RESEARCH ON THE PRESENCE OF SULPHUR-CYCLE BACTERIA IN THE STONE OF SOME HISTORICAL BUILDINGS IN FLORENCE†

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SUMMARY

The problem of the conservation of ancient buildings is often the conservation of stone. The decayed stone is exfoliated and contains in general a relatively high quantity of gypsum.

Fifty samples of deteriorated stones from buildings of the historic center of Florence were collected and examined. The gypsum percentage in the samples, determined by diffractometric analysis, varied between 0.5 and 10 per cent. The sulphur bacteria were in the range from 250 to 20,000 per g of stone. In spite of certain indications it is not possible to establish a direct correlation between gypsum content and number of sulphur bacteria.

INTRODUCTION

Gypsum is almost always found in weathered stones. Its presence is not easily explained because gypsum and other sulphur salts are absent or only present in very small quantities in unweathered stones.

Many hypothesis have been formulated on the formation of gypsum. It has been attributed to the presence of small quantities of SO₃, formed in the atmosphere under the catalitic action of several inorganic agents. Another hypothesis suggests that sulphur-oxidizing bacteria transform SO₂ (present in the air), or sulphur containing compounds, derived from soil or other sources, in SO₄-ions. Sulphur-oxidizing bacteria of the genus Thiobacillus usually

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utilize sulphur compounds such as $\text{H}_2\text{S}$, elemental S and even thiosulphate as sources of energy for carbon dioxide reduction. $\text{SO}_4$-ions are formed which give gypsum by reaction with calcium carbonate. Since the transformation of $\text{CaCO}_3$ in gypsum is accompanied by an increase in volume, it does contribute to the degradation of the stony material. In the present work we have tried to collect data which might give indications on an eventual correlation between the presence of sulphur-cycle bacteria and gypsum in weathered stones.

**MATERIALS AND METHODS**

The examined stones collected from historical buildings of Florence were of two types:

**Pietra Serena** which is used mainly for ornamental purposes, is a feldspathic sandstone with abundant clay matrix, a low calcite content and an average grain size. Decay takes place through formation and fall off of crusts, parallel to the wrought surface. (Fig. 1).

**Pietraforte** which is basically used as construction material, is a feldspathic sandstone with abundant carbonate cement and a fine grain size. Decay occurs in the same way as in Pietra Serena but with formation of much thinner crusts. (Fig. 2).

Fig. 1. Window-sill made of Pietra Serena situated in Giglio’s street (sample no. 20).