# Environment and Cultural Heritage: an Important Link to Develop Suitable Protection Strategies

Editorial

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## 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 [1-7]. 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 [9-12]. 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 [11].

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 (Na2SO4x10 H2O) and the nitrite (Na2SO4), depending on the humidity and temperature conditions [14].

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.

## References

1. Amoroso GG, Fassina V (1983) Stone Decay and Conservation, Elsevier Science Publishers, UK, pp. 453.
2. Zappia G, Sabbioni C, Riontino C, Gobbi G, Favoni O (1998) Exposure tests of building materials in urban atmosphere. Sci. Total Environ. 224(1-3): 235-244.
3. Brimblecombe P (1998) Urban Air Pollution-European Aspects. In: Finger J, Herter O, Palmer F, Springer Netherlands, p. 7-20
4. Brimblecombe P (2000) J Archit Conserv 6(30).
5. Bonazza A, Sabbioni C, Ghedini N, Gobbi G (2007) Pollut Atmos, Numèro Spèc 7.
6. Ghedini N, Sabbioni C, Bonazza A, Gobbi G (2006) Chemical–Thermal Quantitative Methodology for Carbon Speciation in Damage Layers on Building Surfaces. Environ Sci Technol 40(3): 939-944.
7. Moropoulou A, Bisbikou K, Torfs K, Van Grieken VR, Zezza F, et al. Origin and growth of weathering crusts on ancient marbles in industrial atmosphere. Atmospheric Environment 32(6): 967-982.
8. Ghedini N, Sabbioni C, Bonazza A, Gobbi G (2006) Chemical–Thermal Quantitative Methodology for Carbon Speciation in Damage Layers on Building Surfaces. Environ Sci Tecnol 40(3): 939-944.
9. Barca D, Belfiore CM, Crisci GM, La Russa MF, Pezzino, et al. (2010) Application of laser ablation ICP-MS and traditional techniques to the study of black crusts on building stones: a new methodological approach. Environmental Science and Pollution Research 17(8): 1433-1447.
10. Barca, D., Belfiore, C.M., Crisci, G.M., La Russa, M.F., Pezzino, A., Ruffolo, S.A. J. Anal. At. Spectrom. 26, 1000-1011(2011)
11. La Russa MF, Belfiore CM, Comite V, Barca D, Bonazza A, et al. (2013) Geochemical study of black crusts as a diagnostic tool in cultural heritage. Applied Physics A 113(4): 1151-1162.

12. Ruffolo SA, Comite V, La Russa MF, Belfiore CM, Barca D, et al. (2015) An analysis of the black crusts from the Seville Cathedral: A challenge to deepen the understanding of the relationships among microstructure, microchemical features and pollution sources. Science of The Total Environment 502: 157-166.

13. Silvestro AR, Valeria C, Mauro FR, Cristina MB, Donatella B (2015) An analysis of the black crusts from the Seville Cathedral: A challenge to deepen the understanding of the relationships among microstructure, microchemical features and pollution sources. Science of the Total Environment 502(1): 157-166.

14. La Russa MF, Ruffolo SA, Belfiore CM, Aloise P, Randazzo L, et al. PeriodMineral 82: 113-127.

15. Flatt RJ (2002) Salt damage in porous materials: how high supersaturations are generated. Journal of Crystal Growth 42(3-4): 435-454.

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