MOLAB User Report

Project: *Materials and techniques of the Crucifixion by Antonello da Messina.*

User Group Leader: Prof. Koen Janssens**,** Department of Chemistry, University of Antwerp, Belgium
Location: *Royal Museum of fine Arts Antwerp*
MOLAB responsible: F.Rosi (UNI-PG)

Figure 1: photo of the painting 'the Crucifixion'

Introduction

The Crucifixion was painted in 1475. At the base of the cross, the Virgin Mary and St. John are mourning. In the back, the composition offers a panoramic view of the grassy surroundings of the Calvary hill and the Dead Sea. The scenery is lavishly detailed with several (symbolic) animals, buildings, meadows, trees and people returning home from the event (figure 1).

The study of the materials and techniques used by Antonello has been carried out not only because of the undergoing restoration, but also to gain a better understanding of the considerable exchange between Italian and Flemish art which took place during the 15th century. The *oeuvre* of Antonello da Messina forms a good base for this purpose, as this Sicilian painter is often considered one the first Italian artists who combined the Flemish (oil and glazing) techniques and realism with the characteristic Italian modelling of forms and clarity. His practice of building forms with colour instead of lines and shadows greatly influenced Bellini and late 15th century Venetian painting in general.

The Crucifixion may have been painted during Antonello's visit to Venice (1475-'76) and is therefore thought to be especially significant for the development of Northern Italian painting.
Preceding studies were carried out by conservators by means of visual examination, optical microscopy (OM.), IR reflectography (IRR) and X-ray radiography (XRR). The Department of Chemistry of the University of Antwerp (Micro and Trace Analysis Centre – MiTAC) carried out analytical measurements using a Portable X-Ray Spectrometer (PXRF). All these previous studies provided several preliminary important information.

MOLAB examination took place in March. A total number of 87 non invasive analyses have been carried out: 32 by midFTIR, 11 by nearFTIR, 22 by UV-Vis reflectance and 22 by UV-Vis fluorescence.

Results

Here a partial short summary of results:

-*nature of the ground layer*: on the basis of the MiTAC PXRF measurements, Ca was found in all the examined areas; MOLAB completed this information revealing the presence of a ground layer composed by gypsum and glue, according to the Italian painting tradition [1, 2]
-*nature of the blue pigment(s)*: no elemental cobalt and copper were detected in blue areas by PXRF, excluding the possible use of smalt or azurite and suggesting natural ultramarine or indigo. Natural ultramarine was indeed detected in all the blue areas of the painting by mid-FTIR. In figure 2, the spectrum collected on the Virgin's mantle shows the typical sharp peak centred at about 2340 cm^{-1}, due to CO_2 encapsulated in the sodalite β-cage of natural ultramarine blue [3]. As indicated in figure 2, also oxalates have been found.

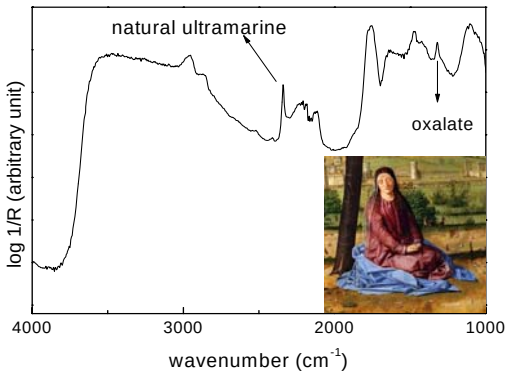

Figure 2: mid-FTIR spectrum collected on the blue mantle of Saint John

-*nature of the green pigment(s)*: MiTAC PXRF spectra on green paint areas (trees and meadows) revealed intense Cu peaks suggesting a green copper pigment (e.g. verdigris, organo-copper complex or malachite) or even possibly azurite in mixture with a yellow pigment (yellow ochre or other). MOLAB FTIR measurements permitted to exclude malachite (and azurite). These finding, combined with the transparency and overall appearance of the green paint, pointed towards the use of verdigris and/or an organic copper complex (i.e. verdigris dissolved in oil and/or terpenic resin).
-*presence of organic dyes and lakes*: fluorescence spectroscopy performed on areas painted with and without vermillion revealed the presence of an emission at about 630-640 nm suggesting the use of an animal anthraquinone lake. The same organic pigment was found mixed with natural ultramarine blue in the purple areas.
-*binders in original and repainted areas*: the presence of the typical near-FTIR doublet at 4300-4400 cm^{-1} indicated the presence of a lipidic component in the original paints. Diversely, some re-painted areas were characterized by the signals of proteinaceous components.

References

[1] C. Genestar, *Mat. Lett.* 54 (2002) 382-388
[2] **Artists' Pigments**, Vol. 2, Ashok Roy Ed., R.J.Gettens, E.W.Fitzhugh, R.L.Feller
[3] C. Miliani, A. Daveri, B. G. Brunetti, A. Sgamellotti, *Chem. Phys. Lett.* 466 (2008) 148-151