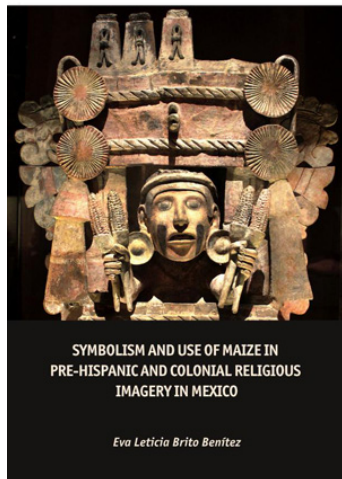




Symbolism and Use of Maize in Pre-Hispanic and Colonial Religious Imagery in Mexico

This article presents an historical review of symbolism and use of maize in religious imagery in Mexico, during pre-Hispanic era and Colonial period....



E.K. Mori, E.A. Del Lama, M.A. Rizzutto, E.M. Kajiya, and P.H.O.V. Campos, *An Analysis of Alfredo Volpi's Paintings by X-ray Fluorescence, Spectrophotometry and Technical Photography*, e-conservation Journal 5, 2016
Available online 21 March 2017
doi: 10.18236/econs5.201701

An Analysis of Alfredo Volpi's Paintings by X-ray Fluorescence, Spectrophotometry and Technical Photography

E.K. Mori, E.A. Del Lama, M.A. Rizzutto, E.M. Kajiya and P.H.O.V. Campos

Abstract

□ Painter Alfredo Volpi (1896-1988) was one of the most important Brazilian artists of recent years. His extensive work was characterized mainly by chromatic compositions and geometric abstractions. He attributed great importance to craft and materials, developing his own systematic way of working, making his own canvas, paint, and pigments with naturally occurring earth pigments. The current study, making use of complementary non-destructive analytical techniques, sought to study the chromatic and elemental composition characteristics of his paintings while gathering information on the technical procedures the artist may have used, in the belief that these are key elements for a deeper understanding of his work. Two tempera paintings on canvas were analyzed, both finished around 1950-1960, a period when the artist's work underwent a major transformation, from figurativism to abstraction, from the use of industrial oil-based paints to the medieval technique of tempera. Techniques of visual examination based on ultraviolet, visible, and infrared photography were used to gather information about the artist's creative process. These techniques also helped to detect past interventions and to identify pigments. A spectrophotometer was used to measure the color based on the reflectance spectrum and numerical reference coordinates within a uniform color space while X-ray fluorescence was used for elemental characterization of the materials. The integration of these techniques made it possible to identify a part of the rich palette of Volpi's paintings and to document the present aspects of the colors and the current condition of the works under study. We were also able to recognize or give indications of pigment and ground compositions and to shed light on parts of each of the works' backgrounds, such as the presence of sketches, covered earlier paintings and brushstrokes. The techniques used have proven useful in characterizing the paintings, revealing new information about the artist's work. The resulting information may be the beginning of a database of his oeuvre.

1. Introduction

Alfredo Volpi's work is catalogued according to two distinct phases: the figurative phase, when his main concern was the naturalist representation of the context and light conditions; and the abstract phase, when form and color became his focus [1, 2]. The works studied belong to the second phase, also characterized by a change in medium from oil-based industrial paint to tempera [3].



e-conservation 2

Download

NEWSLETTER

Email:

Name:

Subscribe



The artist attributed great importance to the craft and the quality of materials, developing his own systematic way of working: from the wooden frame mounting and canvas stretching to ground preparation and the application of the preparatory layers for the final painting. Upon switching to the tempera technique, Volpi also started making his own paint with egg and naturally occurring earth pigments [4].

Although preparing the emulsion for the tempera in the traditional way, Volpi used a particular approach to mixing the colors: instead of using the traditional method of mixing and homogenizing the pigments and emulsion prior to painting, the artist brushed the pure emulsion on to the palette, followed by the dry pigment, or small proportions of different pigments, mixing the whole during the brush strokes [5]. These started with a thick mark that gradually eased, creating in the process a chromatic vibrancy that characterized his painting [1, 2, 6]. Color studies and sketches preceded the final painting of the canvas, and the artist had a peculiar way of filling the colored areas: painting all areas designated for a given color before cleaning the palette and preparing the next [4].

His technical rigor and his careful way of working and choosing colors are reflected in his work, and form an integral part of it. The aim of this study was to investigate chromatic, compositional and artistic aspects of the paintings, important elements for a deeper understanding of Volpi's oeuvre. Two paintings dating from the same period (1950-60), bearing the same chromatic relations were studied using complementary non-destructive analytical techniques, aided by bibliographical and documental research, with the intention of building a corpus of data for future comparisons.

2. Methods and Materials

Two tempera paintings dating from c.1950 and similar in their chromatic relations were studied regarding the aforementioned topics (chromaticity, elemental composition and artistic technique): *Bandeirinhas* (1958) and *Carrinho de Sorvete* (1953). The paintings belong to the University of São Paulo Museu de Arte Contemporânea collection and were analyzed in situ using portable equipment for the techniques of spectrophotometry, energy dispersive X-rays fluorescence (EDXRF), and technical photography [7, 8]. These complementary and non-destructive analytical techniques have been extensively tested in similar studies [9-12]. The equipment used for technical photography is listed in Table I.

The spectrophotometer used was a Konica-Minolta CM-2500d. The investigated area was an 8-mm diameter patch, with a D65 illuminant (using daylight for its calculations, including ultraviolet) and specular component included. CIELab color space was adopted.

The portable energy dispersive X-ray fluorescence (EDXRF) system employed consisted of an excitation source with an X-ray tube (Mini X) with silver anode, and an SDD-type X-ray detector, both manufactured by Amptek, mounted on a fixed position over a movable base. The X-ray tube current and tension amounted to 5 µA and 30 kV, respectively. The measurement period for each spot was 100 seconds, and the spots were the same as used for the color measurements. WinQXAS software was used for spectral analysis.

To endorse and integrate the data collected, bibliographic, iconographic and documentary research was carried as well as interviews with individuals with various degrees of knowledge of Volpi's work, with the aim of gathering information on materials and techniques used by the artist.

Left to right:

Table I. Equipment used for the technical photography.

*Table II. Colorimetric parameters of the *Bandeirinhas* painting.*

*Table III – Colorimetric parameters of the painting *Carrinho de Sorvete*.*

View the embedded image gallery online at:

<http://e-conservation.org/94#sigFreeId16149a9600>

3. Results and Discussion

Given the intrinsic characteristics of the artist's pictorial process, the elemental composition and chromatic data were highly compatible, making it possible to process the results in groups of similar coloration.

Left to right:

Figure 1. Visible photo (VIS). Photo by E. Kajiya and P. Campos.

Figure 2. Infrared photo (IR). Photo by E. Kajiya and P. Campos.

Figure 3. Ultraviolet fluorescence photo (UVF). Photo by E. Kajiya and P. Campos.

View the embedded image gallery online at:

<http://e-conservation.org/94#sigFreeId1568d2334f>

3.1 The *Bandeirinhas* painting

Bandeirinhas, created in 1958, measures 44.2 x 22.1 cm, a 2:1 aspect ratio that is recurrent in Volpi's work [5]. It is an abstract and geometric painting with chromatic interplays (Figure 1).

Using infrared photography, it was possible to observe the sketch underneath the paint clearly, in this case revealing the use of a straight template for the longer lines (Figure 2). Small marks also show the intended divisions of the canvas space. These marks, the composition symmetry and the canvas aspect ratio indicate a project previously envisioned by the artist even before he cut the frame.

Different intensities of fluorescence can be observed in the ultraviolet fluorescence photo (Figure 3), revealing that the painting may have undergone restoration.

Details of the infrared photo and ultraviolet fluorescence photo are shown in Figures 4 and 5 for better visualization of these observations.

Measurements by spectrophotometry and EDXRF were performed on 12 spots as shown in Figure 6.

Three measurements for the white and blue color and six measurements for the red color were made, and each measurement was performed three times. The interval of the colorimetric parameters showed some variation in colors, reflecting the chromatic vibrancy typical of the artist's brush strokes (Table II). These data document the current color of the painting and would be useful as a reference itself in the future or to compare with other Volpi's paintings.

The white areas correspond to the ground left exposed, bordered by the two other colors of the painting. The ground has a better homogeneity in pigment dispersion due to the difference in application. This grants a better homogeneity to the pigment dispersion on the canvas when compared to the other two colors. The following topics show the results of the compositional analysis of each color.

Left to right:

Figure 4. Highlight on some marks in graphite showing the division of space.

Figure 5. Highlight on some possible interventions due to restoration.

Figure 6. Spots chosen for spectrophotometric and EDXRF measurements.

View the embedded image gallery online at:

<http://e-conservation.org/94#sigFreeId5109508382>

3.1.1 White or Ground

In the EDXRF analysis, silicon (Si), sulfur (S), chlorine (Cl), potassium (K), calcium (Ca), manganese (Mn), iron (Fe), zinc (Zn) and strontium (Sr) (Figure 7) were detected.

The elements Ca and S may be present due to the filler used in the preparation of the ground. This is usually calcium carbonate or gypsum [4]. The elements Si, Cl, K, Mn and Sr are probably impurities present in the filler. The elements Fe and Zn, given their low intensity, may be constituents of the canvas, according to analysis performed on the exposed fabric of another painting from the same artist [13].

3.1.2 Red

In the elemental analysis of this color, the elements aluminum (Al), S, Ca, titanium (Ti), Zn, Sr and barium (Ba) showed relative increases (Figure 8).

None of these elements is indicative of red pigments. However, the marked presence of Ba may be associated with the use of barite (BaSO_4) as filler for an organic pigment, or as a ground for lakes. Elements such as Al, S, Ca, and Sr may be associated with barite. There is a range of organic red pigments or lakes that may have been used, but it would be necessary to use a complementary technique for their identification.

The presence of Ti and Zn may be due to the use of titanium white (TiO_2), zinc white (ZnO), a mixture of titanium and barium white (TiO_2 (25%)+ BaSO_4 (75%)), barium titanate (BaTiO_3), or lithopone ($\text{ZnS}+\text{BaSO}_4$).

Left to right:

Figure 7. EDXRF spectrum obtained from the white area, position 1, in Figure 6.

Figure 8. EDXRF spectrum obtained from the red area, position 11, in Figure 6.

Figure 9. EDXRF spectrum obtained from the blue area, position 5, in Figure 6.

View the embedded image gallery online at:

<http://e-conservation.org/94#sigFreeId3eeca97ac>

3.1.3 Blue

The elements that distinctly featured on the blue spots were Al, Si, S, Cl, Ti, vanadium (V), Mn, Fe, cobalt (Co), and Zn (Figure 9).

The presence of Co may indicate the use of cobalt blue ($\text{CoO}.\text{Al}_2\text{O}_3$) or smalt ($\text{CoO}.\text{SiO}_2(+\text{K}_2\text{O}+\text{Al}_2\text{O}_3)$). However, the relative increase in Zn in the spots may point to the use of zinc-cobalt blue ($(\text{Co}, \text{Zn})_2\text{Al}_2\text{O}_4$). Ti makes a discreet appearance, probably as a component of some of the pigments already mentioned, such as titanium white (TiO_2).

Left to right:

Figure 10. Visible photo (VIS). Photo by E. Kajiya and P. Campos.

Figure 11. Infrared photo (IR). Photo by E. Kajiya and P. Campos.

Figure 12. Ultraviolet fluorescence photo (UVF). Photo by E. Kajiya and P. Campos.

View the embedded image gallery online at:

<http://e-conservation.org/94#sigFreeId8b661efcca>

3.2 The Carrinho de Sorvete painting

The Carrinho de Sorvete painting is part of a series of paintings on the theme of Brazilian traditional toys, painted in 1953, and measuring 55.0 x 38.2 cm (Figure 10).

The infrared photo (Figure 11) allowed the identification of marks delimiting the painted image. Orthogonal lines non-coincident with the painting reveal the presence of a pentimento, or an artist's change to the previous design.

From the ultraviolet fluorescence photo (Figure 12), it is possible to observe that, in the blue area, there is an intense fluorescence over the non-coincident markings, making evident the effort done in concealing the lines. On the inferior third of the canvas, the green tones are more intense in the fluorescence, pointing to another layer of paint under the blue.

The measurements by spectrophotometry and EDXRF were performed on 20 spots as shown in Figure 13.

Three measurements for each color were made and each measurement was performed three times. In table 3, the variation of colorimetric parameters reflecting the heterogeneity of paint distribution typical of the artist's brushstrokes can be observed.

The following topics show the results of the compositional analysis of each color.

Left to right:

Figure 13. Spots chosen for spectrophotometric and EDXRF measurements.

Figure 14. EDXRF spectrum obtained from the white area, position 97, in Figure 13.

Figure 15. EDXRF spectrum obtained from the red area, position 90, in Figure 13.

View the embedded image gallery online at:

<http://e-conservation.org/94#sigFreeId0991baf70>

3.2.1 Ground preparation

Judging by the recurrence of certain elements in all colors, it may be assumed that these elements are components of the materials used to prepare the ground, or even belong to the canvas. The recurrent elements in all samples were S, K, Ca, Fe, Zn, Sr and lead (Pb).

Among the ingredients of the classic ground, a recipe Volpi always used [4], calcium carbonate (CaCO_3) or gypsum ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$) is commonly found mixed with an agglutinant such as rabbit-skin glue or gelatin. Further analyses with complementary techniques would be required to distinguish between calcium sulfate and calcium carbonate. Sr and K may be impurities associated with calcium carbonate or gypsum, present in the filler used.

The presence of Fe and Zn in all spots may be due to the elements being part of the canvas.

The element Pb is present in all the spots analyzed. It may be that a coat of lead white ($2\text{PbCO}_3 \cdot \text{Pb}(\text{OH})_2$ or $\text{PbSO}_4 \cdot \text{PbO}$), lead carbonate (PbCO_3), or lead sulfate (PbSO_4) was applied over the ground to whiten it.

3.2.2 White

Besides the identified elements over the entire canvas, probably associated with the ground base, Ti and niobium (Nb) were the elements that characterized the white paint (Figure 14).

The element Ti is most likely due to the use of titanium white (TiO_2). The origin of the Nb was not identified but is clearly visible on the white areas of the painting (Figure 13). These two elements were found associated in analyses of other paintings by the artist [13].

3.2.3 Red

In the EDXRF measurements, the elements worth of note on the red areas were S, K, Ca, chromium (Cr), Zn, molybdenum (Mo), and Pb (Figure 15).

The presence of S, Cr, Mo, and Pb indicates the use of the pigment molybdenum red ($7\text{PbCrO}_4 \cdot 2\text{PbSO}_4 \cdot \text{PbMoO}_4$). The elements K and Ca present a variation in harmony with the other elements quoted, and may be the component of this pigment as filler agent.

The presence of Zn suggests the use of zinc white (ZnO), which would render the red slightly pinkish.

Left to right:

Figure 16. EDXRF spectrum obtained from the blue areas, position 99, in Figure 13.

Figure 17. EDXRF spectrum obtained from the green area, position 94, in Figure 13.

View the embedded image gallery online at:

<http://e-conservation.org/94#sigFreeIdbfff0e5d497>

3.2.4 Blue

The elements worth of note in the blue areas were Ti, Co, nickel (Ni) and Zn (Fig. 16).

From this data it possible to infer that the pigments used for the blue paint could be cobalt-blue ($\text{CoO} \cdot \text{Al}_2\text{O}_3$) mixed with zinc white (ZnO) or zinc-cobalt blue ($(\text{Co,Zn})_2\text{Al}_2\text{O}_4$), both mixed with titanium white.

Regarding the presence of an underlying painting, the violet-hued spots (Figure 11) coincident with the graphite markings (Figure 12) suggest the use of a paint based on a titanium pigment, probably the same pigment as present in the white areas. The intensity of the violet fluorescence, typical of titanium-based pigments, corroborates this hypothesis [14].

The fluorescence in light-green hues in the lower third of the canvas points to the use of zinc white under the blue layer [14]. However, further measurements on more spots would be necessary to draw conclusions about the composition of this layer.

3.2.5 Green

On the EDXRF analysis, the behavior of the three spots measured regarding composition and quantities of elements was very consistent. The noteworthy elements in the green areas were: S, Cl, copper (Cu), Sr, and Ba (Figure 17).

Based on the elements found, it is possible to infer that the green is associated with some copper-based pigment, a chromophore element from the transitional metals group: atacamite ($\text{CuCl}_2 \cdot 3\text{Cu}(\text{OH})_2$), phthalocyanine green ($\text{Cu}(\text{C}_{32}\text{H}_{16}\text{-nCl}_n\text{N}_8)$), malachite ($\text{CuCO}_3 \cdot \text{Cu}(\text{OH})_2$), basic copper sulfate ($\text{CuSO}_4 \cdot n\text{Cu}(\text{OH})_2$), and brochantite ($\text{Cu}_4(\text{OH})_6\text{SO}_4$), among others. It was impossible to identify which one of these pigments was used, since EDXRF is an elemental technique. The presence of a higher count of Cl on the green areas may indicate the use of atacamite, an uncommon mineral pigment, or of phthalocyanine green, a fairly common pigment in the 20th century.

3.3 Integration of the studied data

For the integration of the information obtained from the paintings' analyses, below we present tables organized according to color, reflectance spectrum (obtained from the spectrophotometer), images from different levels of electromagnetic spectrum, as well as material components that were identified or inferred (Tables IV-VII).

The colorimetric measurements registered the paintings' main colors at present, without subjective bias, and served as a signature for the different shades, providing a basis for comparisons between them. This database can be used for future comparisons.

The variation interval between the colorimetric parameters and spectral curves reflected the chromatic vibrancy typical of the painter's brushstrokes, and his method of preparing the paint and mixing pigments.

The imaging methods registered the paintings at present, contributed to the observation of the technical procedures of the artist, such as sketches and brush strokes, and were auxiliary in the identification of pigments, underpainting (pentimento) and

Left to right:

Table IV – Integration of data obtained from the white areas of the paintings studied.

Table V – Integration of data obtained from the red areas of the paintings studied.

View the embedded image gallery online at:

<http://e-conservation.org/94#sigFreeIdd955aaae4b>

Left to right:

Table VI – Integration of data obtained from the blue areas of the paintings studied.

Table VII – Integration of data obtained from the green areas of the paintings studied.

View the embedded image gallery online at:

<http://e-conservation.org/94#sigFreeId15dfcb2721>

The elemental analysis by EDXRF demonstrated a qualitative robustness and consistency between different spots of the same coloration in each painting. These results reflected intrinsic characteristics of the pictorial process of the artist, who commonly used to work with one color at a time in his paintings, mixing the pigments with the emulsion on a clean surface. Such consistency on the corpus of data made possible a more precise analysis, in comparison to other studies of palette characterization [11, 15, 16]. It was possible to identify inorganic substances used as fillers in pigments, or as substrates for the precipitation of colorants, to recognize elements present in the filler used on ground and on the canvas, and to determine the pigments used, or indicate a gamut of possible choices.

The integrated analysis of the paintings revealed the care taken by the artist regarding the choice of his colors, the repetition of pigments in different works and, at the same time, the use of a relatively wide variety of pigments given the limited number of works, the concision on the color palette, the choice of paintings with similar chromatic relationships, and the fact that all paintings studied date from the same period.

4. Conclusions

The methodology used has been proven useful in characterizing the paintings of Alfredo Volpi, permitting a better understanding of the artist's technical processes, the care exercised in the choice of colors, and his treatment of the materials. It may contribute to a more profound understanding of his artistic practices and work.

The information obtained may form the early steps in forming a database of his oeuvre, also being useful to inform future interventions for restoration purposes on the studied works, and, where pertinent, in other works by the artist. Authentication examinations of the artist's work may also be substantiated, among other sources, by the use of the results of this study.

In the case of further research, the data obtained may serve as a basis for possible future studies of comparative analysis with new data, aiming to identify chromatic, chemical, or physical alterations. This data may be complemented with the use of other analytical techniques that can fill in the gaps, and be extended to other works of the artist.

In short, the present study yielded unseen information that may be the beginning of a database on the work of Alfredo Volpi, aimed at a better understanding his work and its preservation. In a general sense, it corroborates the utility of applying physical, non-destructive methods for a better technical and material understanding of artworks.

5. Acknowledgments

This research has been supported by CAPES and FAPESP. The authors would like to thank the Museu de Arte Contemporânea of the University of São Paulo and its conservation and restoration team, the Instituto Alfredo Volpi de Arte Moderna, and the anonymous reviewer.

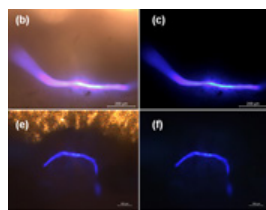
6. References

- [1] S. Salzstein, *Volpi*, Campos Gerais Edição e Comunicação Visual, Rio de Janeiro, 2000
- [2] L. Mammì, *Volpi*, Cosac & Naify Edições, São Paulo, 1999
- [3] M. Giannotti, *Volpi ou a reinvenção da têmpera*, ARS (São Paulo) 4(7), 2006, pp.72-77
- [4] O.T. Araújo, *Atenção: Volpi trabalhando*, Revista Arte Hoje 2(13), 1978, pp. 44-50
- [5] M.A. Mastrobuono, *Alfredo: pinturas e bordados*, Instituto Alfredo Volpi de Arte Moderna, São Paulo, 2013
- [6] O.T. Araújo, *Com os olhos da história*, in: O.T.Araújo, O olhar amoroso: textos sobre arte brasileira, v.1, Momesso Edições de Arte, São Paulo, 2002, pp. 100-110
- [7] A. Cosentino, M. Gil, M. Ribeiro, R. Di Mauro, *Technical Photography for mural paintings: the newly discovered frescoes in Aci Sant'Antonio (Sicily, Italy)*, Conservar Património 20, 2014, pp. 23-33, doi:10.14568/cp2015001
- [8] A. Cosentino, *Effects of different binders on technical photography and infrared reflectography of 54 historical pigments*, International Journal of Conservation Science 6(3), 2015, pp. 287-298
- [9] R.S. Berns, S. Byrns, F. Casadio, I. Fiedler, C. Gallagher, F.H. Imai, A. Newman, L.A. Taplin, *Rejuvenating the color palette of Georges Seurat's A Sunday on La Grande Jatte - 1884: a simulation*, Color Research & Application 31(4), 2006, pp. 278-293
- [10] S. Lorusso, C. Matteucci, A. Natali, A. Foschini, *Indagine storico-iconografica e diagnostica degli affreschi di Palazzo Maioli (Ravenna)*, Quaderni di Scienza della Conservazione 6, 2006, pp. 187-214
- [11] P.H.O.V. Campos, E.A.M. Kajiya, M.A. Rizzutto, A.C. Neiva, H.P.F. Pinto, P.A.D. Almeida, *X-ray fluorescence and imaging analyses of paintings by the Brazilian artist Oscar Pereira da Silva*, Radiation Physics and Chemistry 95, 2014, pp. 362-367
- [12] S. Stout, A. Cosentino, C. Scandurra, *Non-invasive materials analysis using portable X-ray fluorescence (XRF) in the examination of two paintings in the Catacombs of San Giovanni, Syracuse*, in: M. Ioannides, N. Magnetat-Thalmann, E. Fink, R. Zarnic, A.Y. Yen, E. Quak (eds), Proceedings of the 5th International Conference, EuroMed 2014, Digital Heritage. Progress in Cultural Heritage: Documentation, Preservation and Protection, Limassol, Cyprus, 3-8 November 2014, Springer International Publishing, 2014, pp. 697-705
- [13] E.K. Mori, *Caracterização de pinturas do artista Alfredo Volpi por meio de métodos não destrutivos: espectrofotômetro, EDXRF, MEV e imageamento multiespectral*, Master thesis, University of São Paulo, 2015, <http://www.teses.usp.br/teses/disponiveis/44/44144/tde-17112015-151200/en.php>
- [14] B.H. Stuart, *Analytical Techniques in Materials Conservation*, John Wiley, Chichester, 2008
- [15] C.R. Appoloni, M.S., Blonski, P.S., Parreira, L.A.C. Souza, *Study of the pigments elementary chemical composition of a painting in process of attribution to Gainsborough employing a portable X-rays fluorescence system*, Nuclear Instruments and Methods in Physics Research 580(1), 2007, pp. 710-713
- [16] C. Calza, A. Pedreira, R.T. Lopes, *Analysis of paintings from the nineteenth century Brazilian painter Rodolfo Amoedo using EDXRF portable system*, X-Ray Spectrometry 38(4), 2009, pp. 327-332

Eva Mori

Cultural Heritage scientist

FEATURED ARTICLES



Fluorescence In Situ Hybridization: a Potentially Useful Technique for Detection of Microorganisms on Mortars

By Marina González, Ricardo Vieira, Patricia Nunes, Tânia Rosado, Sérgio Martins, António Candeias, Antonio Pereira and Ana Teresa Caldeira

This paper discusses the possibilities of applying Fluorescence In Situ Hybridization (FISH) to detect microorganisms on mortars, as this analytical technique has been used in different fields for the detection of....

[Read More...](#)

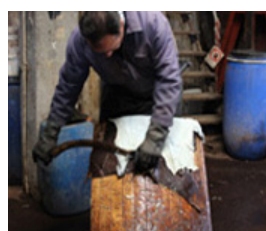


A multi-analytical approach for the study of Neolithic pottery from the Great Dolmen of Zambujeiro (Évora, Portugal) – a preliminary study

By Ana Manhita, Sérgio Martins, Joana Costa, Cátia Prazeres, Leonor Rocha, Cristina Dias, José Mirão, and Dora Teixeira

The chemical and mineralogical composition of the Zambujeiro Dolmen ceramics was analyzed using X-ray diffraction (XRD)...

[Read More...](#)



Travelling Beneath the Gold Surface – Part I: Study and Characterization of Laboratory Reconstructions of Portuguese Seventeenth and Eighteenth Centuries Ground and Bole Layers

By Irina Sandu, Fancesca Paba, Elsa Murta, Manuel Pereira, Conceição Ribeiro

This paper is the first part from an experimental study on documented reconstructions of gilded composites performed on gilding materials....

[Read More...](#)

[Home](#)

[Journal](#)

[Submission](#)

[About us](#)

[Current Issue](#)

[Archive](#)



2017 © e-conservation journal



This work is licensed under a Creative Commons Attribution-Non Commercial 3.0 Portugal License