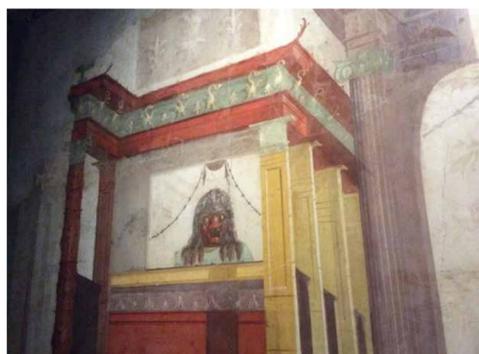


**PARETI DIPINTE
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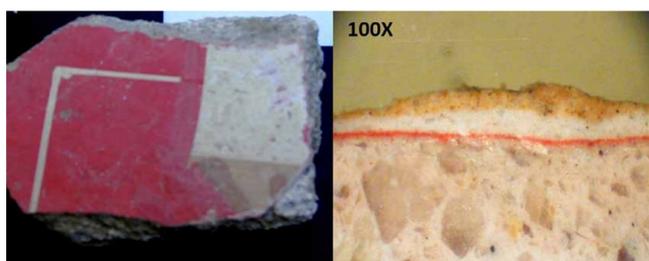
Plasters from the Augustus' House on the Palatine: the archaeometric study



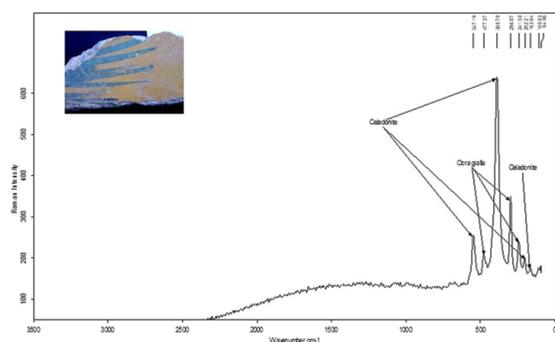
1. Masks Hall in Augustus' House on Palatine Hill (photo M.L. Santarelli).



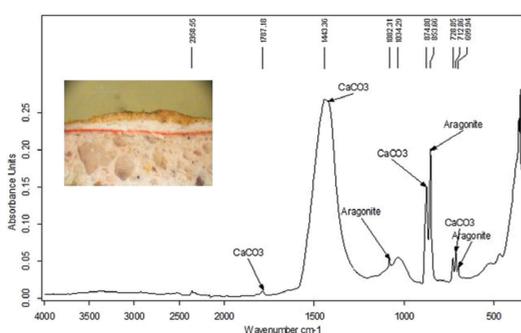
2. Fragments from the excavation in Augustus' House.



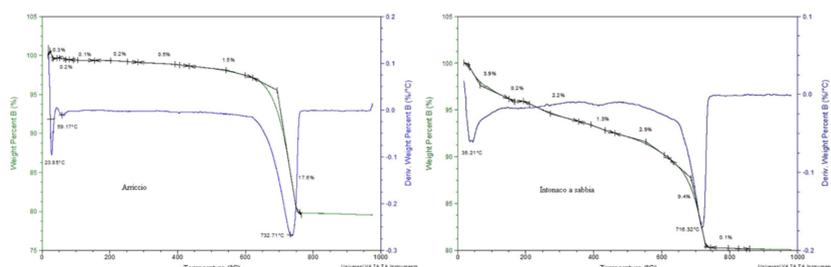
3. Microscopic observation of the fresco technique.



4. Raman spectrum of the celadonite.



5. FTIR spectrum of the aragonite.



6. TGA thermograms of arriccio and sand plaster.

The Roman fresco represents not only an expressive form, but also a means to celebrate the magnificence of the emperor or the owner of the opera. The use of precious pigments and refined techniques of realization, according to the Vitruvian suggestion, are representative and diagnostic elements to identify the importance of an archaeological site or structure.

The painted fragments of the plasters collected from the Augustus' House on Palatine Hill Domus Augustea) were used to develop a study on the executive technique of the frescoes of the Emperor of Pax Romana. The fragments of the Augustus' House came from the collection of the Soprintendenza Archeologica di Roma (now Parco Archeologico del Colosseo) and were found during the excavation of the sixties. The pieces were reused by the architects of Augustus as filling material during the remaking of the Imperial House on the Palatine and discovered during the archeological excavations of the Soprintendetzna (Carandini 2010). The restorers were able to locate the fragments in important rooms as the Hall of Masks (fig. 1) and the Emperor's Studiolo rebuilding their painted walls (Borrello, Musatti 2009).

Many fragments (fig. 2), however, have not been repositioned and they became important elements in order to define the technical realization of the plasters and of the painting layers. This information can become an important diagnostic element to distinguish fragments from the emperor's rooms from fragments coming from service rooms. Their characterizations were used to construct a database for the classification of Roman paintings in different areas coming from Rome and parts of the Empire. Several pieces with different colors and pictures have been analyzed with micro-destructive techniques, defining the layers of plasters, their nature and technique of application. Instead, the characterization of the pictorial phases allowed to identify different phases at "fresco" and not and, obviously, the nature of the used pigments.

Analytical approach

The analytical approach was based on the qualitative and quantitative characterization of the components in the plasters and on the characterization of the pigments. Indeed, using thermogravimetry (TGA) in combination with optical microscope (MO) observation on thick stratigraphic section and X-ray diffraction (XRD), it is possible to obtain information on the nature of the binder and the aggregate in the plasters, defining also the quantitative ratio. Combining Fourier transform infrared spectroscopy (FTIR) with Raman spectroscopy it is possible to identify the nature of the used pigments.

Characterization of the pigments

In the case of the frescoes in the Augustus' house, observation of the MO allowed to recognize the fresco treatments from ones not at frescoes, used to make specific drawings on the surface of the paintings. Generally, it is possible to recognize the penetration of the pigment in the still non-carbonated lime and to identify different color depositions, obtaining a compact covering of the underlying plaster.

The realization of drawings (like lines, flowers, squares, shadows, etc.) was carried out later, when the first fresco painting was dry, applying the color directly on the first layer and creating the design.

An example can be seen in fig. 3, where the red color was applied to fresco on marmorino plaster, while the line and the whitish square were obtained with lime applied to the dry red and colored with a yellow pigment. The latter pigment was also applied with still fresh binder, obtaining a slightly darker of white.

In order to identify different colors present in the fragments using FTIR spectroscopy and Raman spectroscopy, the following pigments were characterized: cinnabar, Egyptian blue, red and yellow ocher, celadonite. Figure 4 shows the Raman spectrum of celadonite present in the green color of the palms, where Egyptian blue was also found, as a regulator of the intensity of the green. In figure 5 the presence of aragonite has been identified in the FTIR spectrum. Aragonite powder probably was obtained from shells and was added to the color to give an iridescence to the fresco.

Characterization of the plasters

Regarding the nature of the plasters, the characterization by MO, TGA and XRD highlights the difference in composition between the "arriccio" and the plaster. Generally, the arriccio was mainly made up of a mortar in lime and pozzolan.

The hydraulic nature of this plaster identifies a tenacious mortar, adhering well to the masonry and supporting the painted plaster. Instead, the plaster is made up of 2 different layers, well cohesive to one another. Especially, the innermost layer, adhering to the arriccio, consists of a mortar in lime and sand, while the painted outer one consists totally of lime mortar and marble dust (marmorino).

The application of several layers was necessary to paint in fresco and a fresh lime surface was useful for binding pigments in working day. In figure 6 the different trend between the arriccio (hydraulic mortar) and the sand plaster (non-hydraulic mortar) can be observed. The TGA has determined the ligand/aggregate ratio of 1:3 for the arriccio and 1:2 for the sand plaster.

Conclusion

The combination of several analytical techniques has allowed to obtain information regarding the technique of execution of the frescoes in the house of Augustus on the Palatine Hill, identifying the respect of the Vitruvian indications. Indeed, the technique used to realize the painted walls of the Emperor 'House identifies the remarkable nature of the plasters and the pigments, even mixed, and the application of particular solutions to obtain specific effects, such as the use of aragonite to give iridescent effects to the painting.

Carandini A. 2010, *La Casa di Augusto dai "Lupercalia" al Natale* (con D. Bruno), Roma-Bari.

Borrello L., Musatti G. 2009, *La Casa di Augusto sul Palatino: il recupero e il restauro della decorazione pittorica*, in "Bollettino d'arte" 2, s. VII, pp. 1-21.