
EXAMPLES OF APPLICATION OF SOME MODERN TECHNIQUES OF ICON AND FRESCO RESTORATION AND CONSERVATION

Elena Ene D.-Vasilescu *

14a London Place, Oxford, OX4 1BD, UK

(Received 16 May 2008, revised 1 August 2008)

Abstract

Icon and fresco restoration and conservation are among the most appropriate meeting places for science and art, even when this art is essentially liturgical.

The science is present here not only because chemicals, minerals, and colours are involved, but also because the most advanced scientific techniques and methods are used, both in order to restore the original appearance to frescoes and individual icons, and also to prevent their deterioration. Among the techniques used are optical microscopy, Digital Image Analysis, Scanning Electron Microscopy, X-Ray Microanalysis, and gas-chromatography.

My paper gives several examples in which these modern techniques are used for restoration and/or conservation, and shows the results obtained as a consequence. The examples refer to icons and frescoes from Thessaloniki, Mount Athos, Athens and Lysi (Cyprus).

Keywords: Digital Image Analysis, gas-chromatography, non-destructive techniques, optical microscopy, Scanning Electron Microscopy, X-ray Microanalysis

1. Introduction

It seems there are no other domains in the field of iconography and sacred Christian images so prone to the meeting of science and art, albeit liturgical art, as restoration and conservation of icons.

One good exemplification of this is what happens in the restoration centre 'Resurrectio' in Iași, where this Symposium takes place. In 2001 when I visited it I was impressed by the minutious labour people put into their endeavours of applying the results of various sciences to the special objects with which they work.

The science is present in restoration and conservation not only through the fact that, as always, colours, minerals and chemical substances in general are involved, but also because the highest scientific techniques and methods are used, when necessary, to try giving back to frescoes or individual icons, their

* e-mail: elena_vasilescu@yahoo.co.uk

initial appearance or one as close as possible to that. In order to restore and conserve them, substances as glass fibre, Styrofoam (expanded rigid polystyrene plastic), Ethafoam (a polyurethane material), etc. are been used today, in addition to traditional and other new substances.

Among the methods which help in the above-mentioned processes optical microscopy - in both visible and infrared spectra, Scanning Electron Microscopy, X-ray Microanalysis, gas-chromatography, and Digital Image Analysis are included.

In this paper I will presents some successful examples of restored works, and the process which led to their completion. The examples refer to icons and frescoes from Athens, Mount Athos, Thessaloniki and Lysi (Cyprus).

2. Examples of icon restoration and conservation

In order to engage in restoration and conservation, the specialists study the techniques and materials used by the Byzantine artists. For example, a team from Athens has analysed the binding media of Byzantine and Post-Byzantine icons by using Gas-Chromatography. They have published the result of their work on an icon of Mother of God *Hodegetria* at an International Symposium which took place in 2002 in Crete [1]. They had known that traditionally, these materials are supposed to consist of a mixture of animal glue and chalk (CaCO_3) or gesso ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$), and sometimes they might contain linseed oil. Egg yolk or an emulsion of egg yolk and linseed oil were the most common binding media of pigment layers, although other combinations could have also been used.

A new chromatographic method, based on the simultaneous determination of amino-acids and fatty acids of proteinic or fatty binding media, was applied for the first time on samples taken from the above-mentioned Post-Byzantine icon of St Luke *Hodegetria* type in the National Gallery of Athens: Alexandros Soutzos Museum. This method is of particular interest and enables the specialists to distinguish between various emulsion types of binding media used by the icon painters.

Five samples were taken from the icon in order to identify the binding media of the preparation and the paint layers. Four samples were from the paint layers and one sample was from the preparation layer. All the samples were analysed using gas-chromatography. The result revealed indeed the presence of egg yolk in the paint layers, and the presence of animal glue in the preparation.

According to Kalifo Milanou the most important stages in the process of conservation are the initial steps: examination and documentation [2]. Their aim, *inter alia*, is the precise determination of damage and its causes, as well as the detailed study of the icons' structure and their production technique. There are many procedures to do this, depending on the situation.

The authors give the example of the icon of the Virgin *Glykophilousa*, in the Benaki Museum, in Athens. In this particular case, examination included:

1. An X-ray study of the icon, which led to the determination of over-paintings as well as the extent of damage.
2. UV (ultraviolet) fluorescence study of the surface, which led to the accurate determination of recent interventions, executed over the varnish coat, especially in the central part of the icon.
3. IR (infrared) reflection study of the surface, which led to extremely interesting results that solved various problems: a) the initial composition was revealed, as well as the free-hand drawing executed by brush on the gesso ground, b) the comparison of the drawings of the busts of apostles with the central representation allowed the distinction between the original and latter additions, c) the application of the same method to the base-reliefs revealed the presence of granules indicating that they were not made of steatite but of some other non-homogenous material, d) the incised drawing on the two triangular glass plates was clearly recorded.
4. Study of the surface under magnification. This icon of the Virgin is of special interest because of its high quality technique and its particularity. The busts of the apostles are drawn on gold leaf, which was also used as the ground of the central depiction as well as of the figures of the evangelists, which are incised on the glass plates. The four busts of apostles on a silver ground are later additions, executed by incision on brownish red background. The surface of the bas-reliefs is coated by a greyish green glaze which is also observed on the flesh of the central depiction. Due to its translucency, the large grains of the plaster are clearly visible. The background of the bas-relief is covered with blue and the haloes are gilded.
5. Study of cross-sections of the ground and paint layers revealed the painter's technique; the structure of the paint layers, the mixture of the pigment grains and the density of the colours. All the above constitute further information, which helps to date the icon and to determine the school to which it belongs. The artists used a coat of *imprimatura* (observed in all cross-sections). The flesh and draperies were to be covered by a translucent glaze of green earth pigment.

The various methods applied provide rich information, which leads us to conclude that the icon dates from the fourteenth century. The four busts of the apostles, executed in silver, are later additions, which replaced lost parts of the original icon.

Another icon, that of Saint John the Baptist, was subjected to 'an extensive non-destructive and micro-spectroscopic study' with the view of restoring it [3]. This typical Post- Byzantine icon was painted during the second half of the fifteenth century and is now kept in the Simonopetra monastery on Mount Athos. It was studied through both non-destructive and microanalytical techniques, such as ultraviolet reflection and fluorescence photography, optical microscopy and stereo-macroscopic observation. X-ray radiography, infrared reflectography, colour measurements and representation, as well as micro-Raman [4] and micro-FTIR spectroscopies [5-7].

Thus, the present state of conservation was revealed, damage and subsequent interventions made over time were recorded, and a detailed identification of pigments and materials used was possible. The preparation layer consisted of gesso with animal glue as the binding material. The pigments, detected in a proteinic vehicle, were as follows: lead white, carbon black, cinnabar, indigo, limonete, red ochre and red lacquer. The ground of the upper part was covered in gold leaf. The icon's painted surface was protected by a recent coat of beeswax.

The seemingly punctiform process of restoring an icon can indicate not only the social status of its past owners (especially if it is richly decorated) but also of, for instance, the history of a place [8]. To give just one example, this is the case of a processional icon in the Municipal Art Gallery, Thessaloniki, which comes from the cemetery church of Annunciation (*Evangelistria*). The icon has on one side the Virgin as the *Hodegetria* and on the other, Christ as the Man of Sorrows. Based on iconographic and stylistic features the icon is dated ca. 1300.

Because there is a fine layer of soil preserved between the fourteenth and the eighteenth-century paint films, we can read some of the history of the city and, implicitly, of this icon. The presence of the dirt testifies to the fact that the icon was there during the Bayazid's conquest of Thessaloniki, in 1391. At that time some churches were converted into mosques and this icon was vandalised, among others. It must have been restored after 1403, when the Byzantine regained the city, and buried in 1430, when the Ottomans attacked and eventually occupied the city. It was unearthed in the eighteenth century, when the Mother of God was entirely repainted, but the traces of soil could have not been totally removed. The icon was cut off on all four sides in order to adapt to the iconostasis to which it was displayed. That is attested by the fact that the floral decorations surrounding the eighteenth-century painting was removed, and only some remains are visible today along the upper edge. In 1875 the icon was donated to the *Evangelistria* cemetery church. During the late Ottoman period, moving of the surviving icons around was the way of consecrating the churches that were built in this city under occupation. This happened because the respective icons were regarded as sacred relics.

3. Problems which can occur during frescoes restoration

The same high regard is valid also in the case of the frescoes coming from Lysi, Cyprus, which were stolen from the dome and the apse of a small church during or after the Turkish occupation of the Northern part of the island in 1974 [9]. Annemarie Weyl Carr dated these frescoes to the thirteenth century. When they became aware of the theft, the Holy Archbishopric of Cyprus in Nicosia asked the Menil Foundation in Huston to do their best to acquire the respective frescoes in order to stop their total destruction by dispersal on the art market, to restore them and eventually to return them to Cyprus. They manage to do it, and contacted the restorer Laurence J. Morroco, on behalf of the Archbishopric, to reconstruct and restore the frescoes, which the art thieves had cut into pieces.

When he agreed, the 38 pieces were delivered to him in the warehouse of Artworld Shipping in North London.

The work, which lasted 5 years, needed industrious thinking, as only very unreliable measurements had been provided by those who stole them and, in addition, the curvature of the parts was lost. The curvature would have shown how to put the pieces together; in the case of the dome that was very important. Therefore, the creativity and the technical abilities of the specialists were challenged to the greatest extent. In such a case, the 'human factor' was more important than the 'high technology', even though a fine and 'tender' technique was employed. Morroco and his team had to remove the coarse cloth facings glued on the face of the painting to protect the paint layer. In order to do it the fragments needed to be supported on the back, otherwise they would have fallen apart. For the canvas backing Morroco and his team applied a different type of glue than the one used for the facing of the frescoes (which was a strong rubber adhesive, only solvable in toluene, that is very toxic). It was important to avoid toluene as a solvent for the backing, because that would have softened and dissolved the front facing while applying the new ones to the back. They used animal glue instead, because it is water soluble, strong and easily reactivated by steam, which is important during their removal, in the process of reconstruction. That was only one technical problem. There were others, as for example, a certain amount of shrinkage occurred because of the lack of required climatic conditions in the warehouse; that especially because the work took longer than initially predicted. But the most difficult problem was to reconstruct the curvature.



Figure 1. The work on the dome made of Styrofoam.

Based on their own measurement of each fragment of frescoes, and on some incomplete black and white photos of the dome before the thieves removed them, the team of specialists in London made a three-dimensional convex dome of Styrofoam (Figure 1).

In order to do the templates (of Ethafoam) for the dome, a system of canes, chains, a plywood sheet, and other materials were used. The specialists named conventionally the part of the dome where Christ Pantocrator is the 'inner' dome, and the part containing the band of angels around the Christ figure, the 'outer' dome, in order to facilitate the communications among the members of the team. They were looking to connect the two, and also the fragments among themselves. They joined the fragments containing the angels with strips of ragboard (acid-free mounting board), and when all the saw cuts had been covered by these strips, a layer of gauze was glued over them. That was done to keep them temporarily together. The photos from the *situ* taken in 1972, and which arrived later, confirmed that their view of the dome and of the position of figures inside it was the right one. They also asked Ove Arup & Partners firm to check on their measurements on the computer and the result was positive (the same firm designed the scaffold bridge necessary for the work inside the dome).



Figure 2. (a) Lysi dome (detail), face of an angel showing removal of clear paper facing during the restoration process; (b) Outer dome; removal of ragboard peg system.

Since the fragments were only temporarily united within the dome, soon after the right position of each fragment were determined and the measurements taken, the team had to remove the ragboard from the face of the frescoes (Figure 2), and also the opaque gauze facing (Figure 3a), and the clear paper facings (Figure 3b).

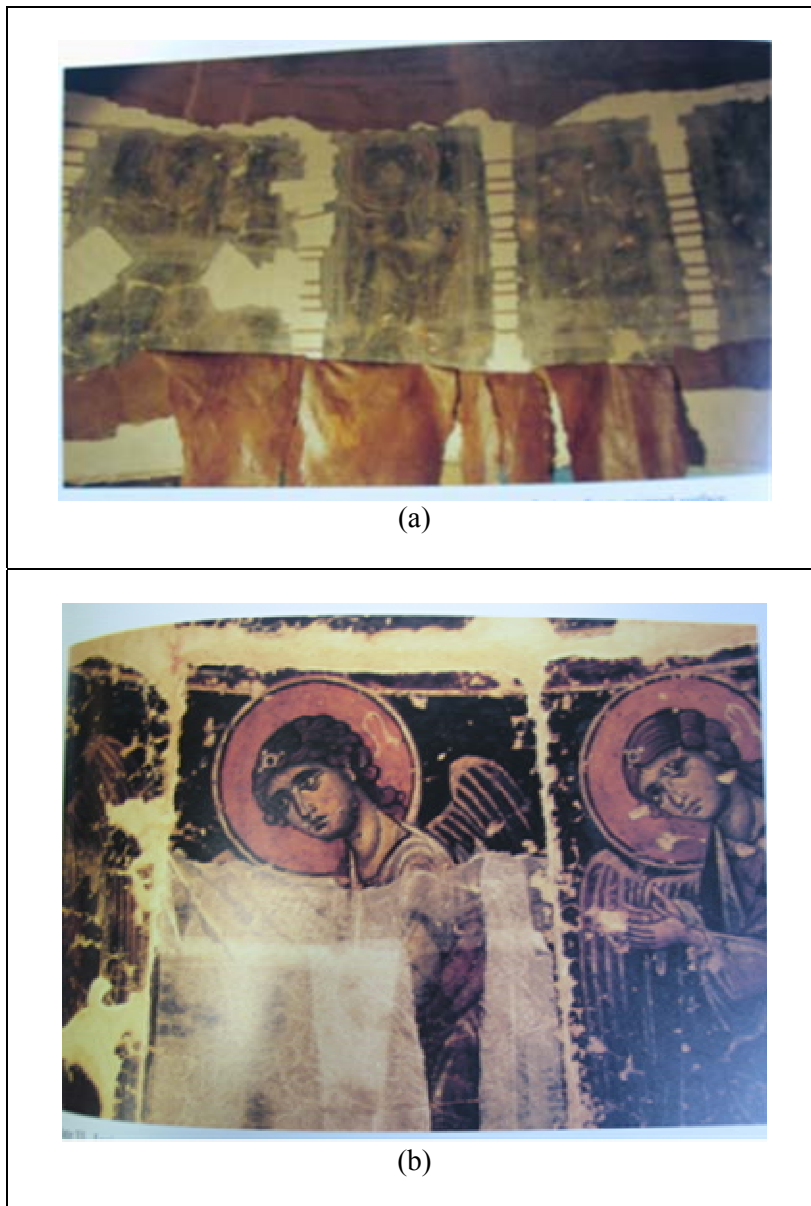


Figure 3. Lysi outer dome restoration: (a) final removal of opaque gauze facing from painted; (b) final removal of clear paper facings from painted surface.

Only when everything was almost done, eventually Laurence Morroco managed to obtain the permission to visit the church in Lysi from where the frescoes had been removed. He took numerous photographs and they confirmed that the dome they built has the right circumference; it was also possible to double check the position of the frescoes.

It is obvious only from these few examples that the work which the restorers faced on Lysi frescoes was far from being easy. But the results were very satisfactory, as the images below (especially Figures 4 and 5), and some of the above prove.

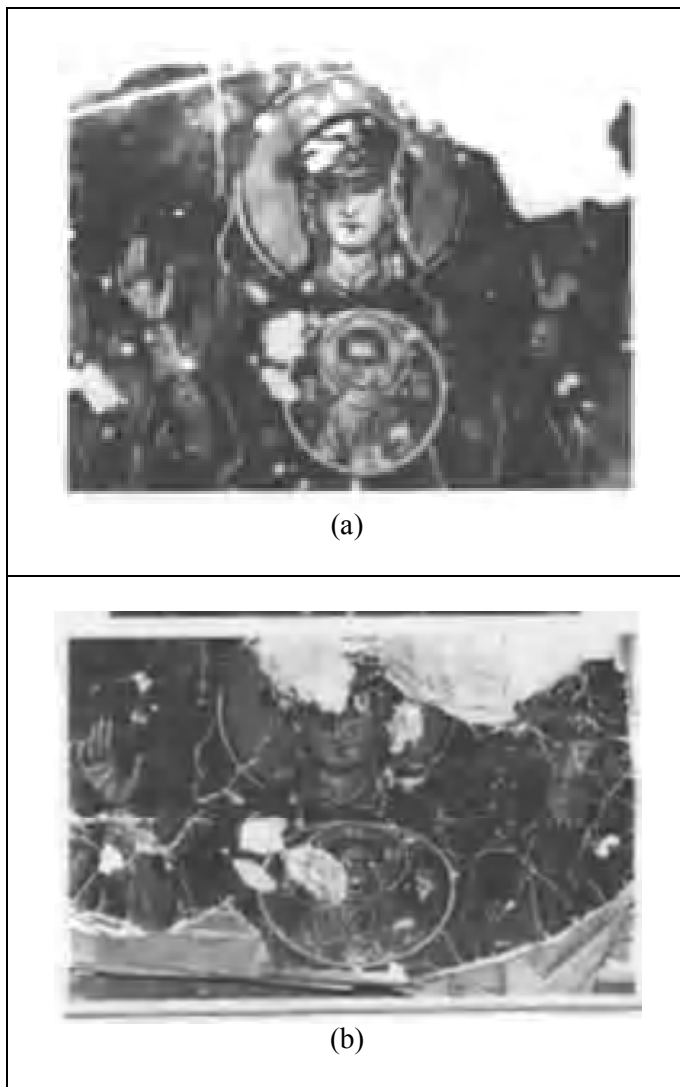


Figure 4. (a) Lysi apse in situ, condition photo ca. 1972 (detail), Virgin and Christ Emanuel; (b) Lysi apse fragment. after removal of smugglers' crude facing, photo 1984.

After a remarkable achievement marked by a series of problems solved on the way, Morroco draws people attention to them and to other possible occurrences during a process of reconstruction and restoration – or conservation in general:



Figure 5. (a) Lysi, restored apse, Virgin and Christ Emanuel, 1988; (b) detail.

“Whatever the work of art is trying to convey, it is precarious, and the conservator’s duty is to preserve it. This creates the demand for a certain kind of sensitivity and respect, a demand which is often difficult to meet. Sometimes regrettable choices are made because they are easier, or quicker, or cheaper, showing that the connection with this sensitivity is also fragile and can be easily broken. A great danger for the conservator lies in *imposing too much of himself*

on the work of art, thus unintentionally interfering with or obscuring its meaning or significance, while *the ideal is to remain invisible*. A live interest in the problems is essential, not only for the sake of finding answers, but for the sake of participating in the questioning. In my experience, if this interest can be kept alive, the answers seem to appear by themselves, resulting in a more appropriate course of action.” [9, p. 157]

5. Conclusion

As a general conclusion it can be underlined that the reconstruction, restoration and conservation of icons and frescoes cannot follow any algorithmic steps. It requires creativity, and a professionally qualified degree of improvisation is to be expected. Also in some cases team work is essential. The modern technologies, some of them very high, can only help and enhance the work of specialists; they cannot replace them in any way.

References

- [1] A.V. Terlix, M. Doulegerides, E. Ioakeimoglou, *St. Luke Painting The Virgin Hodegetria. National Gallery of Athens: Alexandros Soutzos Museum*, in *Art, Technique and Technology. An International Symposium*, M. Vassilaki (ed.), Crete University Press, Foundation for Research & Technology, Heraklion, 2002, 275-286.
- [2] K. Milanou, *The Icon of the Virgin Glykophilousa (Inv. No. 2972) in the Benaki Museum: A Technical Analysis*, in *Art, Technique and Technology. An International Symposium*, M. Vassilaki (ed.), Crete University Press, Foundation for Research & Technology, Heraklion, 2002, 219-229.
- [3] S. Soteropoulou, Ad. Danihlia, D. Bikiarès and I. Krusoulakes, *An Extensive Non-destructive and Micro-spectroscopic Study of an Icon with the Birth of St John the Baptist*, in *Art, Technique and Technology. An International Symposium*, M. Vassilaki (ed.), Crete University Press, Foundation for Research & Technology, Heraklion, 2002, 247–260.
- [4] L.C. Prinsloo, W. Barnard, I. Meiklejohn and K. Hall, *J. Raman Spectrosc.*, **39(5)** (2008) 646.
- [5] R.L. Frost, B. Jagannadha Reddy, M.C. Hales and D.L. Wain, *J. Near Infrared Spec.*, **16(2)** (2008) 75.
- [6] B. Jagannatha Reddy, R.L. Frost, M.L. Weier and W.N. Martens, *J. Near Infrared Spec.*, **14(4)** (2006) 241.
- [7] J. Burger and P. Geladi, *J. Near Infrared Spec.*, **15(1)** (2007) 29.
- [8] A. Cutler, *Uses of Luxury: On the Functions of Consumption and Symbolic Capital in Byzantine Culture*, Byzance et les images. Cycle de conférences organisé au musée du Louvre, A. Guillou and J. Durand (eds.), Musée du Louvre, Paris, 1994, 289-327.
- [9] A. Weyl Carr and L.J. Morroco, *A Byzantine Masterpiece Recovered. The Thirteenth-Century Murals of Lysi - Cyprus*, University of Texas Press, Austin, 1991, 124.