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800 Years of FENESTRAtion history
Flat glass and windows in Federal Scientific Institutes

Introduction

The Royal Museums of Art and History (Brussels) have unparalleled resources for the study of flat glass providing information between the 13th and the 20th century. The collection is sufficient by itself to illustrate technical and stylistic evolutions of stained glass and the glaziers craft in the Low Countries and Belgium. However, this great quantity of high-quality material remained unappreciated and understudied in the storerooms of the Belgian Federal Institute. The study of this collection is the subject of the research project 'Fenestra' funded by Belspo, the Belgian Science Policy. The envisioned methodology will lead to new insights in the use of flat glass in the Low Countries and Belgium and related socio-cultural and economic encounters and confrontations. The collection is approached from different backgrounds incorporating humanities and social sciences; applied sciences and conservation. At the colloquium, two posters are highlighting some achievements obtained during the first project year.

The Project 'Fenestra'

Across numerous disciplines stained-glass windows in monumental settings in Belgium have been thoroughly studied. However, an even greater quantity of material remained unappreciated and un(der)studied in Belgian storerooms. The Royal Museums of Art and History (RMAH) have unparalleled resources for the study of flat glass in their depots providing a unique collection of material dated from the 13th to the 20th century. The collection consists of circa 450 pieces and can be divided in several sub-collections including small panels, unipartite panels (roundels, ovals, rectangles, etc.), fragments and stained-glass windows. The main part originates from the Southern Low Countries and the Prince-Bishopric of Liège together with pieces from France, Switzerland and Germany.

The main objectives of the 'Fenestra' project are research and dissemination, preservation and access. The objectives can be further classified per discipline leading to specific research questions:

(1) History of the collection: The aim is to reconstruct the history of the formation of the collection by gathering provenience and contextual data that over time have been separated from the collection.

(2) Art historical and archaeological research: The aim is to make a detailed inventory of all material preserved. A combined historical, art historical and archaeological research will be carried out on well-selected sub-collections, including detailed technological examinations and stylistic details. This research will be the foundation for the applied scientific research. It will also give the opportunity to publish a "checklist" volume in the Corpus Vitrearum Belgian series. This study mainly

concerns roundels prior to the end of the Ancien Regime, because the monumental stained-glass windows have already been published – most of them in the Corpus Vitrearum inventory series. In fact, the first stained-glass window studied in the first volume of the Belgian series of Corpus Vitrearum, is a panel from the Museum representing an angel holding a streamer, from the Rhine school, dated around 1230-1250.

(3) Applied sciences: The goal is to improve the methodology of dating flat glass based on chemical and optical fingerprints (fingerprinting by optical means of potash-, HLLA- and industrial material, investigation of the relation between composition, fabrication, technology and optical transparency as well as research on flashed glass and specific paint layers such as silver stain).

(4) Conservation: Examination of the collection as well as perform concrete conservation actions. The goal is to establish a workflow for preventive conservation and long-term storage and maintenance of the collection.

The consortium consists of three Belgian partners (VUB – Prof. W. Meulebroeck; KIK-IRPA – Dr. I. Lecocq and RMAH – Dr. V. Montens) and one international partner (UCL – Dr. I. Freestone).

Materials and methods

The transdisciplinary approach requires that all researchers follow a well-defined and time-efficient workflow to receive/provide the necessary input/output for each partner. During this research minimal human interaction with the material is pursued. First the correlation between inventory numbers and the database numbers linked to past research are made. High-resolution pictures are taken, distributed to the other researchers and added to the digitalization platforms BALaT (KIK/IRPA) and Carmentis (RMAH). Secondly, the collection is investigated piece by piece by the conservator describing the state and identifying fragile pieces. All this information is described in technical fiches and related schemes. Then, a macroscopic investigation of every individual piece is performed, consisting of profound visual examination under a variety of lighting conditions using simple magnifying instruments. A full documentation of this research is made per object including evidence of the production method and manufacturing techniques (technical and typological research) and a description of traces of cultural and natural formation processes. This research also includes the selection of measuring points for the applied research ensuring that the main types are included (bare glass, framework glass and different paint layers) [1]. Subsequently, the objects are studied using optical spectroscopy. In this step absorbance spectra are recorded covering the spectral range 300-1700 nm. The glass is illuminated with a spectral broadband light source. Some of the light is absorbed, some reflected and some transmitted. An optical spectrum analyser is used to record the transmitted intensity as a function of the wavelength. A first step of the analysis process is to group the spectra according to their spectral shape. In a next step the spectral pattern is studied to identify glass with equal spectral fingerprints and to unravel information regarding composition and technology. Finally, all results are combined to come to an integrated evaluation of all research fields.

Results and discussion

The current inventory database contains 448 objects. Approximately 90% of the collection has been photographed (ca. 660 photographs) of which 50% is currently inserted in the KIK-IRPA database. So far, 50 panels were investigated during the conservation research leading to the preliminary conclusion that 6 panels need an urgent conservation action before they can be investigated and that 10 panels should be restored.

For the macroscopic and applied research, it was decided within the consortium to start with the sub-collection of roundels and unipartite panels. Detailed macroscopic research of all materials and techniques of ca. 35 roundels has been made. So far 23 panels are studied via optical means all originating from the Southern Low Countries. Most roundels date from the 16th century. Based on the historical and art historical results, the dating and provenance will be fine-tuned. So far, the analysed glass pieces are quite homogeneous and attention is focused on the identification of different production groups in relation with archaeological and art historical data.

Concerning the bare glass, the optical grouping of glass spectra is linked to the archaeological and art historical data. Several spectral compositional groups are identified. At first, we identified five groups without cobalt impurities which are classified based on differences in divalent and trivalent iron concentrations ([Fe^{2+}], [Fe^{3+}]). These spectral groups are defined via their colour coordinates (fig. 1).

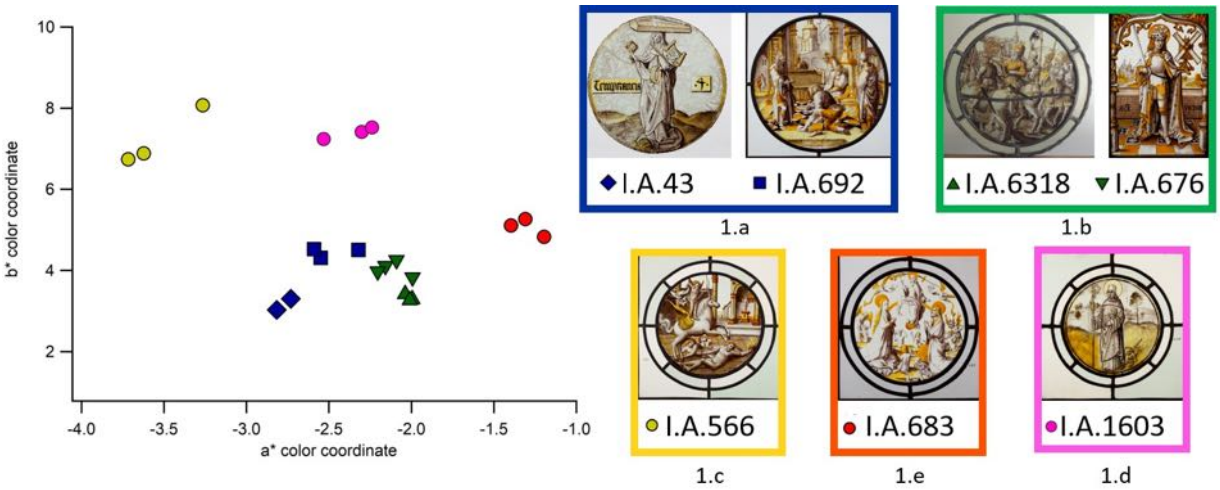

Fig. 1. Differentiation of the 5 subgroups without cobalt by glass colour coordinates

Secondly, we identified eleven groups with cobalt impurities. As an example, the combined evaluation of the macroscopic and spectroscopic study allowed us to identify a series of four roundels that were potentially made using two different sheets of glass coming from the same batch. This conclusion was first made based on comparable macroscopic observations and subsequently confirmed by spectral shapes. These four roundels are obviously from the same iconographical series (I.A.569.1, I.A.569.2, I.A.571 and I.A.681) illustrating the story of Griselda. Based on visual research of the glass the four panels are divided into two groups, likely being cut out of two different sheets of glass. (group 1: I.A.569.1 – I.A.569.2 and group 2: I.A.571 – I.A.681). This temporary conclusion is based on a wide variety of subtle production traces in and on the glass. The equal spectral shapes indicate that the glass of the four roundels is part of the same production. The exact superposition of I.A.569.1 and I.A.569.2 of the two spectra in combination with thickness and visual observation indicate that these panels were most probably cut from the same sheet of glass (fig. 2.).

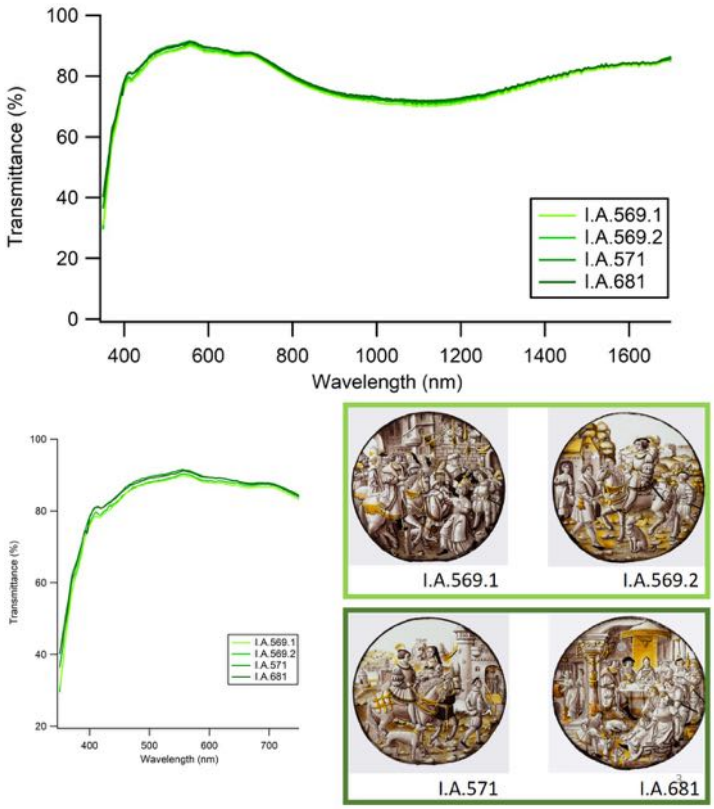

Fig. 2. Identification of four panels of the same type of bare glass (I.A.569.1, I.A.569.2, I.A.571 and I.A.681). Both groups indicate two roundels cut from the same sheets of glass (I.A.569.1, I.A.569.2 and I.A.571, I.A.681).

Fig. 3. I.A.555 is decorated with a light yellow and a dark orange yellow stain.

Research on paint layers and especially yellow stain is ongoing. Visual observations suggest the use of different types of yellow stain on the same objects: lighter and darker (sometimes almost orange) yellow (fig. 3). The aim is to match the appearing spectral shape (spectral peak position and full-width at half maximum value) with the composition and technology.

References

[1] MEULEBROECK Wendy, WOUTERS Hilde, NYS Karin, and THIENPONT Hugo, "Authenticity screening of stained-glass windows using photonics", *Scientific Reports*, 2016, p. 1-10.

Acknowledgement

The research leading to the described results was funded by the Belgian Science Policy Office supported through contract no. BR/175/A3/FENESTRA.

29th International Colloquium of the Corpus Vitrearum

Stained glass in the 17th century
Continuity, Invention, Twilight

Antwerp
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Conference organized by
Corpus Vitrearum Belgium
Flemish Committee for stained glass associated to the Corpus Vitrearum Belgium

With
University of Antwerp
Rubenianum, Research Institute for Flemish Art of the 16th and 17th Centuries
Royal Institute for Cultural Heritage (KIK-IRPA), Brussels

Supported by
International Committee of the Corpus Vitrearum
Union Academique internationale, Brussels
Fonds voor Wetenschappelijk Onderzoek (FWO), Brussels
Fonds national de la Recherche scientifique (FNRS), Brussels
City of Antwerp
Région de Bruxelles-Capitale – Brussels Hoofdstedelijk Gewest
City of Leuven

Editors: Madeleine MANDERYCK, Isabelle LECOCQ, Yvette VANDEN BEMDEN

Layout: Isabelle LECOCQ

Scientific Committee

ISBN 978-2-930054-33-9

Outside front cover *The Entry into Jerusalem*, Jan de Labaer, 1633, details (phomontage L. Langouche). © St Paul's Church Antwerp.