



## Surface protection treatments of highly porous building stones and sustainability problems

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The growing attention to the cultural value and the potential touristic attraction of the historic towns has led to increasing activities of rehabilitation and conservation of the historical built heritage. Chemical treatments have become a common practice for the protection of the stone building surface against the decay agents and traditional methods of protection, such as the application of sacrificial layers, have been even more neglected. The use of chemical products on large scale works on the historical built heritage draws the attention towards the sustainability of the conservation treatments, that involve peculiar features with relation to the different types of stones. Sustainability is undoubtedly in terms of human and environmental impact of the used products, so that the use of new formulations based on aqueous solvent should be preferred. Sustainability also means the equilibrium between the required performances of the treatments and the preservation of the original stone properties (colour, permeability, etc), namely harmlessness and effectiveness of the treatments. This can be a critical aspect when we deal with very porous stones, namely having porosity between 30-40%, that are widely used in many countries as traditional building materials. In most cases no information – or very general recommendations - is reported in the technical sheets of the conservation products with reference to the application to these types of stones. Relevant problems of compatibility can arise from the significant amounts absorbed by the high porous structure, as well as in terms of cost effectiveness of the treatments.

In this work several calcarenites with different petro-physic characteristics and porosity between 30 and 45% are concerned for the assessment of the performance of two commercial water based products for stone protection, respectively an alcoxy-siloxane with low molecular weight and a modified organo-silane. This activity is a part of the Apulia (Southern Italy) POR funded Research Project, devoted to the study for conservation of traditional building materials used in this region.

Moving from the wide range suggested by the product's suppliers, different treatments, based on several dilution degrees and different amounts of the products, were experienced. A preliminary screening of the effectiveness and harmfulness of the treatments was carried out by measuring the colour parameters (by colorimetry) and the superficial water-repellence (by water-stone static contact angle measurements) of the untreated and treated stones. It was followed by further investigations by capillary rise water absorption and water vapour permeability tests.

The distribution of the products and the properties obtained for the treated stones was seen strongly depending on their open porosity and microstructural features. Some critical issues were shown by the experimental activity, confirming that information given by the suppliers are often not sufficient in order to decide about the adoption of the treatments without a previous assessment on the basis of the characteristics of the stone supports. They should be taken into account by the Institutions and operators devoted to the safeguard and preservation of the Cultural Heritage, as well as by the chemical companies for the optimisation of their formulations.