

Application of Optical Coherence Tomography to the examination of varnish layers on the *Ghent altarpiece*

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The *Altarpiece of the Adoration of the Lamb* (The *Ghent Altarpiece*) painted by the Van Eyck brothers and finished in 1432 for Joos Vijd is thought to be one of the most influential old master paintings in Europe. The quality of the execution, the exceptional rendition of light, space and materials and the monumentality of the altarpiece are exceptional. It is conserved in the Saint Bavo Cathedral in Ghent, the church housing the chapel funded by the donor.

The altarpiece is undergoing an extensive conservation-restoration treatment from 2012 to 2017, following the conclusions of the urgent conservation treatment and diagnostic study from 2010. The work is carried out by the Royal Institute for Cultural Heritage (KIK-IRPA, Brussels) in one of the exhibition halls at the Ghent Museum of Fine Arts. Only a third of the panels is removed for treatment at any one time, the rest of the polyptych remaining on view in Ghent's Saint Bavo Cathedral. The public can follow the progress of the restoration at the museum through a large, transparent window.

The altarpiece has undergone many restorations throughout its eventful history, marked by civil unrest, wars and thefts. Little is known about the nature of the early restorations that are mentioned in historical literature and in archives. A cleaning intervention carried out before 1550 is said to have caused damage to the paintings, and several other treatments are known to have taken place since the sixteenth century. The altarpiece was dispersed at the end of the eighteenth century and the different parts underwent diverse alterations and restoration campaigns.

In 1951, the last complete treatment of the paintings since their reunification in 1923 comprised the structural stabilization of the wooden supports, consolidation of the paint layers and selective cleaning of the paintings.

Since 1951, the paintings have been revarnished at least four times. The numerous layers of varnish, retouching and overpaint have severely degraded over time and distort the perception of the paintings. Varnish removal is necessary to remedy this problem and to allow for the consolidation of the fragile paint layers.

The first phase of the conservation campaign that started last year involves varnish removal. The complexity of the material history of the paintings implies that both their condition and varnishes differ considerably. The number of varnish layers, their relative thickness, colour and evenness vary.

Optical Coherence Tomography was applied early 2013 to support the characterization of the varnish layers to guide the cleaning. The portable system used for this study was built especially for the examination of cultural heritage objects under 7FP *Charisma* project at N. Copernicus University in Torun, Poland. It is high resolution custom designed Fourier domain OCT instrument with the spectrograph used as a detector. The axial (in-depth) resolution is 3 μm in air (2.2 μm in varnish). The instrument utilizes the superluminescent multi-diode light source emitting in band 770 nm–970 nm with the intensity at object less than 800 μW . The axial imaging range is 1.4 mm and sensitivity 98 dB. Volume data acquisition with protocol used in this case (100 B-scans comprising 3000 A-scans each) takes 12 s. The system is equipped with two standard video cameras for the precise documentation of the position of examined area at the object.

In connection with other examination techniques, it contributed to the understanding of the complex cleaning issues. This paper will describe the circumstances of the examination and discuss the contribution of OCT to the project.

