

An integrated approach to assess air pollution threats to cultural heritage: the case-study of Michelozzo's Courtyard in Florence (Italy)

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Atmospheric pollution is widely recognised as one of the major threats to cultural heritage [Brimblecombe, 2005]. In particular, atmospheric particles deposition on surfaces of artistic interest may cause deterioration due to chemical reactions and can intensify surface damage acting as condensation nuclei for moisture or adsorbing gaseous pollutants. Thus, information on both indoor air quality and microclimate are needed for an effective evaluation of conservation actions.

An example of an integrated approach to assess air pollution threats to cultural heritage is presented in this work, where the monitoring campaign carried out at the Michelozzo's Courtyard (in Palazzo Vecchio, Florence, Italy) is used as a case-study.

Palazzo Vecchio (XIV century), located in the centre of the urban area of Florence, is the most important historical building of the town. Its main Courtyard (Cortile di Michelozzo) was redecorated in 1565 by Giorgio Vasari. All the wall paintings, representing sights of major Austrian cities, are situated under the portico and were executed using the lime wash technique. In spite of several restorations performed since the 19th century, these paintings show an advanced level of degradation, especially those that were not detached from the original support.

Attention focused on the painting depicting the city of Hall because of its anomalous and critical conservation conditions, which are visible at a glance, due to a wide darker central zone.

In view of scheduled new restorations of wall paintings, a wide research project was carried out, with the aim of identifying the main causes of degradation and suggesting appropriate conservation strategies.

The investigation adopted an integrated approach involving thermographic measurements on the wall paintings, microclimate assessment, gaseous pollutant monitoring, atmospheric particles characterisation, and dry deposition compositional analysis. Furthermore, compositional analyses (SEM-EDS and micro-PIXE) and microscopy observation

were performed in a previous study on samples collected on this painting, singling out the role of sulphation [Giuntini, 2008].

As a general result, the study identified as possible causes of the Michelozzo's Courtyard observed degradation the peculiar microclimate (characterised by large variations in principal thermo-hygrometric parameters) and pollution conditions (a strong impact of urban air pollution was evident). Finally, the use of the lime wash technique, which is considerably less durable than the good fresco, makes the wall painting particularly vulnerable. For future actions, aiming at preventive actions it should be also taken into account that the Courtyard is subjected to a strong tourism pressure throughout the year.

Brimblecombe, P. (2005). *Cultural Heritage Conservation and Environmental Impact Assessment by Non Destructive Testing and Micro-Analysis*, Van Grieken R., Janssens K. (eds.) A.A. Balkema, Leiden; 11

Giuntini, L. (2008). *Uso e sviluppo di microfasci ionici in problematiche sui beni culturali PhD Thesis in Cultural Heritage Conservation Science*, University of Florence (in Italian)