



Investigation of painted stucco in historic buildings of Delta, Egypt

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Abstract Samples removed from stucco ornaments of two mosques (seventeenth century) in El-Mahalla El-Kubra, Delta, Egypt, are investigated using optical microscopy, micro-Raman and micro-FTIR spectroscopy and X-ray diffraction (XRD). Samples are studied as removed from the ornaments and after treatment with trichloromethane, which was used to extract the organic content. Moreover, the stratigraphies of the ornaments are investigated through a sample's cross-section analysis revealing a bulk stucco layer, a colouring layer (either red or black) and overpainted layers of later interventions.

Red and black colouring layers are composed mainly of fired brick enriched with hematite and carbon black, respectively. Shellac, found in high quantities, is the binding medium used in the colouring layers where small amounts of tree resins are detected as well. Bulk stucco is composed of gypsum and calcite. Metal soaps, oil and tree resins are also detected in the stucco layers. Other identifications are described in the report which,

to the best of our knowledge, is the first effort to identify the materials contained in the “Delta style” stucco used in Ottoman buildings in Egypt.

Keywords Stucco; Mosque; FTIR; Raman; XRD

Introduction

Stucco has been used in Egypt since antiquity. During the Islamic period of Egypt, stucco ornaments have been extensively used in buildings and mosques and have become important architectural decorative elements in wall friezes, in geometrical and inscriptive ornaments as well as in medallions and stucco windows with coloured glass. These decorations cover large areas of walls, especially in mihrabs and facades of Islamic buildings in Egypt (Clevenot 2000; Nardini et al. 2007; Afifi and Mahran 2006).

Most of the Ottoman buildings of the sixteenth to seventeenth century, in Delta's cities in Egypt, such as Rosetta, Fwa, Abyaar, Damietta and El-Mahalla El-Kubra, have been decorated with a special stucco style, called the “Delta style”, where only two colours, red and black, have been used. The stucco ornaments of the Delta style were produced by filling areas between geometrical surface decorative features, with coloured putties as shown, for instance, in Fig. 1. The distinguished style was used to decorate large areas of facades, entrances and niches (mihrabs) of buildings and mosques (Abdel-Allah 2006; Khaled 1995). The main component of the decorative material was fired brick. Clay, the raw material of brick, was abundant in the Delta area and it was therefore extensively used both as a building material and for decoration purposes. The small mud bricks were burnt until they obtained the black colour, by adding some carbonaceous material

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