

## **Effectiveness of aged graffiti cleaning on granite by chemical and mechanical procedures**

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Granite is one of the most common building stones in the European Cultural Heritage mainly in Northwest Iberian Peninsula. Nowadays, graffiti when a result of an act of vandalism is one of the most important threat, involving a serious risk to heritage sustainability. The cleaning is expensive and in most of the cases, the complete removal is not achieved. Many cities worldwide spend huge amounts of money in cleaning campaigns and European Commission started to create urban environment policies to prevent and eliminate graffiti and also finance projects to develop new cleaning procedures and antigraffiti coatings<sup>1,2</sup>. However, in many cases graffiti is applied in monuments and façades without antigraffiti and in real practice, they are only cleaned after being long exposure to the atmosphere, reaction with the environment (rain and atmospheric pollutants) and also with the substrate, leading changes in their physical and chemical properties. However, no scientific studies focused on graffiti aging were found and also on the influence of the aging on the cleaning effectiveness, which is always evaluated with fresh graffiti. Therefore, the need to optimize the cleaning of aged graffiti is urgent.

This paper aims to study the influence of the exposition of graffiti paintings to one of the most important urban contaminant SO<sub>2</sub> on the cleaning effectiveness of graffiti on the valuable ornamental granite Rosa Porriño. Two different chemical products and two different mechanical procedures based on low pressure projection (wet and dry) were evaluated. Four different colour graffiti paintings (red, black, blue and silver) with different compositions were tested. The criteria for assessing the global cleaning effectiveness was considering the graffiti extraction and also the damage induced on the substrate through changes in the chromatic parameters, static contact angle and surface roughness of the stones, identification of deleterious products and modification of the morphology and the composition of the surfaces. The previous characterization of the aged graffiti subjected to SO<sub>2</sub> in an artificial chamber was also performed.

After the evaluation of the global cleaning effectiveness, it was found that silver graffiti was the most sensitive painting to the aging under SO<sub>2</sub> exposure and its higher deterioration degree hindered the cleaning, mainly with the chemical products. Also, the presence of neoformed minerals in the graffiti layers influenced the cleaning effectiveness achieved.

**Acknowledgements:** This project is financed by Fundação Calouste Gulbenkian (Programa de Estímulo à Investigação). J.S. Pozo-Antonio was supported by a postdoctoral contract with the University of Vigowithin the framework of the 2011–2015 Galicia Plan for Research, Innovation and Growth (Plan I2C) for 2014. The authors also gratefully acknowledge the support of the CERENA (strategic project FCT-UID/ECI/04028/2013).