. Most of this overpaint is assumed to date from the 16th c.

The panels under treatment were examined with a combination of Macroscopic X-ray fluorescence (MA-XRF, phase I and II) and X-ray powder diffraction (MA-XRPD, phase II) with the aim of distinguishing the original and non-original (overpainted) parts of the painting. For comparison purposes, we also examined two other works by J. Van Eyck in Flemish collections: *Madonna & Child with Canon van der Paele* (1436, Musea Brugge) and *Madonna at the Fountain* (1439, Royal Museum of Fine Arts, Antwerp).

In the presentation, attention will be given to the different subtypes of three inorganic pigments that were encountered in *the Ghent Altarpiece*: lead white, copper greens and ultramarine blue.

Lead white (LW) is an omnipresent pigment in most historical paintings and is mainly composed of two components: hydrocerussite and cerussite. However, the mass ratio between these two components is not always the same and has the potential of making a distinction between the LW as employed by (the) van Eyck (brothers) and LW added in later restorations.

Prior to 2012, in the central Adoration panel, in the green meadow surrounding the altar of the Mystic Lamb, several darkened green areas were evident that corresponded to ancient retouching areas. MA-XRPD mapping revealed that in these areas, the rare copper sulfate Posnjakite ($Cu_4(SO_4)(OH)_6.H_2O$) was present, while this pigment is never encountered in the original green areas of *The Ghent Altarpiece* panels. Posnjakite is a mineral blue-green pigment that originates from a mining area in (what is now) the Czech Republic/Moravia.

A comparison of the pattern accessory minerals (such as albite, diopside, ⋯) that accompagny the intensely blue mineral lazurite among different van Eyck paintings suggests that the Van Eyck workshop may have used a fairly specific type of natural ultramarine (NU). This could have potential to distinguish early 15th c. from those of later periods and also allows to differentiate original from add-on ultramarine paint in the Ghent Alterpiece.

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