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New findings on past treatments carried out on stone and marble monuments' surfaces

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Abstract

The traditional mechanisms of the causes of marble and stone decay are now almost completely understood. Many works were carried out by us and other authors on this subject. However, the frequent occurence of new alteration products, identified on different monument's surfaces has suggested a need to investigate this new field. It is of paramount importance to study these decay products, above all in relation to treatments which were very frequently used in the past as a maintenance operation for monuments or works of art. This is a very important research task because it can help to clarify the influence of past treatments on the velocity of stone decay. To assess the morphology of deterioration, samples of marble included in resin were analyzed in cross-section by means of optical microscopy and scanning electron microscopy interfaced with an energy dispersive X-ray system. We focused our attention on: the identification of old treatments carried out on the surface as a maintenance operation; weathering of old treatments carried out in restoration works at the beginning of this century and most recently in the 1960's carried out to stop the decay; thin yellow patina extensively present on different lithotypes, Istrian stone and marble; and an extensive grey appearance of the surface of the marble. A recent survey carried out on some monuments allows us to summerize the following results: silica is extensively present in the black areas due to the decomposition of fluorosilicates applied as consolidants; silica is very frequently located on the surface because it was not able to penetrate into the lower microcracks which remain voids; sometimes silica is interposed between calcite crystals and the small gypsum crystals previously penetrated before the treatment; a yellow-brown patina was generally found both on Istrian stone and on marble (this film can be formed by calcium oxalate or alternatively by fluorite and calcium oxalate); fluorite can be originated by a reaction of calcite with fluorosilicates, but also by a reaction with hydrofluoric acid perhaps used as a cleaning agent. This last hypothesis seems confirmed by the superficial aspect of some marble slabs which present some corrosion forms typical of an acid attack.

Keywords: Stone and marble monuments; Maintenance operations; Consolidants; Flurosilicates; Scialbatura

1. Introduction

Previous works carried out by the present author and other researchers have demonstrated that gypsum formation on limestone is caused by sulphuric acid, which in turn is formed by sulphur dioxide oxidation (Fassina et al., 1976; Fassina, 1978; Lazzarini, 1972; Lazzarini, 1979; Marchesini, 1970; Marchesini et al., 1972; Torraca, 1969; Amoroso and Fassina, 1983).

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