STUDY OF WALL PAINTINGS AND MOSAICS BY MEANS OF ULTRAVIOLET FLUORESCENCE AND FALSE COLOUR INFRARED PHOTOGRAPHY

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1. Introduction

This paper reports the results of the application of ultraviolet (UV) fluorescence and false colour infrared (IRC) photography to the study of wall paintings and mosaics. The case studies proposed in this work are the wall paintings in the crypt of the medieval church of Sant'Andrea in Viterbo (Italy) and the fragment of wall mosaic with an Angel, coming from the Giotto Navicella, at present placed in the Grotte Vaticane. This mosaic fragment was examined on the occasion of the restoration carried out from November 2004 to February 2006. This restoration intervention was promoted and funded by Bonifacio VIII Committee on the occasion of the celebrations for the VII centenary of the death of Bonifacio VIII. Ultraviolet (UV) fluorescence and false colour infrared (IRC) photography are non invasive methods of analysis useful for a preliminary and sometimes resolutive investigations of works of art. The main advantage of these techniques is their simplicity and inexpensiveness but, at the same time, they made possible an overall examination of the work of art before starting with more sophisticated and in-depth investigations (Aldovrandi [1], Cardinali [2], Poldi [3]). There are few references about the application of this kind of analyses to the study of wall paintings and mosaics (Aldovrandi [4], Fiori [5], Castro [6]), so the aim of this research was to apply these photographic methods to some wall decorations and at the same time to several specimens carried out in laboratory to have a valid comparison. The aim was also to prove the potentiality and usefulness of these methods especially in the examination of mosaics because taking samples for laboratory analyses is often impossible.

2. Materials and Methods

UV fluorescence photographs were taken using a Nikon F70 camera and 2x160 Watt Philips MLW UV lamps positioned at 45° as regards the surface to be examined, on a Fujicolor Pro 160 C daylight colour film. In front of the camera lens a Kodak 2E Wratten gelatine filter was placed. The IRC photographs were taken with the following equipment and according the following conditions: Nikon camera F3 on Kodak Ektachrome Infrared film and Kodak n.12 Wratten gelatine filter coupled from time to time with Kodak CC50 Cyan, CC30 Magenta and CC20 Cyan filters. The illuminating system was made up of 2x250 Watt High component IR Photolyte lamps.

3. Results and Discussion

The study of the fragment of wall mosaic with an Angel, coming from the Giotto Navicella, by means of UV fluorescence and IRC photography was very useful for the execution of the restoration and conservation intervention. In particular, UV photography showed the presence of a diffuse light-blue fluorescence probably due to ancient restoration materials and of a localized bright red fluorescence due to the use of a red lake for the false mosaic integration in the red areas. These findings assisted the restorers to the choice of the

cleaning systems. The results of IRC photography were carefully examined and compared with the XRF elemental analyses of the mosaic tasserae. Most of the pigments used for the false mosaic integration were identified thanks to their IRC colours: red for artificial ultramarine, pink-red for cobalt blue, white for calcite (fig. 1).

Fig. 1 - Visible and IRC photographs of the mosaic with an Angel from Giotto Navicella, before the restoration intervention. The blue areas made of artificial ultramarine are red in IRC photograph; the blue area made of cobalt blue become pink-red in IRC photograph. Photographs: Domenico Ventura ©

The UV and IRC photographs of the mosaic fragment were taken before and after the restoration.

The study of the wall painting fragments of the crypt of the church of Sant'Andrea in Viterbo by means of IRC photography allowed the characterization of most of the pigments employed in the scenes. In particular, red and yellow ochre, lime white, green earth and cinnabar were found. This last pigment gives a yellow-brown response to IRC photography (fig. 2); its presence was confirmed by means of micro analytical spot test and polarizing microscope observation. The other pigments were confirmed by means of DRIFT FTIR and reflectance spectrometry analyses and of polarizing microscope observation. UV fluorescence photography put in evidence the bad conservation state of the wall paintings: the presence of an intense yellow fluorescence in many area of the scenes suggests a diffuse biological deterioration. The high UR values of the crypt favoured the development of this biological attack. The registered UR values were in fact above 80% in both summer and winter. The visible plaster areas showed a light blue fluorescence due to the mortar materials. At last, the white surfaces (halo edges, book background, highlighting of the wings of the eagle) gave rise to a whitish fluorescence probably due to the presence of the lime white pigment *bianco di San Giovanni* (fig. 3).

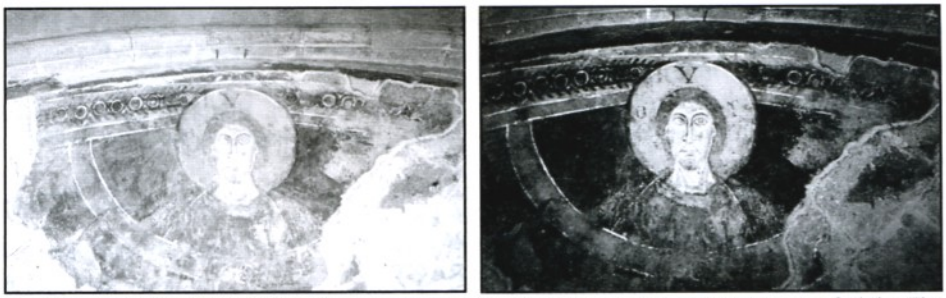

Fig.2. Visible and IRC photographs of the left side apse wall paintings with the half-length image of Christ. The red frame that borders the Christ figure gives a yellow-brown response to IRC photography due to the presence of cinnabar. Photographs: Fabio Castro ©

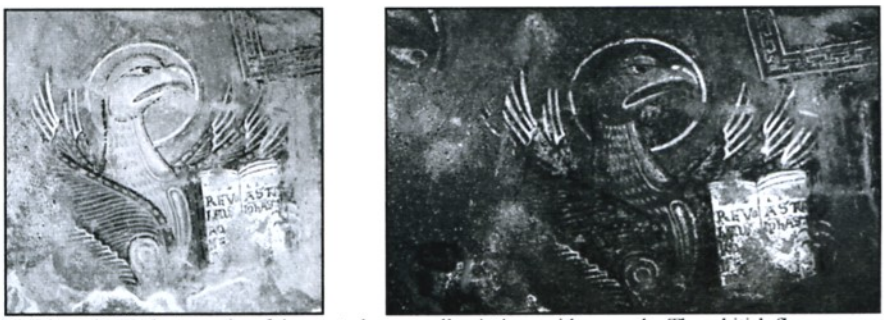

Fig.3. Visible and UV photographs of the central apse wall paintings with an eagle. The whitish fluorescence (halo edges, book background, highlighting of the wings of the eagle) is probably due to the presence of the lime white pigment *bianco di San Giovanni* Photographs: Fabio Castro ©

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