



The art of building in the Roman period (89 B.C. – 79 A.D.): Mortars, plasters and mosaic floors from ancient *Stabiae* (Naples, Italy)



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HIGHLIGHTS

- Villa San Marco is one of the best-preserved *otium villae* of the Bay of Naples.
- A multilayer technology was adopted for mortar-based materials.
- Lime binder and calcite/silicates/pozzolan aggregate were mixed following a precise recipe for each layer.
- Volcanic and sedimentary raw materials from surroundings were exploited.

ARTICLE INFO

Article history:

Received 29 November 2015
Received in revised form 9 April 2016
Accepted 26 April 2016
Available online 10 May 2016

Keywords:

Stabiae
Villa San Marco
Somma-Vesuvius volcanic complex
79 A.D. eruption
Mortar-based materials
Mosaic floors
Multi-layer technology
Arriccio
Unmixed lumps
Raw materials

ABSTRACT

This current research is focused on the mineralogical and petrographic characterisation of mortar-based materials from Villa San Marco in the ancient *Stabiae* (modern Castellammare di Stabia, Napoli), an outstanding example of Roman *otium villae*, and aims at recognising the technology used by the ancient skilled workers.

Several analytical techniques were used such as digital videomicroscopy, optical microscopy, digital image analysis, scanning electron microscopy coupled with EDS analysis and Quantitative Powder X-ray Diffraction.

A multi-layer technology characterised the plasters; the scratch coat was made with lime mortars mixed with a pozzolanic lightweight aggregate and *cocciopesto*, required ingredients providing a quick-setting and a better adhesion with the support. As far as the *arriccio* layer is concerned, the mix-design is a lime mortar with volcanic sand as the aggregate and a minor content of pozzolan and/or *cocciopesto* to enhance the workability of the mortar in order to correct any error due to the roughness of the scratch coat. The plaster s.s. was the removable support in case of mistakes, and gave a lighter colour to the preparation layer of the frescoes. The last thin layer, prepared with lime mortars and a carbonate aggregate, is characterised by low porosity in order to avoid pigment adsorption. The painting technique was a fresco with *encaustication*.

In contrast, the mortars of the building structures were made with lime added to a pozzolanic aggregate (volcanics and *cocciopesto*), giving a quick setting during the implementation of the yellow tuff *opus reticulatum*.

The *rudera* and *nuclei* of the mosaics were built with abundant volcanic sand and *cocciopesto* mixed with the lime, producing a more resistant surface, and finally the *tesserae* were fixed exclusively with lime. The white and black colours of the mosaics were produced by local limestone and tephritic lava.

The results permitted an evaluation of the high level of specialization of both the workers and the artists that built and decorated these maritime villas. Moreover, the collected data highlighted the wide potentiality of the materials cropping out in the environs of the Somma-Vesuvius volcanic complex. This research aims at furnishing a useful reference for future restoration action in Villa San Marco and the other Roman villas in this area.

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1. Introduction

Archaeological mortar-based materials are the products of the complex technological knowledge and ability of ancient skilled workers. An approach to the characterisation of these construction materials permits recovering some fundamental information regarding the material culture of these ancient craftsmen. In the past years, numerous research studies have been devoted to the study of such building materials, focusing on: an accurate identification and classification of mortar-based materials [1–5]; the composition and provenance of the raw materials [6–11]; the use of mortar-based materials for the identification of construction phases of a building in different epochs [12,13], also using ^{14}C dating [14], and knowledge building techniques [15–20].

The above-mentioned knowledge represents a fundamental premise for suitably and accurately planning the conservation of Cultural Heritage [21–26]. To this end, the present research aims at characterising the mortar-based materials (mortars, plasters and mosaic floors) from Villa San Marco, one of the *otium villae* of ancient *Stabiae*.

The archaeological site of *Stabiae* represents one of the most important concentrations of seaside Roman villas of the Mediterranean area. The site was the subject of a large restoration and conservation program involving local stakeholders such as the “Soprintendenza Archeologica di Pompei” (the Superintendence of Archaeology of Pompeii, the Restoring Ancient *Stabiae* (RAS) Foundation and other research institutions. Despite the archaeological relevance of this site, no literature data concerning the material characterisation (such as mortars, building stones and ceramics) is available. In contrast, a plethora of studies has focused on archaeological findings and their raw materials and

technology from the neighbouring and world famous settlement of *Pompeii* and, more generally, from the Campania region [7,8,13,27–41].

This current study is a first attempt to fill this gap by means of a detailed mineralogical and petrological investigation on a set of mortar-based materials collected from Villa San Marco, probably the most important among the so-called *otium villae* of ancient *Stabiae*. This investigation aims at providing new data on the composition and provenance of raw materials used in the Vesuvius-environs during the Roman period, as well as an evaluation of the implementation construction techniques linked to the ability of the skilled workers, before the Vesuvius eruption of 79 A.D. Furthermore, this research can represent a valuable tool for the preservation and restoration of the Villa San Marco frescoed masonries that, despite a good state of conservation, are subject to some weathering such as efflorescence, discoloration and convex deformation.

2. Brief archaeological outlines

The Vesuvius-environs land has always attracted people since the Early Bronze Age thanks to the large availability of natural resources and soil fertility [33,42–48]. In contrast, several natural episodes, such as the Campanian Ignimbrite eruption (39 ka) [49–53], that of *Pompeii* in 79 A.D. and the eruption in 472 A.D. [54,55], deeply modified the landscape from a geological and geomorphological point of view with a consequential impact on human activities [45].

Ancient *Stabiae* is located on the Pianoro di Varano, a plateau in the junction between the Lattari Mountains carbonate ridge and the Sarno River flood plain (Fig. 1).

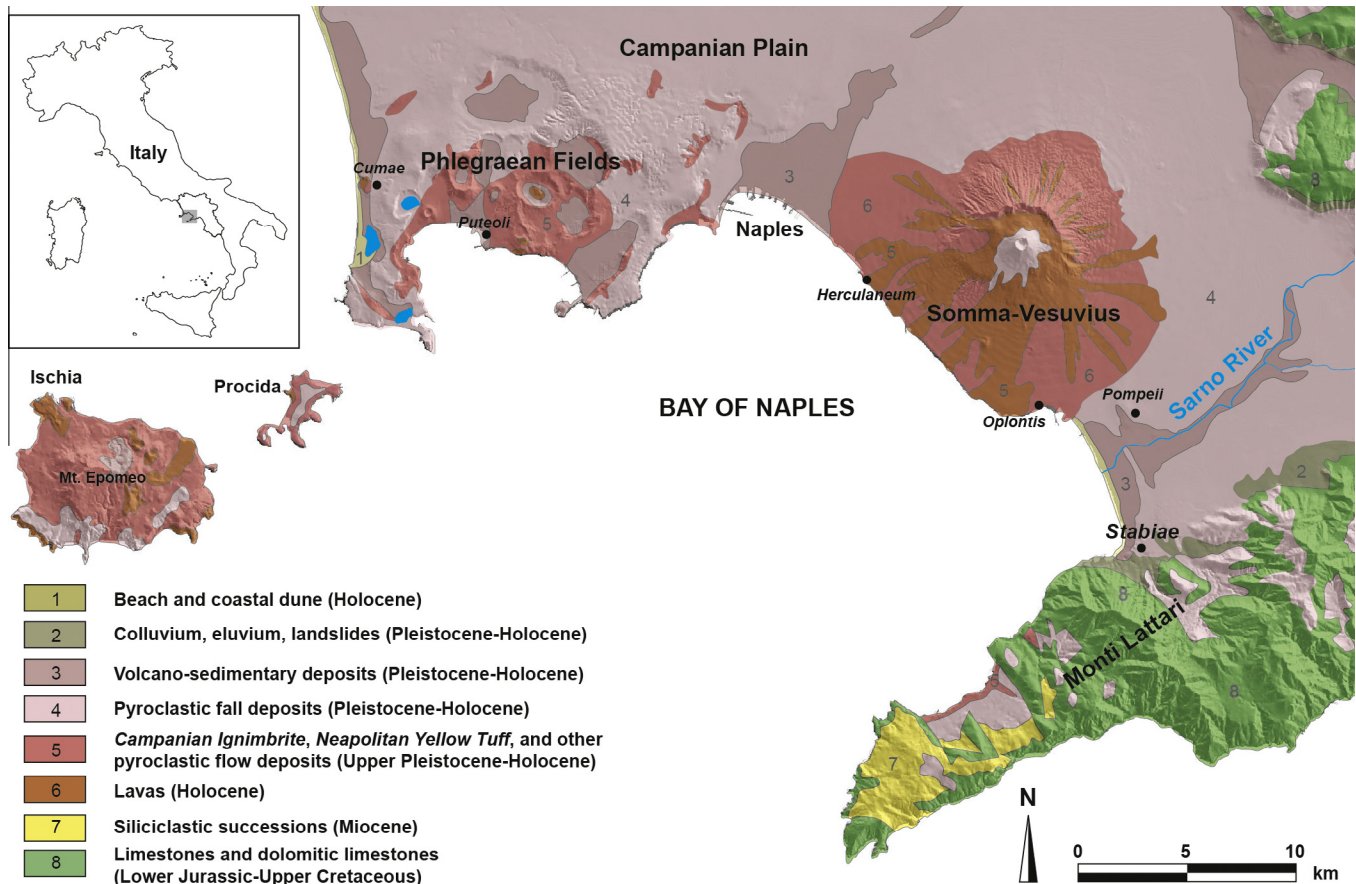


Fig. 1. A geological sketch of the Bay of Naples area and the location of the archaeological site of ancient *Stabiae* (modified after Bonardi et al. [56]).

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