“Ideal” Versus “Possible” in Field of Scientific Investigation Nowadays

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Introduction

The aim of this paper is to discuss the relationship between the “ideal” and the “possible” in the field of scientific research applied to conservation of cultural heritage. The scientific research on works of art must be done very carefully. The non-destructive analysis methods are preferred to the destructive. First of all the question and the reason of this question must be clear. Then it’s necessary to know that methods of analysis can give the expected response, which of these methods are available and which are possible to be applied to works of art. It’s necessary to think also about whether the analysis will be done *in situ* or if the work must be carried. If with withdrawal of samples or not. In other words it is necessary to create a strategy and approach procedure. However, as is known, it’s not always possible to use the ideal procedure with all equipment and analysis desired. Sometimes the restriction is imposed by the artwork itself, because of the size, location, condition, etc.; other, by the project, deadlines, budgets, resources, availability of equipment, materials, etc.

It takes a very broad knowledge in the scientific area to make the most appropriate decisions. To illustrate this, two examples will be discussed here: the research done in the paintings on the ceiling of the Carmelite church in SP, which used destructive methods, and the research done in an oil painting named "Annunciation", which used non-destructive methods.

“Madonna of Carmo”

The paintings on the ceiling of Carmelite Church in Sao Paulo, carried in the eighteenth century and attributed to the great Baroque artist Frei Jesuíno of Mount Carmel, had refinish on funds and central figures. Original paints, as well as the subsequent interventions were investigated scientifically through diverse methods based on the use of complementary techniques and cross link of results, for the purpose of timing layers and propose treatment of restoration. The original materials and those added later were physicochemical and analytically characterized.

Method and Results

Samples of repainting (Figures 5a and 5b) and micro-samples from the original painting were taken. The following techniques were employed: cross-section of the pictorial layer; optical microscopic (OM), scanning electron microscopy (SEM) with energy dispersive analyzer of X-ray (SEM/EDS) and infrared spectroscopy (FTIR).

The elements of each layer were identified by MEV/EDS. The pigments were made at different epochs, and therefore it was possible to indicate when each layer was painted. Tables 1 and 2 reveal the mass percentage of each element in each layer. Figure 1 illustrates the image at OM and at MEV with the indication of the pigment present. Table 3 reveals the composition and epoch of each pigment

Table 1

CAMADA	1	2	3	4
ELEMENTO	% MASSA	% MASSA	% MASSA	% MASSA
C	64,44	52,37	46,04	41,66
O	32,37	42,02	46,47	44,22
Al	3,4 E-16	--	--	--
Ca	0,20	--	0,52	0,06
Ba	0,10	2,76	2,71	--
Zn	0,12	--	0,18	6,41
Pb	2,84	2,83	2,31	2,56
S	--	--	1,74	3,19
Os	--	--	--	0,09
Na	--	--	--	1,77
TT	100,00	100,00	100,00	100,00

Table 2

CAMADA	5	6	7	8	SUB. BRANCA
ELEMENTO	% MASSA	% MASSA	% MASSA	% MASSA	% MASSA
C	35,27	38,75	43,97	35,44	61,41
O	39,76	38,22	34,41	41,60	35,09
Al	0,74	0,001	0,14	--	0,04
Ca	0,75	0,57	0,06	--	0,09
Ba	0,27	2,73	0,06	--	--
Zn	19,83	--	18,11	16,44	0,64
Pb	0,34	1,23	0,70	0,59	2,32
S	2,56	7,22	2,22	3,40	--
Si	0,40	0,001	0,09	1,24	0,10
P	0,02	5,18 E-46	--	--	--
Fe	--	--	0,18	0,32	0,12
Ti	--	--	--	--	0,15
Cl	--	--	--	0,93	--
TT	100,00	100,00	100,00	100,00	100,00

Figure 1

Table 3

PIGMENT	CHEMICAL COMPOSITION	SINCE
BARITA	$BaSO_4$	
BRANCO DE CHUMBO	$2PbCO_3 \cdot Pb(OH)_2$	
BRANCO DE ZINCO	ZnO	1834
BRANCO DE TITÂNIO	TiO_2	1918
ULTRAMARINO FRANCES	$(Na_{8-10}Al_6Si_6O_{24})S_{2-4}$	1828
NEGRO DE OSSOS	$C + Ca_3(PO_4)_2 + CaCO_3$	
TERRA VERDE	$K[(Al,Fe^{III}),(Fe^{II},Mg)](AlSi_3,Si_4)O_{10}(OH)_2$	

Figures 2 and 3 illustrate the spectra of FTIR of the two different repainting areas. The medium encountered was egg tempera.

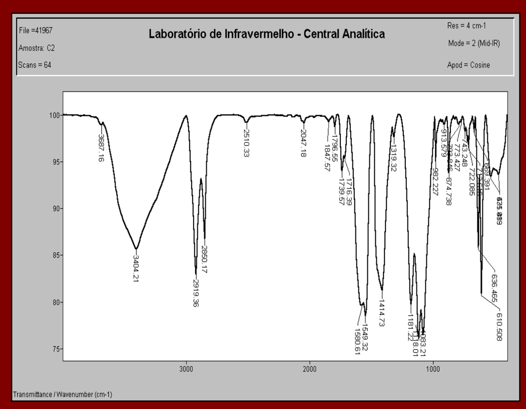

Figure 2

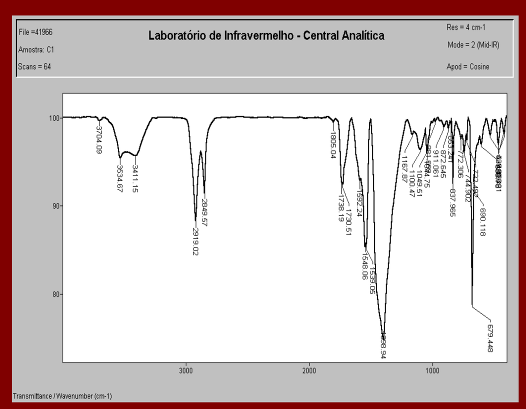

Figure 3

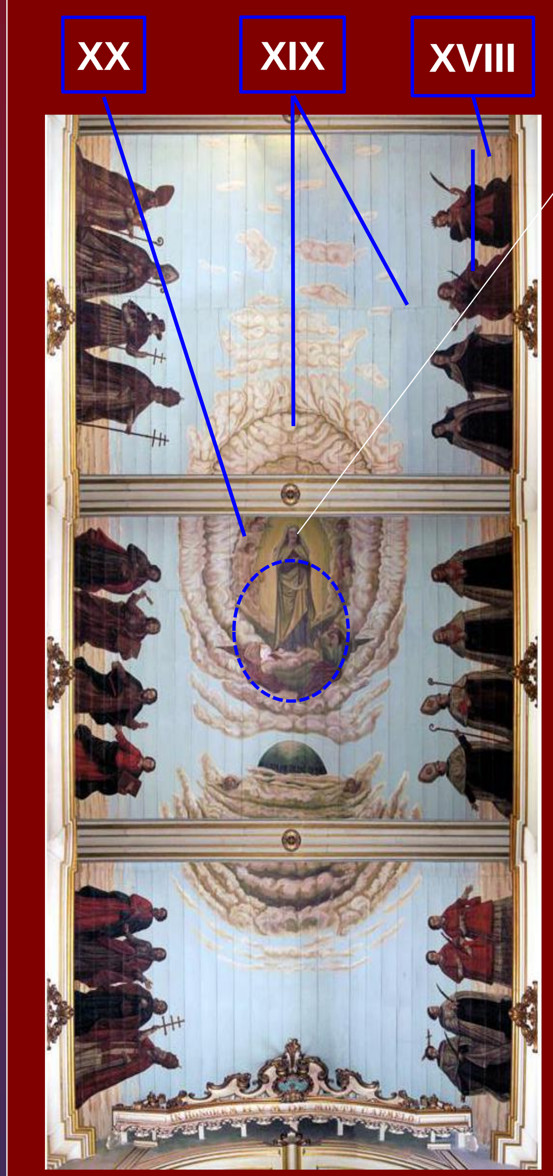

Figure 4

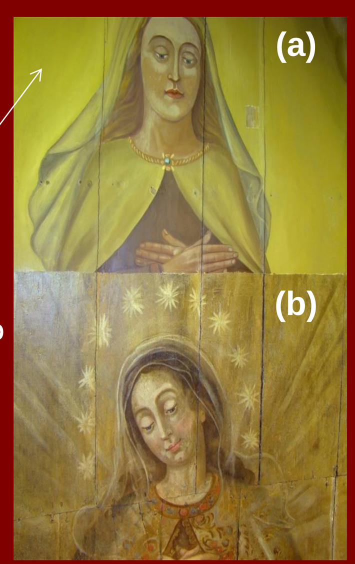

Figure 5

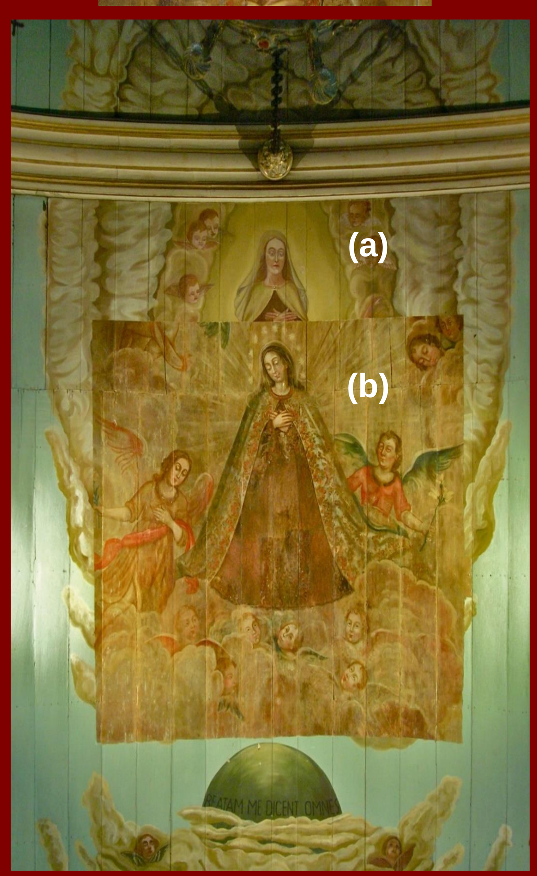

Figure 6

"Annunciation"

The Annunciation painting made by the Swedish artist Fredrik Westin (1782-1862), presented refinishing in several areas. It was possible to identify these areas through observation with UV radiation. The original pigments and the paints added later were characterized with a portable fluorescence X-rays Tracer III-SD da Bruker. In this case it was not necessary to remove samples.

Method and Results

In this case it was not necessary to take out samples of the painting. The original pigments and the repainting were identified by a non-destructive method: X ray fluorescence (XRF). The points marked at Figure 7 were measured *in loco* by the portable equipment TRACER III SD (Figure 8). Figure 9 illustrate the overlapping of the spectra from the points 2B (red); 11B (white); 18B (blue); 21B (brown); 26B (rose); 28B (gray); verse.

Figure 7

Figure 8

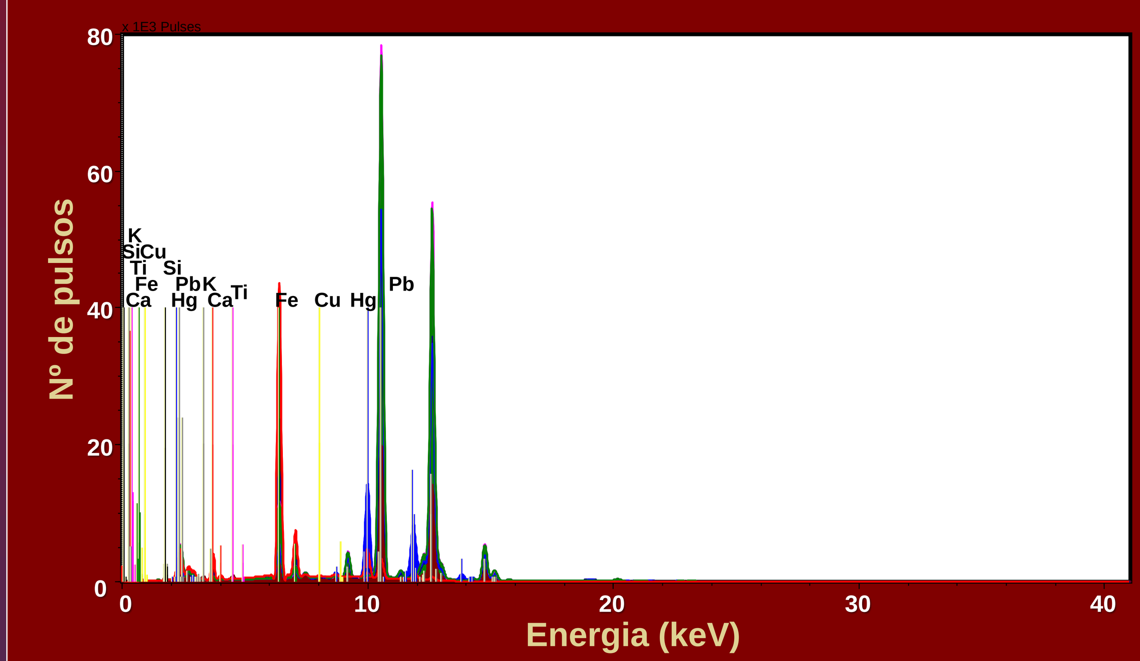

Figure 9

Table 4

Nº	Color	Pigment(s) Indication
	Ground	Probably: calcium carbonate $(CaCO_3)$+ lead white $[2PbCO_3 \cdot Pb(OH)_2]$ + iron oxide (FeO or Fe_2O_3) + animal glue
2B	Red	vermellion (HgS)
11B	White	lead white $[2PbCO_3 \cdot Pb(OH)_2]$
18B	Blue	Prussian blue $\{Fe_4[Fe(CN)_6]_3\}$
21B	Verse	lead white $[2PbCO_3 \cdot Pb(OH)_2]$ (from ground)
26B	Rose	vermellion (HgS) + lead white $[2PbCO_3 \cdot Pb(OH)_2]$
28B	Gray	lead white $[2PbCO_3 \cdot Pb(OH)_2]$ + zinc white (ZnO)

Conclusion

Whenever possible, the ideal is to make the scientific investigation of works of art with non-destructive methods *in situ* analysis, analyzing the front of pictorial layer; however sometimes it is necessary to observe directly the overlapping strata. And in these cases the withdrawal of samples could be required. It is important to assess whether the response I intend to get justified the use of a destructive method of analysis.

The investigation made at Carmo’s Church contributed to reveal a very important painting (Figures 5b and 6b) and also part of Brazilian history and to determine treatment procedures.

The investigation made at Annunciation painting contributed to ensure the epoch of the painting and also to determine treatment procedures.