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A scientific approach in the recovery of the historic center of Rome: limits and potentialities of the "color plan"

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Abstract

The development of studies about conservation of historic centers has highlighted the importance of interventions on the color of the plastered facades. The study of a color plan in city centers has been the subject of numerous debates in Italy, particularly in complex cases such as the historic center of Rome. Over the past thirty years also the development of new products for the construction industry has introduced the problem of materials selection and evaluation of their compatibility in historic urban context. By a preliminary analysis of the current legislation it is clear only the definition of general precepts without giving clear rules for the restoration of plasters and colors. Similarly, studying the law on the protection of historic center of Rome it is noted that the regulations avoid repaintings that «offend the decency», not specifying materials, colors and techniques allowed. For examining these problems concerning the restoration of finishing colors our study has considered the front of some historic buildings in the center of Rome both through archival studies and scientific investigations, in order to define the status of the existing degradation of plasters, the stratigraphic sequence of colors applied on the building facade, and if possible, to detect the original color of the masonry. The aim of this study is to compare the results obtained from this survey with the current "Plan of protection of the urban image of Rome", to highlight the potentialities and limits of existing regulations and to better understand the tools to be used for the restoration of historic buildings.

Selection and peer-review under responsibility of the IA-CS (Italian Association of Conservation Scientists) and University of Antwerp

Keywords: building facade, color plan, finishing, plaster;

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1. Introduction

The study of a color plan in the historic centers has been the subject of numerous debates in Italy, particularly in many complex cases such as the historic center of Rome, where often we can find side by side monumental buildings and minor architectures from different ages with different finishing colors.

In June 1971 already, Antonio M. Colini [1], on behalf of the ordinary members of the Institute of Roman Studies gathered in assembly, expresses his deep concern about the alteration of the traditional color of Rome, paying a warm appeal to the Government and Municipal Bodies responsible for monitoring on this matter. Even in the following years researchers from different backgrounds developed a debate on this issue [2-6]. At present the problem of painting of the historic center of Rome is carefully studied to avoid future errors in this important and delicate issue, by strictly applying the existing rules and strengthening oversight the work both in progress and at work done. A second crucial step for comparing the different approaches is the Conference held in Rome on 27 and 28 May 1987 about colors of historic buildings in Rome, in which a round table coordinated by prof. Gianfranco Spagnesi was held on "The case of Rome and other Italian experiences" [7]. In a short time, after this Conference, a seminar was organized by national and international Institutions [8] as well as an exhibition on "The Color of Rome" by the Superintendence of Artistic and Historical Heritage [9].

An extensive analysis of different issues raised in these debates is presented by M. Piera Sette in 1988 "Color and historic city". In spite of the diversity of the overall approach, the author stresses that the "color problem" is recognized by everyone as an issue that cannot be considered as an autonomous reality but «it must be examined in a solid and indivisible connection with the facades, the building organisms, its context, seen in their ensemble and in relation with the structure of the historical city» [10]. However there are many studies on this topic both in general [11-13] and specifically on Roman reality [14-18]. Since 2003, and with various modifications until 12 February 2008, the Municipality of Rome issues the "General Plan" with the implementation of technical standards and an handbook to the quality of interventions [19-20]. The handbook cites verbatim that: «the maintenance of the original plasters and finishing colors will be carried out by ensuring the maximum possible conservation [...] with the revival of the preexisting both for the color characteristics and the texture of surfaces». However the indications are pretty generic and they refer to the requirements/recommendations included in the CD room "*L'architetto e l'imbianchino. Guida alla progettazione e all'esecuzione delle tinteggiature delle facciate degli edifici nella zona A del Piano Regolatore di Roma*" [21]. More specific are the indications concerning the interventions and materials to avoid, advising against the use of plastic coatings, paints a basis of synthetic resins, such as quartz or plastic paints, and execution of "false rustic" plasters (scratched, spatulated, orange peel, etc..) or otherwise not related to the Roman building tradition. The lack of a detailed definition of "preexisting" to which refer in the intervention, it often makes rather subjective the choice of the same intervention. Finally, in 2007 the II Municipality of Rome, including only a part of the historic center, approves - with subsequent amendments - a more specific document, the "Protection Plan of the Image of Urban Area of II Municipality of Rome: Color Plan and Urban Furnishing Plan" based on the studies carried out by M. Morlacchi since 2004 [22]. In this Plan there are the guidelines on the age of the architectures of different areas, the parts of apparatus to apply the brick tones or those of stone, and the color palette to be used, specifying the traditional palette for the building types identified.

The prestigious area of historic center of Rome, ranging from the *Pantheon*, *Piazza della Rotonda* and *Largo di Torre Argentina* does not fall within the II Municipality and, therefore, it is necessary to refer to it only with reference to the Master Plan of Rome. In addition, the area is characterized by a high flow of tourists, and especially in ground floors, where commercial premises are located, we are witnessing the rapid spread of painting, often dictated by business needs. Only in ground floors there are localized repainting, contrary to the provisions of the Master Plan that explicitly states: «maintenance/restoration interventions of the external finishings will be extend in whole to all facades of a building».

For this reason that area with high flow of tourists is the object of this paper, and our experimental research has been aimed precisely to the study of such repaintings in the ground floors of historical building.

2. Experimental

The samples of plaster for the study of repaintings were collected from some buildings in the area identified in the historic center between *Piazza della Rotonda* and *Largo di Torre Argentina* shown in Fig. 1.

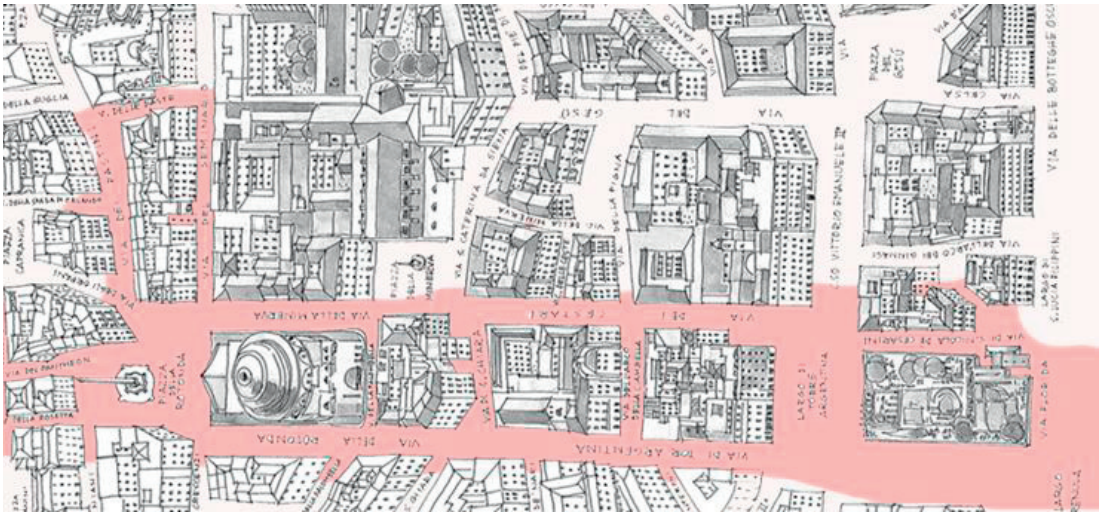


Fig. 1. Historic center of Rome (Italy): area between the *Pantheon*, *Piazza della Rotonda*, and *Largo di Torre Argentina*. The sampling area is highlighted in red.

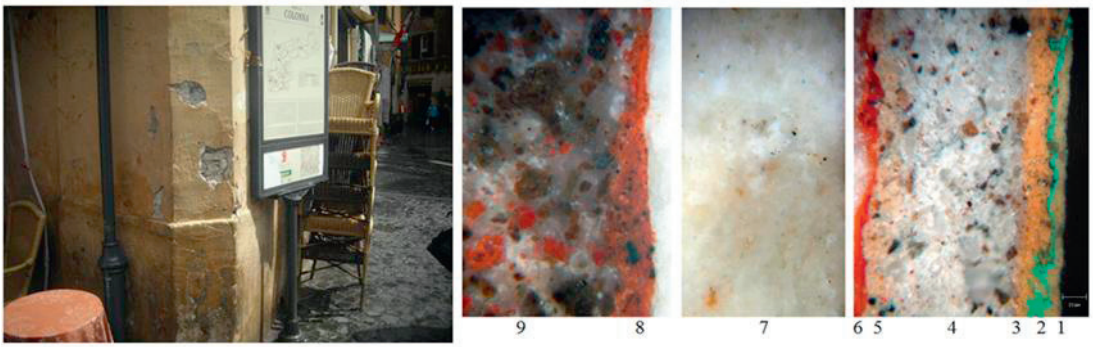
Sampling was carried out in the ground floors of buildings characterized by the presence of commercial activities with obvious repaintings. The study of these samples was aimed to characterize the materials used, the colors and the procedure for preparing the plaster. The samples were examined in polished cross-section. For the realization of the sections the resin EpoFix, produced by Struers, was used. These sections were investigated by morphological observations under optical microscope Leica DM EP in transmitted light and Raman spectroscopy in back-scattering geometry with an inVia Renishaw micro-Raman spectrometer equipped with air-cooled CCD detector and super-Notch filters. A 785.8 nm emission line from a diode laser was focused on the sample by a Leica DLML microscope, using 5x or 20x objectives. Five 20 s accumulations were acquired for each sample; the power of the incident beam is about 8 mW. The resolution was 2 cm^{-1}; spectra were calibrated using the 520.5 cm^{-1} line of a silicon wafer.

3. Results and discussion

The following section describes the results of optical microscope and Raman spectroscopy [23] analyses of four more representative samples of those coming from *Piazza della Rotunda* (Sample 1, Figs. 2-6); *Via di Torre Argentina* (Sample 2, Figs. 7-8); *Via Pantheon* (Sample 3, Figs. 9-11); *Via della Spada d'Orlando* (Sample 4, Figs. 12-14).

The study of the stratigraphic section of the building in *Piazza della Rotonda* (Sample 1, Fig. 2a) shows the presence of nine different layers. Starting from the surface (Fig. 2b), we found in sequence: 1) a light yellow

layer attributable to yellow ochre covered - on the surface - by a thin gray layer; 2) an emerald green layer present only in the polished section, and therefore not linked to a color applied to the building; 3) a yellow layer with red grains; 4) a preparation mortar with medium grain size; 5) a thin light yellow layer; 6) a Red Ochre layer; 7) a glossy white with fine-grained average with dark particles (probably carbon); 8) a Red Ochre, with black particles; 9) *cocciopesto* mortar [24-25].

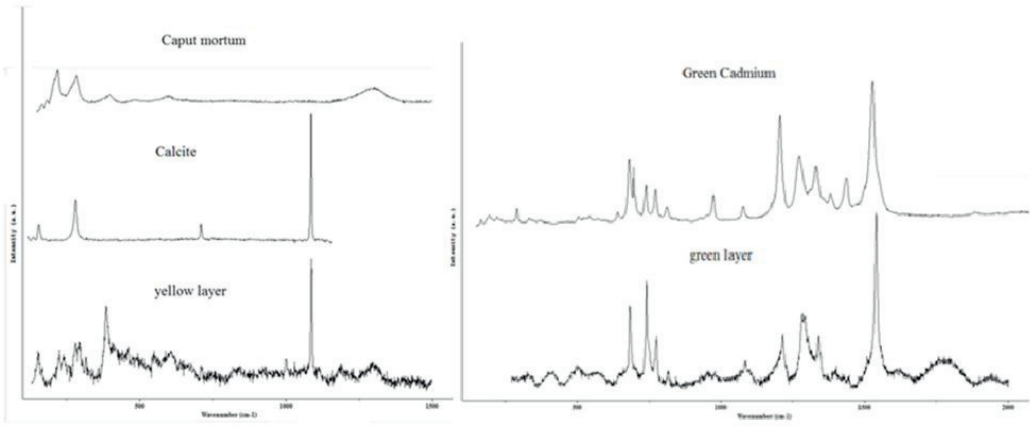


(a) (b)

Fig. 2. Sample 1 - *Piazza della Rotonda*: (a) sampling area; (b) stratigrafic section.

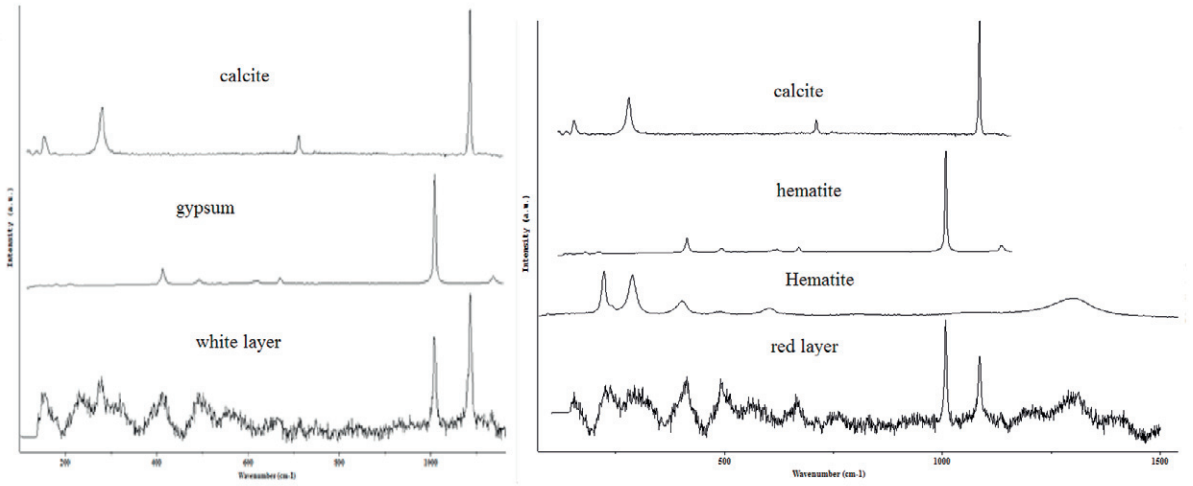
The study by Raman spectroscopy of the layer 1 (Fig. 3a) has shown the presence of Calcite ($CaCO_3$), identified by peaks at about 1086.1 cm^{-1} and at ~289.4 cm^{-1}, and of *Caput Mortum* (Fe_2O_3), identified by peaks at about ~1296.9, ~592.0, ~385.2, ~289.4 and ~224.1 cm^{-1}[23].

The layer 2, green color (Fig. 3b), has been identified as Cadmium Green ($Cd_3 + Cr_2O_3 + nH_2O$) by main peaks at about ~1339.6, ~1293.3, ~1282.3, ~1282.4, ~1213.5, ~1084.2, ~816.7, ~777.3, ~732.7, ~648.8,324.5 and ~227.9 cm^{-1}. In the layer 7, white color (Fig. 4a), the presence of Gypsum (peaks at about ~1007.5, 487.5 and ~410.8 cm^{-1}) and Calcite (~1085.8 and ~278.4 cm^{-1}) is detected. In the layer 8 (Fig. 4b) Hematite (Fe_2O_3) has been identified by peaks at about ~567.4, ~495.4, ~406.1, ~309.6, ~233.6 cm^{-1} as well as Gypsum ($CaSO_4 \cdot 2H_2O$) by the main peaks at about ~1007.7, ~662.0, ~495.4 and ~406.1 cm^{-1}. The peak at ~1088.6 cm^{-1} is due to the likely presence of Calcite.



(a) (b)

Fig. 3. Sample 1 - *Piazza della Rotonda,* Raman spectra (a) layer 1; (b) layer 2.

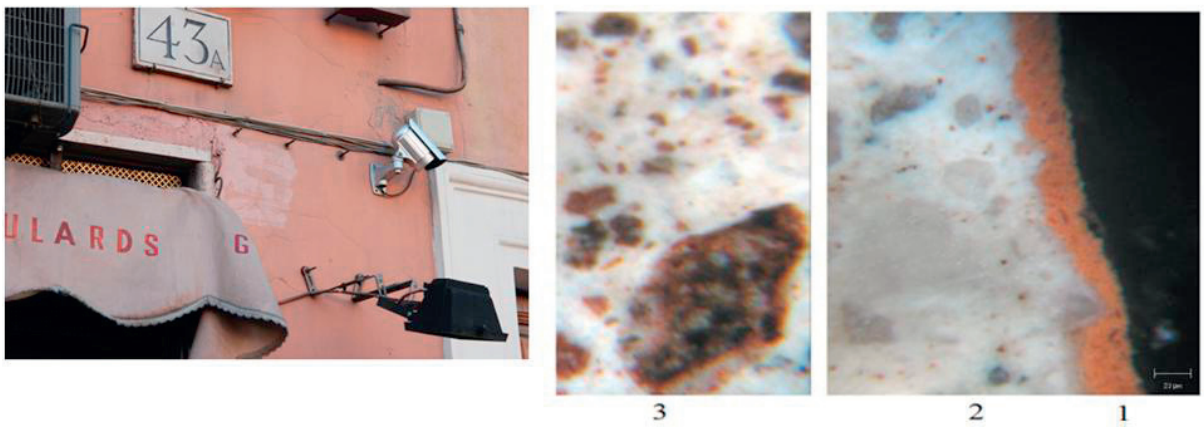


(a) (b)

Fig. 4. Sample 1 - *Piazza della Rotonda,* Raman spectra: (a) layer 7; (b) layer 8.

Sampling carried out on the building in *Via di Torre Argentina* (Sample 2, Fig. 5a) has not shown a particular stratigraphy of color, due to the frequent urban changes of *Largo Argentina* starting from the late 1800s. The presence of the *Area Sacra* in the middle of the square has however imposed in the early 1900s the demolition of entire buildings and the modification of some facades of the still existing buildings. The stratigraphic study, starting from the surface (Fig. 5b), shows the following three layers: 1) orange finishing; 2) white plaster with medium fine aggregate; 3) layer identified as pozzolanic mortar.

The Raman study of layer 1 (Fig. 6) has allowed to identify: i) Calcite (main peak at ~1085.8 cm^{-1}), ii) Rutile (TiO_2) (main peaks at about ~607.0 and ~446.6 cm^{-1}) and iii) compound with peaks at about ~839.9 cm^{-1} and ~356.3 cm^{-1} comparable with the reference spectrum of Crocoite ($PbCrO_4$).



(a) (b)

Fig. 5. Sample 2 - *Via Torre Argentina*: (a) sampling area; (b) stratigrafic section.

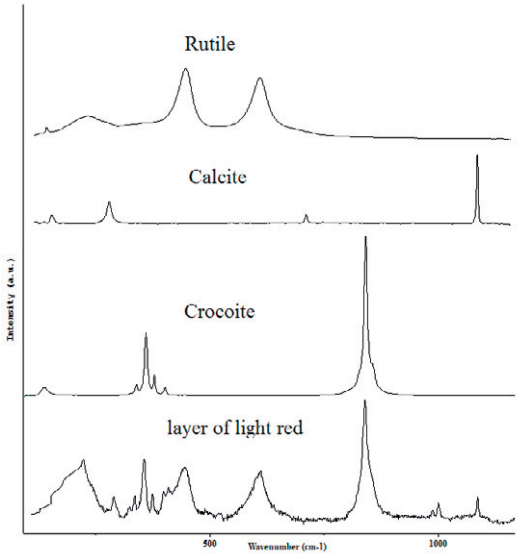
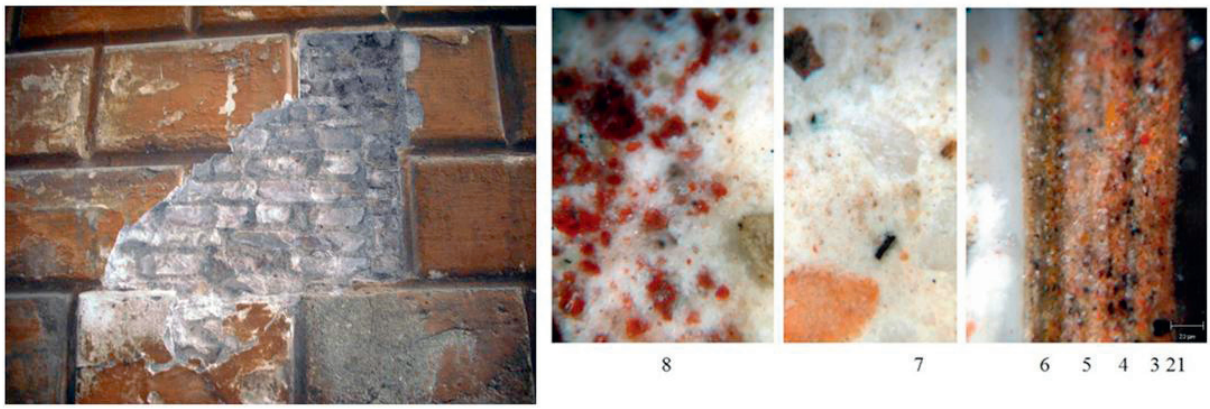


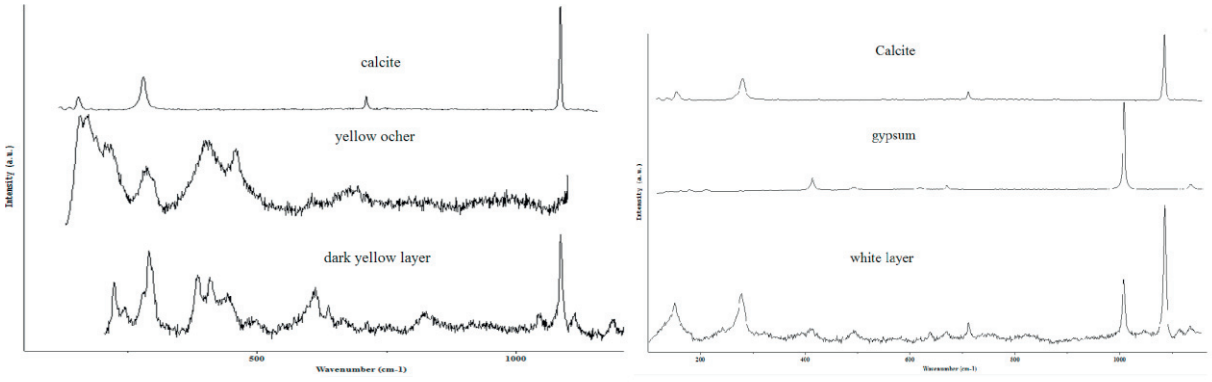
Fig. 6. Sample 2 - *Via Torre Argentina,* Raman spectrum: layer 1.

Due to the overlapping of several degraded layers the of Sample 3, from a building in *Via Pantheon* (Fig. 7a), is extremely complicated and sometimes difficult to interpret. The stratigraphic study, starting from surface (Fig. 7b), shows eight layers: 1) to 6) finishing layers very degraded with a color ranging from light yellow to dark yellow; 7) white layer - probably finishing layer like *Travertino* - with non-oriented aggregate well distributed over the whole section; 8) a pozzolanic mortar-like . As an example, the layer 2 (Fig. 8a) has been identified as Yellow Ochre (peaks at about ~609.5, ~444.3, ~409.3, ~385.0, ~291.8, ~242.4 and ~224.0 cm^{-1}), while the peak at 1088.6 cm^{-1} is probably due to Calcite. The layer 6 contains Ochre comparable with the Sienna Burnt pigment (main peaks at about 1302.5, ~564.4, ~495.8, ~314.6 and 235.5 cm^{-1}) and Gypsum (main peaks at ~1007.3, ~661.8, ~497.0 and ~405.8 cm^{-1}). In the layer 7 (Fig. 8b) Gypsum and Calcite have been identified.



(a) (b)

Fig. 7. Sample 3 - *Via Pantheon*: (a) sampling area; (b) stratigraphic section.



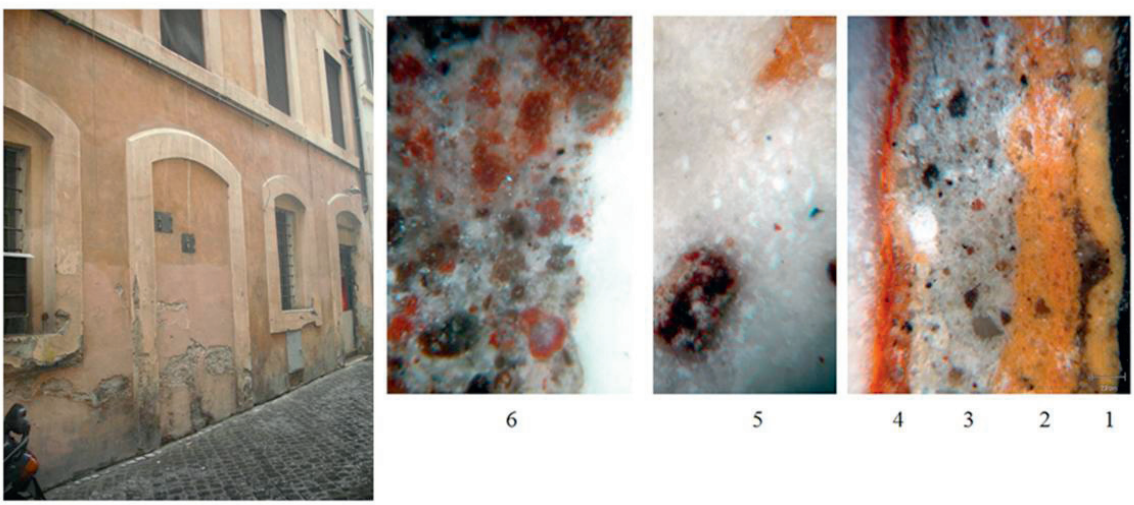
(a) (b)

Fig. 8. Sample 3 - *Via Pantheon* Raman spectra: (a) layer 2; (b) layer 7.

Sampling from one of the frames of the windows in the ground floor of the building in *Via della Spada d'Orlando* (Sample 4, Fig. 9a) shows six layers (Fig. 9b): 1) and 2), variable colors from light yellow to dark yellow; 3) plaster with well distributed medium size aggregates; 4) Red Ochre, 5) white plaster with aggregates larger than those present in the third layer; 6) pozzolanic mortar.

The Raman spectrum of layer 1 (Fig. 10a) shows the presence of Yellow Ochre (main peaks at ~463.2, ~285.3 and ~284.4 cm^{-1}), Calcite (main peaksat ~1086.6 and 710.5) and Gypsum (peaks at ~1001.2 and ~411.2 cm^{-1}).

The Raman spectrum of layer 5 (Fig. 10b) shows the presence of Calcite (peaks at ~710.2 and ~1086.3 cm^{-1}) and Gypsum (peaks at ~1005.1 and 411 cm^{-1}).



(a) (b)

Fig. 9. Sample 4 - *Via della Spada d'Orlando*: (a) sampling area; (b) stratigrafic section.

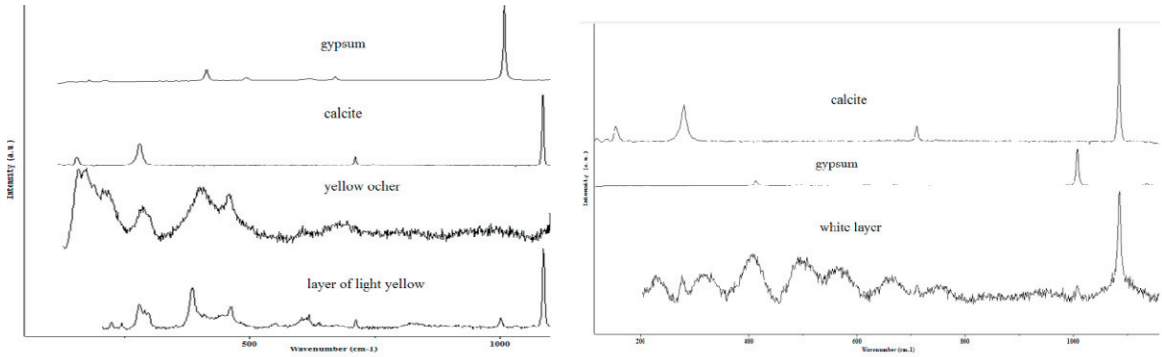


Fig. 10. Sample 4 - *Via della Spada d'Orlando,* Raman spectra: (a) layer 1; (b) layer 5.

The results obtained by optical microscopy and Raman spectroscopy clearly indicate that most of the surface layers are composed by Red Ochre and Yellow Ochre mixed with Gypsum and Calcium Carbonate. Although the materials are consistent with those used in the Roman tradition, the polished sections highlight that the application technique of finishing colors on the surface are different from the oldest ones. The paints are often applied without an underlying plaster causing, through the time, the detachment from the wall.

In the case of the building located in *Largo Argentina* the materials collected were identified by Raman spectroscopy as Chrome Yellow and Titanium Oxide. Chrome Yellow, chemically defined as lead chromate ($PbCrO_4$), proposed by Vaquelin in 1798, of varying shades from lemon yellow to orange depending on the size of the particles, can be used as a colorant in plaster keeping in mind that the alkalinity of the lime turns it into reddish basic chromate. Titanium Oxide (TiO_2) is associable with Titanium White, a white pigment that came into use after 1920. For the building located in *Via Pantheon* the layer number 7, made of Gypsum, Calcium Carbonate with dark particles, indicates the absence of an underlying plaster and the presence of a finishing layer like *Travertino*. Finally, in one of the polished sections of samples from the building in *Piazza della Rotonda* the Green Cadmiun has been identified. This layer, found only in one polished section, is certainly not due to a own color of this building.

4. Conclusions

The current Master Plan of Rome establishes the use of the preexisting colors in the restoration of historic buildings. However, in an urban structure as complex as Rome, developed in different periods, it is extremely difficult to determine whether the preexisting color is the original one. Therefore it becomes difficult to choose among the various preexistences. The stratigraphic analysis is even more complex when we examine the ground floors on which the commercial activities have often carried out frequent interventions arbitrarily aimed to give them an attractive aspect. The analysis of the main components of the different layers by Raman spectroscopy allowed us to determine that the constituent materials of finishing mortars are only in some cases the materials typical of the Roman building tradition.

The high tourist flow in the historic center areas of Rome has determined the proliferation of buildings maintenance often contradicting the guide to quality of interventions issued by the Municipality of Rome, that provides the restoration of the color for the entire facade and not just for small portions.

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