

Characterization of colour changes in limestone sculptures using X-ray based methods

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Since the ancient times, natural stone has been the material selected to construct cultural heritage assets due to its beauty and durability. However, like all materials, stone may suffer inexorable deterioration, caused by several factors, either external or internal. The main degradation promoters that may easily affect indoor limestone are soluble salts, water and biodeteriogenic agents which can induce physical and chemical deterioration, leading in extreme cases to the loss of sculptors' original intention.

The limestone sculptures selected are dated from the 15th and 16th centuries and are currently exposed inside the National Museum of Ancient Art, Lisbon, Portugal. They have two main types of pathologies affecting their chromatic characteristics, namely white and red staining, in addition to the loss of some original material.

The analytical approach allowed the characterisation of several alteration products formed on the sculptures' surface, which can potentiate the structural damages of the sculptures and are probably related to their colour alteration. Using complementary analytical techniques, it was possible to state that the white hues and loss of material are mainly related with the formation of efflorescence (Fig.1a) and microbial development. On the other hand, the reddish hues seem to be related with the of iron oxides' concentration (Fig.1b) and formation of carotenoids.

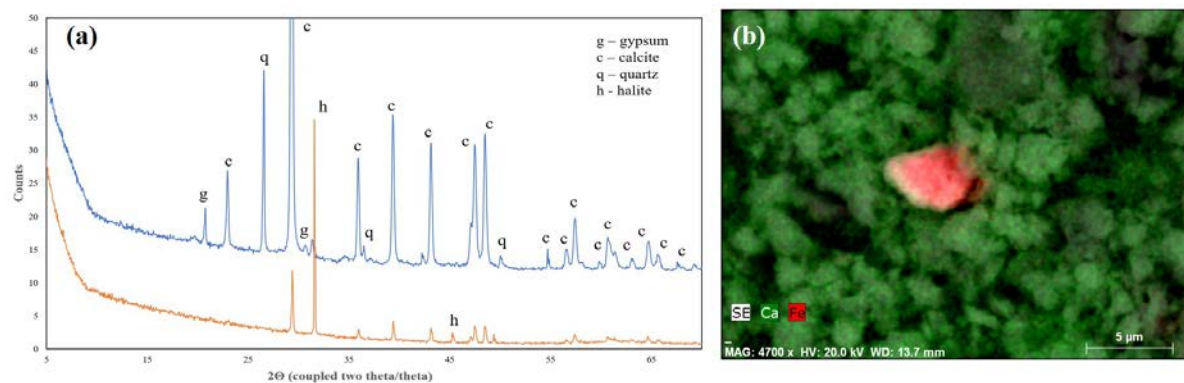


Figure 1: Detection of alteration products using μ-DRX (a) and SEM-EDS (b).