

### The Problem: Salt crusts

The formation of detrimental crusts caused by the enrichment of salts and biopatina is a very real problem in European cities and urbanised developments. The problem originates from the coincidence of sustained economic development growth and industrialisation with the location of an important part of the world's cultural inheritance. It is only through a European initiative that rapid action can be brought to bear on this serious problem, by simultaneous application of remedial measures across the EU.

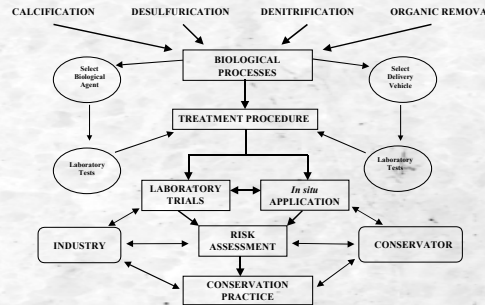


### BIOBRUSH: Scientific Objectives

The aim of BIOBRUSH is to devise a biotechnology tool based on bioremediation. Selected microorganisms will be applied to stone samples both in the laboratory and *in situ*. Risk assessment will be made and in cooperation with conservators and the industry a tool for use in conservation practice will be developed. Risks/benefits for heritage objects (aesthetic consequences, reversibility, durability), the environment and end-users (health problems, aerosols) will be assessed in consultation with industry and conservators, to seek opinion and ensure that the research outcomes influence conservation policies and practice.

### A Solution: Bioremediation

The novel approach of the BIOBRUSH project is to use bacteria to link the mineralisation processes which remove stone crusts to the consolidation phenomenon of calcification. The project aim is to utilise the bacteria carrying out these processes by applying them directly to stone surfaces using techniques that are safe and environment-friendly. It will supplement, not replace existing conservation technologies, which can often be ineffective or toxic to end-users or the environment, and establish the limitations of bioremediation in conservation practice.



### BIOBRUSH: Methodology

- Ion chromatography(IC)
- Gas-chromatography with mass spectrometry (GC/MS)
- Fourier transform infrared spectroscopy (FTIR)
- Fluorescence microscopy (FDA)
- Light microscopy (PAS staining)
- Scanning Electron Microscopy (SEM)
- High performance liquid chromatography (HPLC)
- Polymerase chain reaction (PCR)
- X-ray diffraction (XRD)
- Energy dispersive x-ray microanalysis (EDAX)

### Current Activities

- Selection and analysis of stones materials showing crust formation and the identification of monuments and buildings from locations in northern and southern Europe for future field trials
- Isolation, screening and selection of appropriate biological agents with bioremedial activities with the aim of establishing a bacterial culture collection for use in European conservation
- Evaluation of the feasibility and effectiveness of a potent delivery system to carry the bioremedial agent to the stone.

