

Editorial





# Environment and cultural heritage: an important link to develop suitable protection strategies

#### **Editorial**

In recent decades, the built heritage has been degraded more than in the past, which suggests that air pollution is one of the most dangerous agents in the degradation and alteration processes. Environmental parameters, such as temperature, humidity, precipitation, direction and frequency of winds, pollutants are the main causes of the deterioration phenomena. Many studies have shown the close correlation between these parameters and the formation and development of different degradation phenomena, such as black crusts, salts crystallization, detachments, erosion and alveolization. Black crusts and salts crystallization represent the more common and dangerous ones.

Black crusts are the result of the interaction between atmospheric pollution, produced by human activity, and calcareous buildings located in urban areas.<sup>1-7</sup> In particular, their formation is related to the growth of gypsum on stone substrates, in particular limestone and marble, sheltered from water and attacked by an SO2-polluted atmosphere. The degradation mainly interests those architectural surfaces protected from washing out which usually give rise to a more severe decay of the stone including loss of material. The typical color of such surfaces is black, caused by the accumulation of air pollutants, especially carbon particles taken from the incomplete combustion of fossil fuels.8 Geochemical studies carried out on different historical monuments showed that some trace elements, such as heavy metals, in the black crusts provide useful information about pollution sources.  $^{9\mathchar`-12}$  Furthermore this geochemical approach can represent an important tool to evaluate the best strategies for the protection and conservation of the built heritage, like cleaning procedures In some cases, in fact, higher amounts of heavy metals such as Pb, Zn, Cu, Ni, As and V, due to high geochemical mobility, are detected into the substrate and can become catalysts for the development of further decay of the stone substrate.<sup>11</sup> Salts crystallization is one of the most dangerous weathering processes in the stone materials, mainly porous limestone rocks. Macroscopically, this process can produce different damages such as exfoliation, erosion, flaking, and loss of material, flaking, and disaggregation of the material.13

Salt crystallization takes place into the porous materials when specific supersaturating and thermodynamic conditions occur. Among different salts, an important role is played by sodium sulphate which can crystallize both as mirabilite  $(Na_2SO_4x10H_2O)$  and the nitrite  $(Na_2SO_4)$ , depending on the humidity and temperature conditions.<sup>14</sup>

For this reason, there is an increasing need of preventive measures against potential damages. These procedures include the monitoring of environmental parameters, which are also related to the efficacy of protective and consolidating products for restoration. On the basis of these considerations, research in this field is useful both for monitoring the environment and to safe guard our monuments. Volume | Issue 2 - 2016

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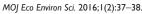
None.

## **Conflict of interest**

The author declares no conflict of interest.

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