

# The Iconostasis of Panagia Damasta: Pigments Identification in Icons Using N.D.T.

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**Abstract** On the northern slopes of Mount Kallidromo at an altitude of 740 m., 23 km away from Lamia is built the Monastery of Damasta. The painting of the Catholicon was undertaken at his expense by the fighter of the Revolution Io. Diouvouniotis, as evidenced by the surviving inscription above the entrance of the Catholic inscription. Through the present research we will highlight the fragments of the wood-carved iconostasis - baroque style - that have survived and kept in the Monastery, since after the devastating fire it was replaced by a later one. Specifically, the "Pyramid" of the iconostasis has survived with the "Crucifix" and the "Lypira", that is, the presence of St John and the Virgin Mary. We identified the pigments of the icons using Raman Spectroscopy and XRF portable instruments for in-situ measurements.

**Keywords** NDT pigments iconostasis Damasta Raman XRF

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## 1. Introduction

On the northern slopes of Mount Kallidromo at an altitude of 740 m., 23 km away from Lamia is built the Monastery of Damasta. There are not many references about its history. Some people believe that the name 'Damasta' derives from the city of Damascus, the city where the Holy Icon of the Virgin Mary came from. There are also others versions of the origin of the name of the monastery, but one of the most prevalent seems to be the version that it comes from the Greek verb «δამაζω»=subdue - "damastra", our Virgin Mary tames pain and passions. The Monastery was burned before the years of the Revolution of 1821. The catholicon is preserved almost intact and has been painted in 1818, and its style is cruciform with a dome, eight-sided symmetrical. However, its initial construction is estimated between the 13<sup>th</sup> and 15<sup>th</sup> centuries, based on its typology. The painting of the Catholicon was undertaken at his expense by the fighter of the Revolution Io. Diouvouniotis, as evidenced by the surviving inscription above the entrance of the Catholic inscription.

According to tradition, the Icon of the Virgin Mary in the type of nursery, which bears no dating and is housed in the catholicon, is a miraculous, came to Greece from the city of Damascus in Syria, birthplace of the great father and Saint of our Church, John Damascene, during the periods of

Iconoclasm, in the 8th-9th century.

But today we believe that the icon of the Virgin Mary is probably a work of the 16<sup>th</sup> century, and bears a silver-plated investment of the 19<sup>th</sup> century (1892). The Monastery took part in the revolution and many of its monks fell on the battlefields. In the offer of the Monastery during the years of the Revolution of 1821, the engraved inscription that exists in the courtyard of the monastery is mentioned.

Through the present research we will highlight the fragments of the wood-carved iconostasis - baroque style - that have survived and kept in the Monastery, since after the devastating fire it was replaced by a later one. Specifically, the "Pyramid" of the iconostasis has survived with the "Crucifix" and the "Lypira", that is, the presence of St John and the Virgin Mary. It is a fact that most of the decorative elements of woodcarving art originate from the early Christian era and then from the Byzantine era, but we must not overlook that significant changes have taken place that are mainly identified with the spirit and the artistic rhythm of the various historical periods and especially with the rhythms that were born and developed in the West during the Baroque period [6]. The detailed examination of certain elements aims at exploring their evolutionary course until their final formation and at searching for the source from which the creators inspired them. In our effort to approach and analyze the decorative parts of our iconostasis in combination with the Byzantine past and the Western artistic styles, we are led to examine them from the lowest points to the top, following the architectural functionality of their parts and always compared to similar sculptural ensembles of the same geographical area, of an earlier or later era.

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## 2. Methodology

The measurements of pigments in icons of the Monastery of Damasta were conducted using Raman Spectroscopy and XRF both non-destructive techniques.

The instrument which was used for Raman Spectroscopy was the portable DeltaNu RockHound with 785 nm laser source, the resolution was 8  $\text{cm}^{-1}$  and the spectral range was from 200 to 2000  $\text{cm}^{-1}$ .



Figure 1a. Part of iconostasis with details



Figure 1b. Icon 1 with more details in colours

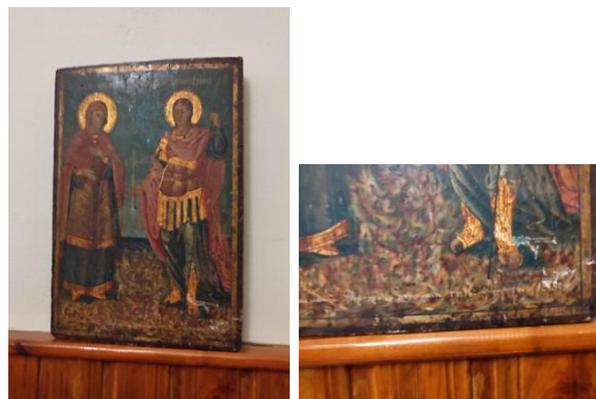


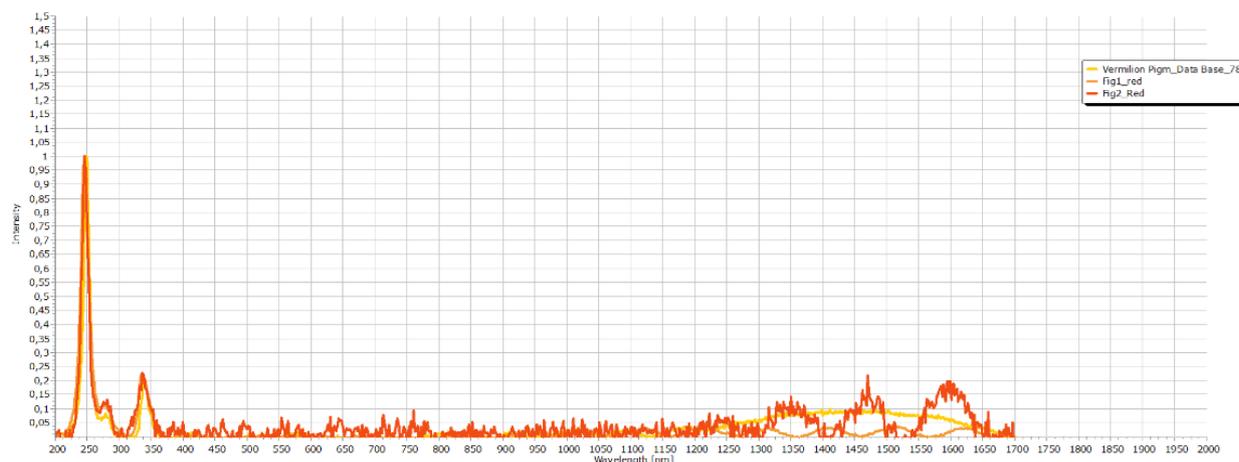
Figure 1c. Icon 2 with more details in colours



Figure 2. XRF (up) and Raman Spectroscopy (down) are the portable instruments we used for in-situ measurements

Table 1. XRF and Raman Experimental results

Colour Hue	Icon (Fig.1)	Icon (Fig. 2) dating 1888	Icon (Fig. 3) dating 1881	Raman (785nm) identified (this work)
RED	Vermilion (HgS)	Vermilion (HgS)	Hematite	
GREEN	Malachite ( $\text{Cu}_2(\text{OH})_2(\text{CO}_3)$ )	Malachite ( $\text{Cu}_2(\text{OH})_2(\text{CO}_3)$ )	Malachite	
Brown	Rich iron ochre – Goethite ( $\text{FeOOH}$ )	Rich iron ochre – Goethite ( $\text{FeOOH}$ )		
BLUE	Azurite ( $\text{Cu}_3(\text{OH})_2(\text{CO}_3)_2$ )	Azurite ( $\text{Cu}_3(\text{OH})_2(\text{CO}_3)_2$ )	Cobalt blue $\text{CoCl}_2 \cdot 6\text{H}_2\text{O}$	
PURPLE	-	-	Hematite ( $\text{Fe}_2\text{O}_3$ + gypsum calcium sulfate)	
LIGHT RED	Vermilion (HgS) Red Lead ( $\text{Pb}_3\text{O}_4$ )	Vermilion (HgS) Red Lead ( $\text{Pb}_3\text{O}_4$ )	Hematite	
GREY	Carbon Black + Lead White ( $2\text{PbCO}_3 \cdot \text{Pb}(\text{OH})_2$ )	Carbon Black + Lead White ( $2\text{PbCO}_3 \cdot \text{Pb}(\text{OH})_2$ )	Carbon black + lead white	
Notes : We suggest that the dating of the Icon (Fig. 1) is probably 1888 related to the pigments identification				



**Figure 3.** Raman spectroscopy identification of the red colour as vermilion

In the XRF technique was used the Thermo Scientific portable XRF Niton XL5 spectrometer. The analytical range was from Mg to U, the X-Ray Tube was Ag anode and the spot size was 8mm.

Raman and XRF spectra analysis were carried out with the help of scientific software Spectragryph. The identification of pigments for Raman Spectroscopy was done with the IRUG, Clark and Pigments Checker and for XRF was used the Pigments Checker.

### 3. Experimental Results

#### I. Black colour

We identified using Raman Spectroscopy Bone black (Experimental Raman peaks:  $961\text{cm}^{-1}$ ,  $1325\text{cm}^{-1}$ ,  $1580\text{cm}^{-1}$ ) which is a finely ground material obtained by carbonizing (charring) animal bones and containing around 10 to 20% carbon. The rest of the material consists of hydroxyapatite (basic calcium phosphate  $\text{Ca}_5(\text{OH})(\text{PO}_4)_3$ ) and calcium sulfate.

#### II. Dark Blue colour

We identified using Raman Spectroscopy Azurite (Experimental Raman peaks:  $403\text{cm}^{-1}$ ,  $746\text{cm}^{-1}$ ,  $839\text{cm}^{-1}$ ,  $1098\text{cm}^{-1}$ ) which is basic copper (II)-carbonate:  $2\text{CuCO}_3 \cdot \text{Cu}(\text{OH})_2$  forming bright blue crystals. The pigment has been prepared either from naturally occurring mineral or produced synthetically.

#### III. Red colour

We identified Vermilion (cinnabar), (Experimental Raman peaks:  $252\text{cm}^{-1}$ ,  $282\text{cm}^{-1}$ ,  $343\text{cm}^{-1}$ ) is mercuric sulfide with the formula  $\text{HgS}$ . The oldest form of vermilion is finely ground mineral cinnabar. Mercuric sulfide can also be produced artificially.

#### IV. Light Blue colour

We identified the Cobalt blue (Experimental Raman peaks:  $203\text{cm}^{-1}$ ,  $512\text{cm}^{-1}$ ), is a mixed oxide of cobalt and aluminum  $\text{CoO} \cdot \text{Al}_2\text{O}_3$ . It can also be considered to be cobalt (II)-aluminate with the formula of  $\text{CoAl}_2\text{O}_4$ .

#### V. Green colour

We identified Malachite (Experimental Raman peaks:  $433\text{cm}^{-1}$ ,  $553\text{cm}^{-1}$ ,  $1492\text{cm}^{-1}$ ) which is a basic copper carbonate with the chemical formula of  $\text{CuCO}_3 \cdot \text{Cu}(\text{OH})_2$ .

#### VI. Brown colour

We identified red ochre, (Experimental Raman peaks:  $220\text{cm}^{-1}$ ,  $286\text{cm}^{-1}$ ,  $402\text{cm}^{-1}$ ) the main color giving component of natural red ochre (ocher) is composed of hematite ( $\alpha\text{-Fe}_2\text{O}_3$ ). The term red ochre (ocher) or red earth describes various kinds of iron oxide pigments such as Venetian red, mars red, English red, Indian red.

### 4. Conclusions

Analytical investigation of the icons and iconostasis, has shown that it consists of the materials well known and widely in use in painting of 16<sup>th</sup> century. Pigments detected with Raman spectroscopy are: for blue azurite and cobalt blue, malachite for green, vermilion for red, and fro black the bone black pigment.

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