Analysis of the Sant'Agata Post-Byzantine Icon from the Hellenic Institute of Byzantine and Post-Byzantine Studies, Venice. A Multi-Method Approach

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INTRODUCTION

This work represents a multi-method approach to the investigation of a 18th Century icon representing Saint Agate, painted by unknown painter which belong to the Hellenic Institute of Byzantine and Post-Byzantine Studies, Venice. Among the analytical techniques, Infrared Reflectography and X-ray radiography, are of paramount importance in the understanding the artist's individual technique as well as the development of the picture.

Since the execution of Byzantine Icons is a long and complex procedure, the understanding of the painting process requires a close examination of the materials and techniques used by the artist. In detail the execution steps can be summarized as follow. A seasoned plank was layered with several coats of glue derived from animal skins. A piece of soaked linen was often laid over the front of the panel to conceal any surface flaws. Over this, coats of gesso, a mixture of powdered calcium sulfate (gypsum) and animal glue were applied as ground layer. Areas to be gilded were prepared with a layer of bole, a reddish clay that provided an adhesive surface for fragile gold leaf made by pounding small amounts of gold into thin sheets, which were then applied to the panel with great care using a tool called a gilder's tip. The gilded surface was then burnished using a hard-tipped instrument to smooth and polish. Additional decoration was then incised or "punched" into the surface and the panel was finally ready to for preliminary drawings and painting.

In the past available information came mainly from artist treatise but in the last few years optical analysis and X-rays radiography have entered the field of painting diagnostics and conservation in order to be comprehensive with minimal impact on the integrity of the artwork.

INFRARED REFLECTOGRAPHY, RGB AND FALSE-COULOR IMAGE

IR reflectography is a non-destructive optical technique commonly used by conservators and art-historians before the restoration action, and during any documentation phase [1]. It enables the visualization of details underneath the visible surface of a painting, such as preliminary drawings, signatures and dates, originally under the paint layer, or covered by restorations (underdrawings). Variations in the composition of the artwork with respect to its final version (pentimenti) and even sketches of objects without any relation to the painting as it is seen today, can also be detected.

The infrared light generally penetrates the upper layers, is then reflected by the ground layer and absorbed by the underdrawing underneath it.

The IR method consists in shining on the artwork a near IR radiation source and capturing the reflected radiation. In order to avoid the visible radiation to sum to the IR, a visible light blocking filter is generally used before the sensor. The visibility of the underdrawing depends on the difference between the reflectance of the material used for the preparatory layer and that used for the underdrawing and on the paint layer transparency to IR radiation.

The differential absorption can be imaged by infrared-sensitive cameras. Nowadays, the traditional IR film has been mostly replaced by digital devices, which allow more reliable database creation, better image processing and enhancing easy reproducibility of the reflectograms.

The analysis was performed using the multispectral scanner of the Opificio delle Pietre Dure (Firenze) based on a fast single-point spectrophotometer, specifically developed for multispectral imaging in the 380-800 nm. The device simultaneously acquires the IR reflectography and the RGB composite image, scanning an area of 100x100 cm^2 with spatial resolution of 16 pixel/mm^2 and tonal resolution of thousands of grey tones. Infrared and RGB digital images can be completely super-imposed, making it possible to highlight the spatial correspondence between the visible and hidden details.

Figure 1 shows details of the IR reflectogram of Saint Agate icon showing the detected underdrawings. In figure 2 it is possible to note the characteristic transparency in the IR image indicating the presence of overpaintings.

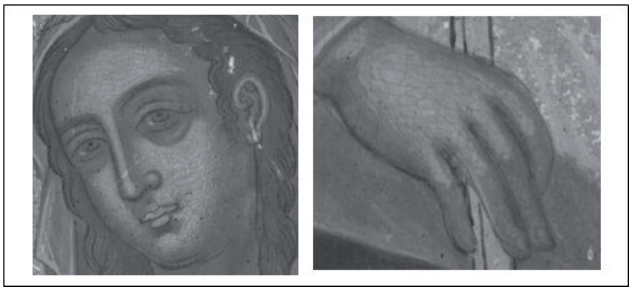

FIG. 1. *Underdrawing; preliminary scketch.*

Another infrared technique which is quite used to obtain additional information on painting materials, techniques and retouches is the false-color infrared photography.

False-colour images can be generated by digital image processing techniques to represent up to three independent measurements over a two-dimensional map or image. In the false colour generation process a green subject is rendered as blue, a red one appears as green and an infrared subject is rendered in red. Blue subjects cannot be depicted and they appear black. The final false colour R-G-B image corresponds to IR-R-G components.

Two different pigments with the same color but showing different IR responses are thus diversified and rendered with different false colors. For example verdigris, green with no IR reflection, appears blue and Cobalt Green with IR response appears magenta.

The technique may thus be very useful for an immediate chromatic discrimination of many pigments as well as overpaintings. In figure 3 two different blue areas are reported as images RGB colour, IR and false colour images respectively. From the comparison of the first and the third images it is possible to highlight the difference between two different blue pigments (azurite and indigo) having the same chromatic yield and being thus indistinguishable at sight. In false color image indigo appears red while azurite black as reported in literature [2].

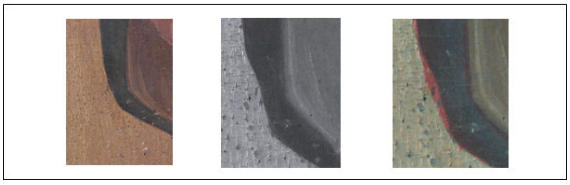

FIG. 2. *Overpainting.*

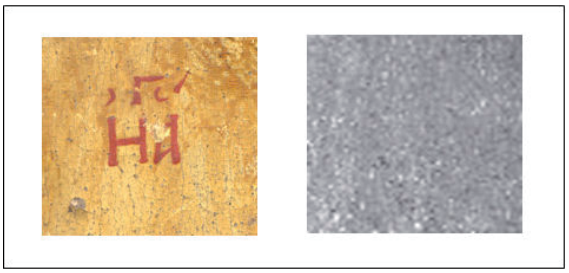

FIG. 3. *RGB, IR and false-color images of blue pigments.*

X-RADIOGRAPHY

X-radiography is used by conservators to determine how artists applied different layers of paint to create an image. X-rays penetrate through paint layers and record on film the atomic weight or density of the various materials. This technology reveals changes, such as figure pose and placement, costume details, or background composition, the artist made during the process of painting.

FIG. 4. *Icon radiography with different areas of interest.*

In figure 4, the white areas in the Saint figure record the denser pigment zones indicating, the application of over imposed layers of paint to create the image. Moreover, from the radiographic image it is possible to put in evidence internal details of the wooden panel.

The areas marked with a) show the existence of metal debris probably due to nails along with evidence of iron oxide (rust) diffusion in the internal part of the wood panel. Areas b) show the existence, in the lateral part on the wooden panel, of empty nails housing. The image in Area c) suggests the presence of a wooden pin while area d) indicate a visible difference in the structure of the paint layer. This could be connected with a former restoration or paint layer damage.

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[1] Italian Painting of the Later Middle Ages: Panel Painting http://www.metmuseum.org/toah/splash.htm

[2] T. Moon et al, A Note on the Use of False-Color Infrared Photography in Conservation, Studies in Conservation, 37(1) (1992) 42-52.