The palette of a 16th century Venetian artist: materials and methods of Giovanni da Mel

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Abstract: Giovanni da Mel (1480-1549) was an Italian Renaissance artist. He worked in the Veneto region and devoted himself to the fresco technique, in his family workshop. During the last part of his life, in the church of Trichiana (Belluno), he painted an altarpiece, which seems to be his only work on canvas.

Thanks to the collaboration between restorers and scientists, it was possible to explore in depth this peculiar painting. The imaging techniques helped in the identification of the artistic methodology, for example highlighting the use of engraving the preparation to draw (typical of the *fresco* technique). Then, the application of spot analysis allowed the identification of the artist's palette, revealing some peculiarities as the addition of a copper based pigment to the bone black, in order to dry the oil. The diagnostic techniques have fully characterized the altarpiece from a methodological and material point of view.

Key words: non-invasive diagnostics, integrated techniques, *in situ* analysis, Renaissance Italian art, artistic technique and materials.

La paleta de un artista veneciano del siglo XVI: materiales y métodos de Giovanni da Mel

Resumen: Giovanni da Mel (1480-1549) fue un artista del Renacimiento italiano que trabajó en la región del Veneto y se dedicó a la técnica del fresco en el taller de su familia. Durante la última parte de su vida, en la iglesia de Trichiana (Belluno), pintó la única obra sobre tela que se le atribuye.

Gracias a la colaboración entre restauradores y científicos, ha sido posible estudiar profundamente esta pintura peculiar. Las técnicas de imagen facilitaron la identificación de la metodología artística, por ejemplo resaltando el uso del grabado de la preparación para delinear el dibujo (típico de la técnica del fresco). Luego, la aplicación de análisis puntual permitió identificar la paleta del artista, revelando algunas características, desde la adición de un pigmento a base de cobre hasta el carbón animal (negro de hueso), para secar el óleo. Las técnicas diagnósticas caracterizaron completamente el retablo desde un punto de vista metodológica y de los materiales.

Palabras clave: diagnóstico no invasivo, técnicas integradas, análisis *in situ*, arte renacentista italiano, técnica y materiales artísticos.

Introduction

In the context of Italian art of the XVI century, Venice was one of the main centres that have been hotbed of master artists. Quite different was the situation at the borders of the Republic, especially near mountains, where the tradition and the contact with the countries beyond the Alps were stronger. However, the study of these small local realities is, nowadays, encouraged in order to know the connection with the main cities, also from the artistic point of view. The training of local artists, the origin of materials employed, the knowledge of other contemporary painters and their techniques are some examples of the main questions posed by art historians.

Giovanni Da Mel (ca. 1480-1549), with the brother Marco and the father Antonio, was an artist dedicated to the fresco technique. Many frescoes have been attributed to him and his family in the valleys of the left side of the Piave river (near Belluno). One example is the cycle of frescoes of the church of San Bartolomeo in Villapiana of Lentiai (Conte 1998). Always connected with the artistic movements in Venice, the peculiarity of Giovanni is that, in the last part of his life, he also painted on canvas, unlike his brother and his father. Up until now, the altarpiece in the church of Trichiana (Prealps of Belluno) is the only canvas attributed to Giovanni (1543). (Conte 1998) [Figure1].

Figure 1.- The Trichiana Altarpiece.

The Trichiana altarpiece (238 x 176 cm) represents Virgin Mary with the Child in throne between St. Bernard, St. Felix, St. Roch and St. Sebastian. In this painting, for the first time, Giovanni enclosed the representation within an architecture of the Renaissance. However, the structure of the painting seems to be more archaic than those represented on (Conte 1998).

The main question arisen by the art historians was if Giovanni simply employed the *fresco* materials (where possible) and related methodologies, or if he adopted any variation. Thanks to the large number of diagnostic techniques used, most of them non-invasive and portable, it was possible to characterize *in situ* both the materials and the artistic techniques of this work of art.

The painting has been analysed at the Restoration atelier "La Conservazione dell'arte" in Vittorio Veneto, while the University of Ferrara has performed all the imaging and spot analyses. Thanks to the collaboration between the Laboratory of Archaeometry (Department of Physics and Earth Science) and the Department of Chemistry, the results of non-invasive and *in situ* techniques have been completed with the microchemical analysis on few selected samples taken from the painting.

Materials and methods

Imaging techniques

The analysis of the painting started with the acquisition of the documentation and raking light photos, in order to highlight peculiarities of the painted surface. Then, the Infra-Red-Reflectography (IRR) has been performed using a Sony DSC-717 camera, operating in the range 950-1100 nm, and a Thorlabs DCC3240N in the range 1000-1100 nm.

As the displacement of the artwork to the Laboratories in Ferrara was precluded for its wide dimensions, the digital radiographies (RX) have been performed using a portable X-ray tube (EIS RX38: W anode). Some relevant details of the whole artwork have been acquired: the faces of the saints, the upper part of the Virgin Mary with the Child and some samples of the architectures. The digital X-ray detector is a Teledyne-DALSA Remote RadEye200, which is a 2D CMOS photodiode array, coupled with a Gd_2O_2S scintillator screen, composed by 1024 x 1000 pixels and with an active area of 98.4 x 96 mm. The digitization is performed at 12 bit/pixel. The radiographies have been acquired at 25 kV, 0.5 mA and 6 s.

UV fluorescence was also applied, in order to reveal the distribution of organic materials, such as varnish, and the presence of previous restorations.

Spot techniques

X-ray Fluorescence (XRF) and Spectrophotometry (SPF) spot techniques have been performed directly in situ at the restoration atelier by means of portable instrumentation. For XRF, a Bruker ARTAX 200 with Mo anode was employed, setting the X-ray tube at 25 kV and 1500 µA, using the collimator of 1 mm of diameter and acquiring the spectrum for 60 seconds. For SPF, the Konica Minolta CM2600d spectrophotometer, working in the range between 360 and 740 nm and integrating on a 3 mm area, was used.

In order to complete and fully understand the materials and the methodologies used by the artist, all results of the previous techniques have been compared with the analysis of 12 samples collected from representative areas of the painting: the leg of St. Sebastian, the green dress and the red mantle (2 samples) of St. Roch, the blue mantle of the Virgin Mary, the step of the throne, the grey and white dress of St. Felix, the brown dress and the foot of St. Bernard, the green and pink tiles of the floor.

All the samples, included in resin to obtain cross sections, have been observed by an optical microscope under visible and UV light at different magnification and photographed with a Canon EOS70D camera. The chemical elements, and hence the pigments, were characterized with the chemical microanalysis performed by the SEM Zeiss EVO MA 15 and SEM Zeiss EVO 40, both equipped with a X-ray Energy Dispersion detector (Oxford X-act), set at 20 kV, working under variable pressure conditions.

The organic compounds have been identified with specific spot tests. In particular, the fuchsin acid one to

Figure 2.- Details in Raking Light: a) second capital from the right, b) steps of the throne with the mantle of St. Roch, c) face of St. Felix.

reveal the protein-based binders and the saponification reaction with ammonia and hydrogen peroxide to detect oils.

Results and discussion

Imaging techniques gave many information about the executive procedure of Giovanni Da Mel on this painting. Starting from the simplest diagnostic, the raking light (see Figure 2), we can appreciate the use of engraving to depict all the architectures: from the arch and the pilasters (Fig. 2a) up to the steps of the throne (Fig. 2b). In Fig. 2c it is evident the use of a compass with a hard tip, that engraved the preparation layer, for the drawing of the halos. It is important to notice that engraving the surface to draw the architectures and, in general, the geometrical elements, is typical of the fresco technique. This suggests that the artist applied the lesson learned on frescoes to the canvas.

In Figure 3, the IRR of the steps of the throne and the mantle of St. Roch is reported. The comparison with the image in Figure 2b shows that the steps of the throne continue under the red mantle, thus indicating that Giovanni firstly depicted the architectures, then the human figures.

Figure 3.- Detail in IRR of the steps of the throne with the mantle of St. Roch.

Figure 4.- RX of the Virgin Mary with the Child.

The last elements sketched are the halos. In fact, in the RX of the Virgin Mary in Figure 4, as well as in the RX of the Saints, the sign of the compass to depict the halo does not continue under the faces. From the RX is also possible to notice that the details of the faces are not so evident, while the weft of the canvas is the main present element. This is due to a very thin pictorial layer, which is appreciable in raking light photos (Fig. 2) and in the cross sections, too [Figure 5a].

The IR-Reflectographies and the radiographies evidence no changes in the planning of the representation and no *pentimenti*, suggesting that Giovanni, in this work of art, was quite sure about the composition.

The UV fluorescence findings indicate that the old varnish is not uniform on the whole surface and reveal areas in which it has been absorbed by the painting. Furthermore, several small retouches are visible, mainly regarding St. Roch and St. Sebastian on the right side of the painting. The UV fluorescence also guided the selection of the point to be analysed with spot techniques, thus allowing to characterize

the original materials employed by the artist and to avoid the restoration ones.

To identify the artistic materials, more than one hundred points have been acquired by means of both XRF and SPF, in order to have representative examples for each colour used by the artist. The data obtained, as well as the microanalysis results of cross section probing, are reported in the Table 1.

Tabla 1.-Artistic materials: The technique that helped in the identification are marked with the X.

Colour/layer	Materials/pigments	XRF	SEM	Spot test
Preparation	Gypsum + Animal Glue	X	X	
				X
Imprimitura	White Lead	X	X	
White	White Lead	X	X	
Blue	Smalt	X	X	
Green	Copper Green	X	X	
	Green Earth	X		
Yellow	Lead–Tin Yellow	X		
	Yellow Ochre	X		
Brown	Brown Earth	X	X	
Red	Cinnabar	X	X	
	Red Earth	X	X	
	Red Lacquer		X	
	Minium	X	X	
Skin	White Lead + Cinnabar+ Red Earth	X	X	
Black	Organic Black (bones black) + Copper Green		X	
		X		
Technique	Oil			X

Examining in depth some of the results reported in the table, the XRF firstly enhanced the presence of calcium and lead elements in all the points analysed, likely as components of the preparation. Indeed, in all the cross-sections the preparation and the *imprimitura* white layers are clearly distinguishable, separated by a thin fluorescent film evidenced in the optical microscope under UV light. SEM analysis on these areas revealed the presence of sulphur and calcium elements in the inner preparation layer, and the presence of lead in the *imprimitura*. The fuchsin acid test gave positive results only for the preparation and the intermediate thin film, while had no effect on the *imprimitura* and the outer pigmented layers. These findings suggest that the preparation is mainly composed by gypsum and animal glue, while the intermediate film corresponds to an additional glue layer (closure), very common in oil Renaissance paintings to prevent the absorption of oil in the preparation. On the contrary, the *imprimitura* is constituted by lead white. The positive response of the saponification spot test applied on some small fragments confirmed the use of an oil binder medium for the *imprimitura* and the painting layers.

Regarding the identification of pigments used, an interesting case regards the blue colour. As can be seen in Figure 1, the blue is evident for the dress of the Virgin Mary, but for the sky it can be confused with the grey of the architectures. The blue grains observed in the cross section were assigned to smalt, as can be inferred from

the characteristic shape of slivers of glass (see Fig. 5a) and according to the XRF and SEM spectra that reveal the compresence of cobalt, silicon, potassium and typical trace elements such as arsenic and bismuth (Fig. 5b). Smalt is also present in the sky, but not in the grey architectures, even if their colours look very similar. The analysis of SPF spectra of the sky, exemplified in Figure 5c, highlighted a decrease of reflectance in the blue region, contributing to look as the grey of architectures. This is a natural ageing effect of smalt, as explained in Cianchetta et al. (2012).
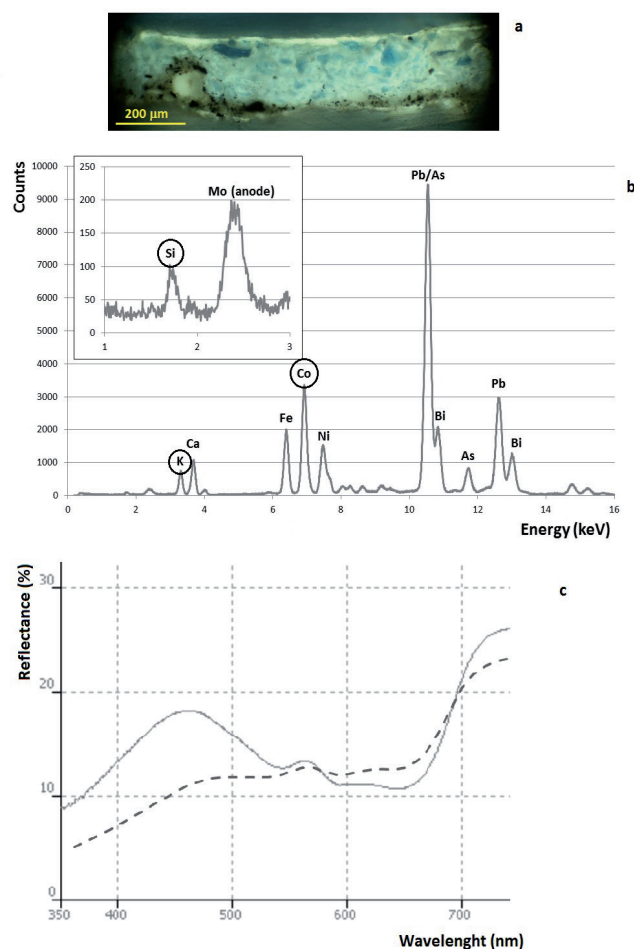
Figure 5.- a) cross section under UV light of the blue mantle of the Virgin Mary sample, b) XRF spectrum of the sky, c) SPF spectrum of the sky in broken line and FORS reference of smalt from http://fors.ifac.cnr.it.

The black pigments are largely used in the grey zones of the painting, as can be seen, for instance, in monumental architecture, on the throne, on the details of the dress of Saint Felix and the tights of Saint Roch. XRF spectra revealed in some cases the presence of phosphorus and calcium. The latter can also be associated to the gypsum in the preparation. No other elements related to inorganic black pigments were detected. The SEM analysis of some black grains confirmed the occurrence of both phosphorus and calcium, thus suggesting the presence of bone black, mainly composed by calcium phosphate. XRF spectra

highlighted the presence of copper in the darker areas, characterized by a higher amount of bone black. Even if it is well known that small amounts of a copper based pigment can be added in order to darken shades (Seccaroni and Moioli 2004), in the case of black pigments it should not be necessary. However, taking into account that carbon based blacks slow down the drying of oil media, it is necessary to add some driers (Berrie 2007). The copper salts are among the best driers for oils, in particular the verdigris (copper acetate), widely used in the past (Ashok 1993). Therefore, our hypothesis is that the artist mixed verdigris and bone black in order to enhance the drying of oil.

Furthermore, the SEM and XRF spectra reveal in all the grey areas the presence of various amounts of bone black mixed with other pigments. For instance, with iron based pigments like earths or with smalt, as in the darker areas of the dress of St. Felix, in the tights of St. Roch and in the throne.

Conclusion

The use of many scientific techniques, most of them non-invasive and portable, and the comparison between the data obtained, allowed to have a comprehensive knowledge of the artwork under analysis. The imaging techniques guided in understanding the artistic methodology and in the choice of relevant areas for spot techniques. The large number of data collected in the spot analyses have been compared and rationalized with the cross sections optical and microanalysis results.

In conclusion, the diagnostic techniques have fully characterized the Trichiana altarpiece, both from a methodological and a material point of view. Giovanni Da Mel, specialized in the fresco technique, tried to apply these knowledge in the only canvas attributed to him, for example in the use of engraving. Nevertheless, the materials employed are typical of that period and have been used skilfully.

This case study is part of a wider project concerning the characterization of the Da Mel's art technique. In this project, paintings on wood panel (Albertin et al. 2013) and frescoes have been studied too, with the support of scientific diagnostics.

Acknowledgments

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