

## **RESTORATION OF STONE MONUMENTS WITH BIOLOGICAL METHODS AKMENES PIEMINEKĻU RESTAURĀCIJA AR BIOĻĒGISKĀM METODĒM**

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### **Summary**

Deterioration of cultural heritage is a severe problem in urbanized developments. Project Novel approaches to conserve our European heritage: BIOremediation for Building Restoration of the Urban Stone Heritage in European States (BIOBRUSH) was one of projects of the EC 5<sup>th</sup> framework (Contract No: EVK4-CT-2001-00055) recently concluded. The main aim of the project was to devise an effective, safe, environment-friendly biotechnological tool based on bioremediation for restoration and conservation of stonework that can be incorporated into conservation strategies.

The formation of detrimental crusts caused by the enrichment of salts and biopatina is a very real problem in European cities and urbanized developments. The problem originates from the coincidence of sustained economic growth and industrialization with the location of an important part of the world's cultural inheritance. The novel approach of the BIOBRUSH project was to use bacteria in order to link the mineralisation processes, which remove stone crusts to the consolidation phenomenon of calcification. The project aimed to utilize the bacteria carrying out these processes by applying them directly to stone surfaces using techniques that are safe and environment-friendly.

BIOBRUSH has generated two databases of information concerning the nature and extent of crusts on buildings in Northern and Southern Europe and microorganisms with bioremediation potential for conservation work. The project has assembled a culture collection of bacteria with organic-degrading, sulphate-reducing, nitrate-reducing and biocalcifying activities. The nature of crust in European buildings has been investigated and found to be very varied. The potential of bacteria to remove crusts has been assessed in laboratory experiments and candidate organisms identified. Risk assessments have been done to reduce possible detrimental human health effects and adverse reactions on cultural objects. Field trials at a wide range of locations in Europe have been completed in Greece, Latvia, Germany and Italy. BIOBRUSH has explored the limitations of bioremediation for the conservation of stone and recommended practical outcomes to allow use by restorers alongside other traditional methods.

The BIOBRUSH consortium has disseminated the research findings by circulation of a publicity brochure; the production of a posters; prezerntations in conferences and workshops as well as by establishment of a WWW site ([www.biobrush.org](http://www.biobrush.org)).

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