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MODERN MURAL PAINTINGS. THE PLANISPHERE PAINTING OF ALMADA NEGREIROS: TECHNICAL AND MATERIAL FEATURES OF PLASTERS AND PAINTING TECHNIQUE

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Abstract:

This paper presents the results of observations and analysis carried out in the modern mural painting of 54m^2, known as Planisphere (or Mapa-mundi), made by Almada Negreiros in 1939 in the city of Lisbon. The painting is Almada's first monumental painted work at fresco, and it is a striking, colourful composition inspired by early world maps of navigators. The aim is to ascertain how he built up this masterpiece and what artistic sources could have inspired him. The analytical setup comprised in-situ technical photography in the visible (Vis and Vis-Rak) and near infrared radiation (NIR), Vis-handled-Optical microscopy, complemented by laboratorial analysis of microsamples collected from paint layers with OM-Vis-UV and SEM-EDS. The data obtained was compared with the painting compendiums of Paul Bedouin's La fresque. Sa Technique-ses applications (1914) and of Costin Petresco's L'art de la fresque (1931), retrieved from the artist studio in 2019. The study reveals the first technical and material features found, such as the painting execution by large giornate, the use of different types of techniques to transfer the drawings to the wall, and the presence of paint layers made with buon and lime fresco. The results also reveal the likely strategies used by Almada to overcome the challenges imposed by a fresco execution, inspired by both eastern and western mural painting traditions.

Keywords: *Almada Negreiros; Modern art; Fresco; Technical photography; OM; SEM-EDS*

Introduction

When one observes the 54m^2 mural painting known as Planisphere (or *Mapa-mundi*) located at the ground level main hall of the DN building in Lisbon, it is hard not to be overwhelmed by the monumental scale of the mural and by the high number and quality of colourful details portraying the fauna, flora, cultural, artistic, mythological, and historical events Fig. 1a). It is even more impressive considering that Almada Negreiros was a self-taught artist who worked alone and that this painting, made in 1939, is considered his first accomplishment in the art of fresco [1, 2]. Until then, he had only executed a few *secco* mural paintings at the Church of Nossa Sr^a do Rosário de Fátima in Lisbon in 1938. The architect Pardal Monteiro, who hired him on both occasions praised Almada workmanship in the ancient art of fresco technique [2]. This was however the only evidence that existed on the subject, and, over time,

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some doubts were raised by conservators' restorers as to the materials and painting techniques used.

If the Planisphere is a fresco painting, how did Almada achieved it by his own immediately emerged and impelled to carry out the research on site and in the laboratory. The opportunity presented itself in 2017, when the acquistion of the building by private parties, made it possible to study the mural before rehabilitation works on the building. Onsite analyses were made in 2017, and completed in the laboratory in 2022, within the framework of ALMADA project.

This paper presents the first results of Almada's methods and materials used in this mural painting. Dealing with such a monumental fresco work certainly required prior knowledge. Fresco painting is technically quite demanding, considering that the pigments must be applied to a fresh lime plaster. Each step must be planned in advance, as there is no time for amendments. In the absence of written records relating to Almada's background training as a mural painter, the results of the research were compared with two books found in 2019 in Almada's studio: Paul Bedouin's *La fresque. Sa Technique-ses applications* (1914), second edition, and Costin Petresco's *L'art de la fresque* (1931) [3, 4]. Both were published in Paris, where Almada had lived from 1919 to 1920 [1].

Costin Petresco (1872-1954) was a professor of painting at the Academy of Fine Arts and Architecture in Bucharest. He was also the son of one of the last mural painters of the ancient tradition of Byzantine frescoes in Romania [4]. Paul Baudouin (1844 -1931), also a painter, is responsible for the revival of the fresco technique at the National School of Fine Arts in Paris [3]. Despite other artistic sources that Almada may have been inspired by, the objective in this work (Part1) is to find out if these two painting manuals could have been somehow guided Almada Negreiros in the construction of this masterpiece in 1939. Considerations about the pigment's identification and colour modellingt are not going to be addressed since they are going to be the focus of another paper in the second part of the research.

Experimental part

This paper presents the visual and analytical results obtained with the following experimental setup for on-situ and laboratorial analysis.

On site survey

On-site research began with a thorough survey of the paint surface with frontal and raking lighting in the visible light range (Vis and Vis-Rak). The image records were carried out with a Nikon D3100 14Mpx with an objective AF-S Micro Nikkor 60mm 1:2.8 GED and a *Nikon* D3200 24Mpx digital single lens reflex with an objective Nikkor 18-55mm f:3.5-5.6 GII. Photographs in Vis-Rak were obtained at an angle of 15–20° from the paint surface in three to four different positions.

NIR images were carried out after this first survey in selected paint layers with *a Nikon* D3100 14MpX camera modified for full spectrum with high-pass filters X-nite 780, 850, and 1000nm. The goal was to ascertain the presence of IR absorbent materials that could have been used in underdrawings.

Halogen lamps 1000 W-230 V D58525 were used as light sources for both Vis and NIR photography. A natural daylight source was also used for the imaging survey of the painted surface. The images were acquired in raw format with target QpCard101 v3 for white balance calibration.

Vis-handled-Optical microscopy was carried out as a complement to the detailed technical and material features found on the paint surface, using the digital microscopes Dinolite PRO AM13T-FVW and Dinolite Premier AD3713TB with 20 and 434 magnifications, respectively.

The microsamples of paint layers were the last phase of the onsite research and were collected from areas of interest previously selected by the imaging survey. Figure 1a shows the location of the four microsamples reported in the subsequent sections (Table 1 and Figs. 4 to 5).

The microsamples (with 0.2 to 0.5mm in diameter) were collected with a scapel in adjacent areas of loss (e.g., fissures and erosion) on the painting backgrounds and figures.

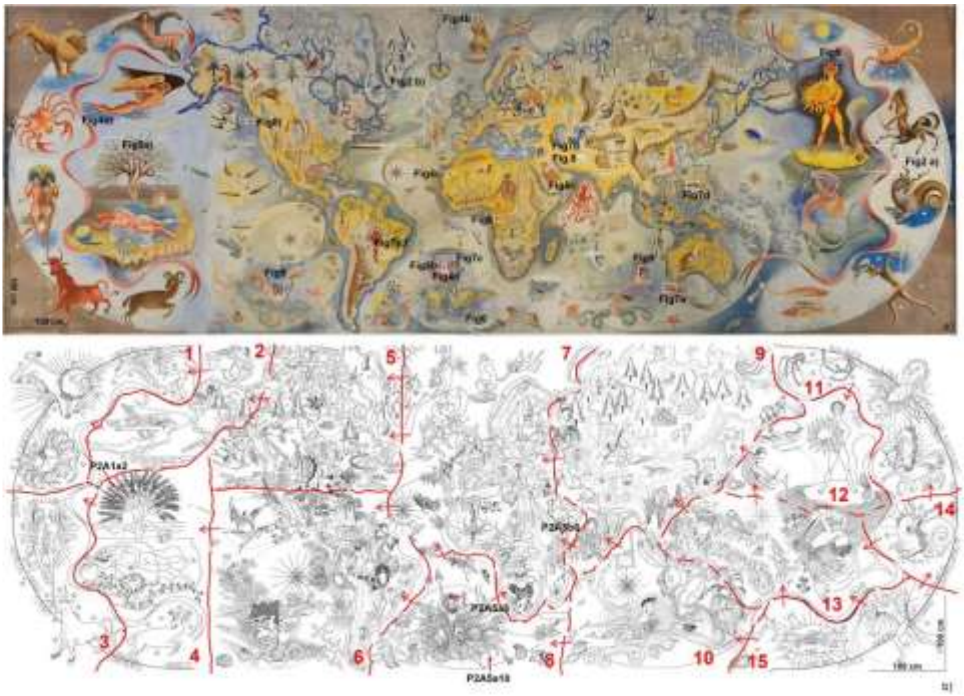

Fig. 1. General view of the planisphere with the location of the paint layers illustrated in figures 2, 4 and 8 (a); graphic mapping of the *giornate* with indication of number and order of execution (b).
The black references indicate the sampling locations of the microsamples illustrated in the results discussion (photo by M. Ribeiro2017/graphic by M. Gil 2022. Project ALMADA. All rights reserved)

Table 1. Summary results of SEM-EDS analysis of plasters and paint layers from figures 5 and 6. Elemental composition in at. %.

					Elemental Compositio (at%)														
Micro sample ref.	Location	Stratigraphy (cross section)	EDS spot location	EDS spot Ref	Ca	Mg	Al	Si	K	S	Cl	Fe	Ti	Na	Se	Cd	Aggregates atribution (hypothesis)	Binder atribution (hypothesis)	Pigments atribution (hypothesis)
P2A1a2	Giornata 4: leef	Fig.5a: yellow green paint layer (≈ 5-22μm) over a blue paint underlayer (≈144μm)	aggregate	a1	7.42		42.31	45.12	5.15								mica; K-feldspars ($KAlSi_3O_4$)	calcitic lime ($CaCO_3$)	cadmium yellow (CdS); green earth (hydrosilicate of Fe, Mg, Al, K) ; ultramarine blue synt?. (Na7Al6Si6O24S3);
			matrix	p1	100														
			pigment particle	p2	47.67	1.23	9.44	26.36	2.92	2.36	1.09	4.98	1.82			2.09			
			matrix	a2	88.76		2.06	4.86	1.36	2.96									
			aggregate	a3			22.25	58.72	19.03										
P2A5a3	Giornata 8: poseidon crown	Fig.5b: red paint layer (≈3-10 μm) over a pink paint layer (≈ 24μm)	aggregate	a1	1.12		21.20	55.45			0.23			22.00			albite ($NaAlSi_3O_8$) Plagioclase ((Na,Ca)Al $(Si,Al)_3O_8$)	calcitic lime ($CaCO_3$)	cadmium red (CdSe); Fe Based Pigment
			matrix	a2	94.98		0.97	1.63		0.71	0.92			0.78					
			aggregate	a3	35.00		31.60	29.59	0.46	0.81	0.68			0.30		0.06			
			matrix	a4	74.10	0.87	5.65	12.69		1.08	1.52			4.09					
			matrix + pigment	a5	59.27			2.15		13.82	0.39			1.44	4.52	18.40			
P2A5b6	Giornata7: african continent	Fig.5c: blue paint layer (≈11-41 μm) over a yellow paint layer (≈5-29 μm)	aggregate	a1	30.06		26.59	33.89				9.47					K-feldspars ($KAlSi_3O_4$); quartz (SiO_2)	calcitic lime ($CaCO_3$)	ultramarine blue synt. ($Na_7Al_6Si_6O_{24}S_3$); cadmium yellow (CdS)
			matrix+ pigment particle	a2	59.50	7.03	8.40	15.62		1.70		5.32		2.43					
			aggregate	a3	0.23	0.72	19.89	1.71	18.74			0.84	0.29	0.84					
			matrix	a4	79.02	1.08	6.00	11.46	0.85	0.82	0.77								
			aggregate	a5	0.10		0.05	97.89											
			matrix	a6	91.72		0.70	7.58											
			matrix	a7	90.05		1.01	7.13		0.70				1.11					
			matrix+ pigment particles	a8	12.34		21.19	27.49	1.01	16.58				21.39					
			matrix	a9	85.11		2.17	10.56		0.75	0.48			0.93					
			pigment particle	a10	36.65		2.05	2.73		24.73						33.83			
P2A5a10	Giornata 8: horse's foot	Fig.6 [microfragment]	aggregate	a1		0.93	39.69	43.34	13.78			0.07		1.19			Muscovite ($KAl_2(Si_3Al)O_{10}(OH,F)_2$)	calcitic lime ($CaCO_3$)	_
			matrix	a2	89.50		2.77	4.92	0.47	2.40									

Laboratory research

The microsamples collected from the paint layers were analysed as micro-fragments, without any previous treatment, and as cross sections for in-depth material and technical analysis. Cross sections were obtained by embedding the paint layers in an epoxie fix resin (Epofix, Struers A/S) and were polished with different *MicroMesh* sanding sheets.

Optical microscopy of the micro-fragments was made with a HRX-01 HIROX Digital Microscope equipped with a 5MP sensor to suit 4K resolution and motorised HR lenses. The HR-5000E lens was used to observe in Vis the sample at 50×, 100×, 400×, 800× and 1000× magnifications with the top lighting system (96% intensity). The images were acquired in 3D for a better perception of the paint texture.

The cross sections were analysed with reflective visible light (OM-Vis) and UV radiation (OM-UV) at 200 and 500x magnification using a Leica DM2500M dark field microscope. For UV mode, a high-pressure burner 103W/2 UV lamp and an excitation Pass Band filter 340–380nm, a dichromatic mirror 400nm, and a suppression filter Lp425, size K coupled, were used. Photographic documentation was obtained with *a Leica DFC290HD* digital camera.

Microsamples representative of the OM observations were further analyzed by scanning microscopy coupled with energy dispersive X-ray spectrometry (SEM-EDS). The analysis was carried out with a variable pressure *VP-SEM HITACHI S-3700N* operator with an accelerating voltage of 20kV at 40Pa. SEM was coupled with a *Bruker XFlash 5010* Silicon Drift Detector (SDD) with a resolution of 129eV at Mn Kα. SEM images were acquired in backscattering (BSE) mode on non-coated microfragments and cross sections. EDS data were obtained with punctual, and area elemental microanalysis and by elemental map distribution. Esprit 1.8. software from Bruker Corporation was used for the data interpretation.

Results and discussion

Laying out and composition of the plasters

The first observations of the method used to lay out the plasters of the planisphere painting were made by Vis-raking light, allowing the identification of fifteen *giornate* on the painted surface (Fig. 1). The Italian term *giornata* (pl. *giornate*) refers to the daily sections (or patches) of wet plaster to be painted at fresco [5]. If the plaster had already settled down, it would compromise the entire paint work, which could become powdery or flake off after drying [3–5]. To prevent this from happening, the painters proceeded gradually with patches of fresh plaster of varying sizes according to the figures to be depicted and the progress of the work onsite [5].

The use of g*iornate* is known since the Roman times but this procedure gained ground in the late thirteen and fourteen centuries in response to the new aesthetic requirements of *buon* (or pure) *fresco* paintings [5]. Gradually the paintings became more aesthetic demanding, with a keen interest for reality (e.g., facial expressions, naturalistic elements), tending in the execution of smaller, yet much more refined and detailed areas of painting per day [5-7]. This is not however the case of the planisphere painting. In Figure 1b, the location of the *giornate* and the execution order can be observed, from top to bottom and from left to right. At the planisphere painting, the *giornate* are quite large reaching over 3.33 m in length and 2.64 m in height. They do not clearly indicate levels of scaffolding, nor do they follow the outlines of the figures, but roughly other lines of the composition, such as the red ribbons and some contours of the continents.

The joining of the *giornate* were made by slightly overlapping the plasters or by leaning them against the edges of the ones made previously (Fig.2a). In two cases, the different paint patches are also easily identified in the visible light by the chromatic differences of the backgrounds and of the decorative motifs represented (Fig.2b). This happened because Almada have allowed an area of continuous color to fall in two different *giornate*, being unable to predict how wet colours would look when dry.

Fig. 2. Details of the joins of *giornate*: a) by Vis-Rak, it is possible to observe the plaster joins of *giornate* 11, 12, and 13 leaning and slightly overlapping; b), the edges between giornata 5 and 7 are identified in Vis by the differences in the background colours (photos by M. Ribeiro2017. Project ALMADA. All rights reserved)

Vis-Raking light examination of the surface highlighted further differences in the plaster laying method (Fig. 3). Some *giornate* appear to have been compressed and smoothed more than others, conferring different textures to the painted surface. Several marks of trowels and other hard instruments used to spread and press the plaster can also be clearly identified by light depressions in raking light (see *giornate* 8, Fig. 3).

Fig. 3. On the top, Vis-Rak overview of plaster layout methods for *giornate* 1 to 6 (left) and *giornate* 6 to 8 (right). On the bottom, details where it can be seen the differences in the texture of the plaster between *giornate*, the different kind of joins and the marks of rectangle trowels used to lay and smooth the surface (photos by M. Ribeiro 2017. Project ALMADA).

Despite the differences in textures, the composition of the plasters used, as expected, appears to be very similar. Due to the lack of deep lacune, it was not possible to determine the number of renderings used by Almada. The on-site image survey and subsequent analyses of microsamples were performed only on the upper layer of plaster on which the paint was laid down, also known by the Italian term *intonaco* (pl. *intonaci*).

The *intonaci* of all fifteen *giornate* are lime-based mortars which are in general rough with several grains of sand with approx. 1mm in diameter exposed on the painted surface (Fig.4, Table 1).

Fig. 4. Details in Vis of the roughness of *intonaci* in *giornate* 2,7 and 8. Several coarse grains of sand are visible on the painted surface. The arrows indicate the presence of organic fibers (photos by Y. Helvaci and M. Gil 2017. Project ALMADA)

Follow-up research by OM-Vis and SEM-EDS also revealed other types of aggregates in the composition (Fig. 5 and Table 1). In Table 1, the variations in Si, Al, K, Na, Fe and Mg content in the aggregates of microsamples from three different *giornate* suggest the presence of quartz, feldspar, plagioclase, and micas [8].

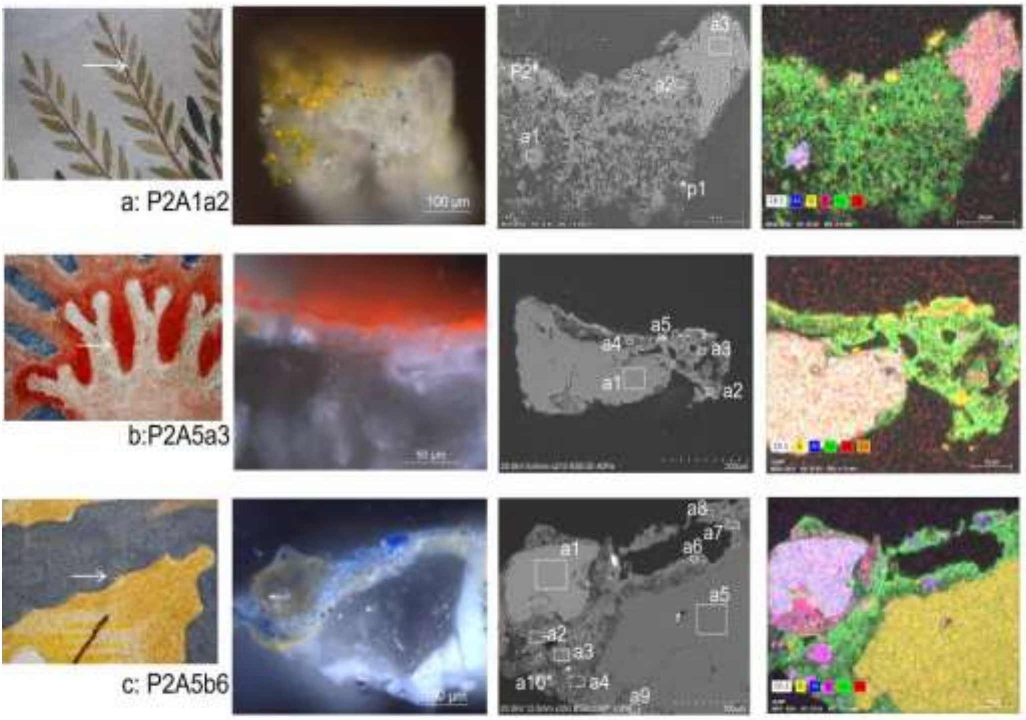

Fig. 5. From left to right, sampling locations of microsamples collected from *giornate* 4, 7, and 8; OM-Vis and SEM-BSE images; and EDS analysis and elemental map distribution of the paint layer cross sections. The EDS data for the areas indicated in the SEM images are expressed in Table 1. Legend in the elemental map distribution: siliceous (Si) in yellow, aluminium (Al) in blue, potassium (K) in magenta, calcium (Ca) in green, and iron (Fe) in red

Muscovite sheets with a pearly to vitreous appearance are observed within and on the surface of most paint layers, adding "glitter" to the paintwork (Fig. 6). The aggregates with granulometries ranging from 0.02 to 1mm exhibit various degrees of roundness, indicating they probably originate from river sands that underwent little transport (Figs. 4, 5 and 6). The aggregates are bound by calcitic lime of high purity, also known as fat lime, as confirmed by the calcium concentration of around 85-95at.% in the paint layers analysed by SEM-EDS (Fig. 5 and Table 1).

Another material observed on site on most *giornate* was organic fibers. The fibres are seen at various locations within and above the paint surface, as shown in figure 4. They seem to have been added to the slaked lime used on the *intonaci*, tinted, and dragged by the paint brush during the paint execution.

The addition of organic fibres, such as flax and hemp, to the *intonaco* is reported in the best-known of the Byzantine painting manuals of the Balkans, the *Hermeneia*, written on Mount Athos between 1701 and 1745 by the monk Dionysius of Fourna [5]. The goal, although not explicitly written, was to retain enough moisture to prevent the mortar from cracking during the carbonation process. The same procedure is also recommended by Costin Petresco in 1931 in his book *'L'art de la fresque'*, which pays homage to the traditions of Romanesque paintings [3].

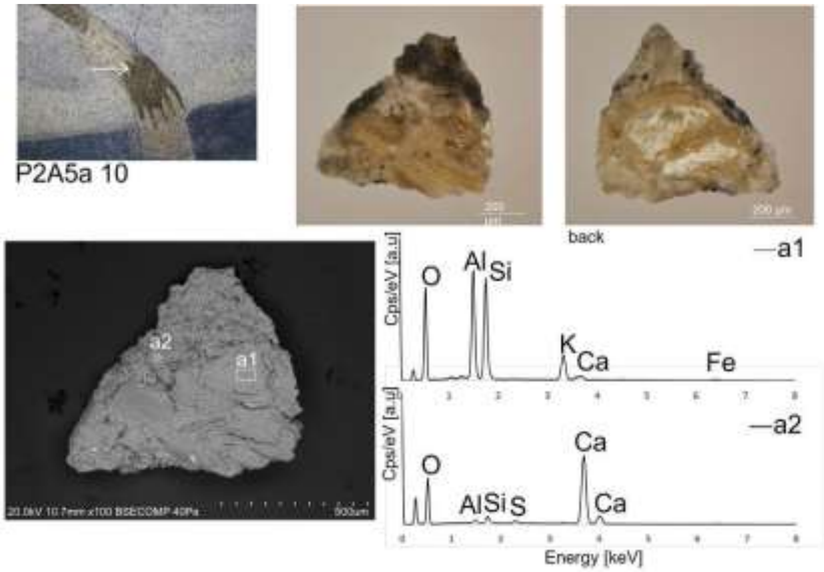

Fig. 6. On the top, Vis-OM images of a microfragment of a paint layer with muscovite at the surface; below, BSE SEM image and EDS elemental composition of the aggregate and of the matrix of the mortar. The EDS data for the areas indicated in the SEM image are expressed in Table 1

Transfering of the composition to the wall

Different techniques seem to have been used to transfer the 1:1 scale models of the drawings to the wall. Observations by raking light shows that most of the outlines of the continents and main figures were incised in the surface of the *intonaci* (Fig.3 and 7). The type of incision vary in thickness, depth, and appearance, from a rounded groove to severe grainy lines, suggesting that Almada might have transferred the composition while the plaster was fresh but also in a later stage of drying (Fig.7a,b,c). Traces of *poncif* were also found in the light visible range (Fig.7 d,e). In the method of *poncif*, a drawing on a paper is pierced with holes and is laid down on the fresh intonaco in such a way that the composition can be transferred by tamping it with a small gauze bag filled with powdered charcoal.

Traces of the black dots are visible locally in several decorative motifs, except on a boat, and on the exotic birds of *giornata* 13, on which they are clearly observed on the painted surface (Fig.7d). Sometimes traces of the black dots can be seen side by side with the incisions which could imply a combination of both techniques (Fig.7e,f). No other kind of underdrawings made with carbon, or another IR absorbent material, were noticed in the imaging survey carried out with infrared photography. Finally, most of the small-scale figures seem to have been painted free hand (Fig.7b, Fig.8).

Paint execution

According to the number of *giornate* identified, the planisphere painting would have been painted at *fresco* in just fifteen days, which at first glance seems unlikely given the extent and richness of the decorated painted surface. Only by closely observing the characteristics of the paint layers does this hypothesis become more plausible.

The first characteristic to highlight is that the figures on the planisphere are very graphic in style, freeing Almada from the rigor of naturalism modelling that would require more time to elaborate and paint (Fig.1,7). This is particularly evident in the small-scale representation of fauna and flora depicted, which were achieved by just a few brushstrokes using as much of the base hue as possible (Fig.8). Almada was an experienced cartoonist at the time, and his craft is reflected in the composition. From the simplicity of the brushstrokes, it can be assumed that he acted confidently, without hesitation, and very quickly (Fig.8).

Fig. 7. Details by Vis-Rak of incised drawings (a-f) and by Vis of the *poncif* (d, e) from *giornates* 10, 7, 8, 12 and 6

Fig. 8. Details in Vis of small-scale figures made by free hand from *giornate* 5 and 7

The second evidence to be noted is an extensive use of diluted paints in light, medium and dark tones in many of the figures, as illustrated in Figs.4,7 and 8. The resulting paint layers exhibit a range of transparencies that are very typical of *buon* fresco painting technique [5,6]. The deep blue tones of the oceans and the yellows of the continents follow the same trend, although some lighter tones show greater opacity. By OM, it can be seen that the thickness of those paint layers varies from 3 to 144 μm depending on the type of pigments used (natural versus synthetic), how they were applied (alone or in mixtures) and on the coarseness of the plaster (Figs.4,5, and Table1).

Calcium is found by SEM-EDS as a binder in the paint layers analysed, confirming the use of a lime-based painting technique (Table1). On Fig.5, blue and red pigment particles can be seen dispersed in a whitish calcium matrices on the lighter inner paint layers of microsamples P2A1a2 and P2A5a3, corresponding to the base tones of the blue sky and Poseidon ‘crown (Fig.1, Table1). Mixing pigments with slaked lime is an historically known method used to enlighten the colours and to increase the paint’s opacity [3,5,9]. More important, it also allowed to increase the working time beyond what is suitable for *buon* fresco technique, in which the pigments are only dispersed in water [5]. In this way the pigments could be laid down at *fresco* (lime *fresco*) but also in a later stage of the carbonation process. The slaked lime in this case also acts as an additional binder ensuring the fixation of the pigment particles on the surface of the plaster. Extended areas of the ocean and continents backgrounds tones seems to have been achieved this way; while others were left unpainted or partially covered with whitewashes.

Finally, the differences observed on the plaster laid down also raised questions. Another stratagem resorted historically by artists to prolong the execution time of a *fresco* painting was to levigate the intonaco to induce the migration of calcium hydroxide and moisture to the surface [5,7]. By raking light, it can be seen that from *giornate* 4 onwards the intonaco was intensely pressed down and smoothed before and, apparently also, after the incised drawings (Fig.3). Could this have been the reason? If so, it would have given Almada enough time to complete his work, which would explain the large dimensions of the *giornate*.

Fig. 9. Examples of diluted paint layers from *giornate* 6, 10 and 12

Comparison with the two painting manuals: some considerations

The data reported in the previous sections have several points in common with the content of the books by Constin Petresco (1931) [3], and Paul Baudouin (1914) [4], retrieved in Almada's studio. Both reflect on the procedures of ancient and modern mural paintings, while being step-by-step practical manuals for artists wishing to venture for the first time into the practice of fresco painting. As stated in the introduction, Almada Negreiros did not had a former artistic background, and thus finding these two books among his assets adds valuable information on his knowledge on the subject.

Overall, Almada seems to have followed, what Costin Petresco claimed to be, the trend of many modern frescoes of that time which had a rough surface due to the presence of coarsegrained sand that entered the composition of the final mortar [4]. Over this grainy plaster, light and diluted paint layers were applied, in an aqueous color, like watercolor on paper [4]. Cases of modern murals made in that way are not provided by Petresco neither does he mention the reason for the artists preference for using coarse grain sands. Might be because Costin Petresco did not really follow this procedure in his *intonaci* but Paul Bedouin did, and he recommended the use of rough mortars when using fat lime to give greater resistance to the plaster [3]. For Paul Boudouin, the plaster obtained this way was the best for outdoor paintings. For indoor paintings on vertical walls, it could also be used also but should be smoothed enough to avoid future accumulation of dirt on the paint surface [3]. Costin Petresco preferred to use finer grain aggregates for the *intonaci* and to add organic fibres to them [4]. This was a clear oriental influence, as western European plasters do not usually contain organic fibres (such as straw, hemp, or flax), as omitted by Paul Baudouin [3, 5].

With regard to the application of mortars, the large size of the *giornate* at the planisphere are somewhat reminiscent of the *pontate* from the byzantine period. According to Paulo and Laura Mora, in their detailed analysis of historical painting treatises, in byzantine paintings, the *intonaci* were always applied in pontate, i.e., in sections about 2m high, corresponding to the levels of scaffoldings. Only occasionally the *pontate* were subdivided in *giornate* which covered a smaller surface area [5]. With this procedure, and in order to achieve a *fresco* execution of the entire composition, the painters resorted often to an intense smoothing [polishing] of the *intonaco* surface prior the painting and to pigments mixed with slaked lime (lime *fresco*) [5]. As such, the advice of Dionysius di Fourna in the *Hermeneia* to complete the painting of the polished areas quickly, implied that the *intonaci* should be polished only as the painting was executed [5]. These observations are quite important because it can then be deduced that on the large surfaces of the *pontate*, polishing may have played a role comparable to that of the *giornate* of the Trecento onwards applied by smaller patches according to the progress of the paint work. In the Romanesque paintings, the methods of Byzantine period were still followed despite local variations as reported also by the Mora’s [5]. Thus, as expected, the same basic procedures are followed by Costin Petresco, while absent in Paul Baudouin's manual, more attentive to the traditions of the Italian Renaissance, and to the recommendations of Cennino Cennini in his book of art [3,9].

The techniques used by Almada to transfer the composition to the wall, the use of diluted, andmore opaque paints, made with pigments mixed in water and with slaked lime, are however reported by both authors; the different uses depended mainly on the pigment nature and on the stage of painting execution [3,4]. According to Paul Baudouin, here is where the modern artist, although restrained by the exigences of the *fresco* technique, could be freer in his personal conception and technique. The planisphere painting is a clear example of this freedom from the bright colour palette used and the several approaches to achieve different chromatic effects, and colour modelling. These aspects will be adressed in follow-on article along with the full pigment’s characterisation.

Conclusions

More than 84 years have passed since Almada Negreiros produced this impressive painting that continues to fascinate for its stylistic quality, creativity, and monumentality. The recent campaign provided a unique opportunity to find out more about Almada’s modus operandi and materials used. The study reveals for the first time the execution phases of the planisphere by *giornate* (number, order, and dimension), the differences of the plasters laid down, the composition of the plasters, the different techniques used to transfer the composition to the wall and the painting execution. The first results reported in this paper confirms that Almada has used a lime-based painting technique with paint layers applied in *buon* and lime *fresco*. No evidence of *secco* paint layers were found so far.

The results also highligts the challenges that he had to face in his first fresco achievement and the likely strategies, based on east and western traditions, used to overcome the difficulties of a fresco execution. Comparison with the two painting manuals on *fresco* tecnhiques found in the artist's studio reveals several aspects in common with those found in the planisphere painting, suggesting that Almada may have been inspired by both authors. The data obtained will be further explored in the second part of the research and will be compared with the other mural paintings sets, to fully understand his mastery and evolution as a mural painter.

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