

Structural health monitoring of the Ninfeo Ponari by combined use of fibre optic sensors, photogrammetry and laser scanning

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Abstract – The Ninfeo Ponari is an ancient building dating back to the first century BC, located in the ancient Roman city of Casinum. The building is one of the best preserved examples of '*coenatio aestiva*', a leisure annex of a rich '*domus*'. It consists of two bodies: a rectangular room covered by a barrel vault and an atrium with no roof and a shallow pool in centre. The structural condition of the building is not critical but its preservation is at risk: it is located on a hill slope where some extended sliding activity is present; it is not protected by an efficient rainfall drainage system. Aim of this paper is to illustrate the strategies and the techniques recently applied to start with a permanent structural health monitoring of the building.

I. INTRODUCTION

The Ninfeo Ponari is a Roman building located in the ancient Roman city of Casinum, near modern Cassino, within the Italian region of Lazio, on the slope of the hill of Montecassino, along the road leading to the famous Benedictine abbey [1-6]. It lays close to the Roman theater, the Museum and the Archaeological Area of Casinum. Until a few decades ago it was owned by the illustrious Ponari family, to whom it owes its name, and was finally donated to the University of Cassino in 1996. It consists of a vaulted room ('*tablinum, oecus*') fully opened on one side into a space ('*atrium*') with two opposite side walls only and no ceiling, with a shallow pool in the centre ('*impluvium*'); both are richly decorated with wall paintings and floor mosaics. Other parts of the building have been detected, but only partially unearthed and not yet properly analysed. The construction technique is the ancient Roman concrete masonry covered with plaster. The vaulted room is about 4.63 x 7.43 m² and reaches a height of approx. 4.58 m up to the top of the vault; the atrium is about 6.35 × 7.55 m² and preserves the side walls up to a height of approx.

3.50 m. The wall paintings cover about 120 m², and the mosaic paving has a surface of about 70 m². It was probably a summer dining complex ('*coenatio aestiva*'), maybe enriched by fountains (hence the conventional name '*nymphaeum*', after the typical grottoes connected with the cult of the Nymphs), and belonged to a luxurious private '*domus*'. The residence was built around the middle of the 1st century BC, and then restored and redecorated either during the 1st or at the beginning of the 2nd century AD, as suggested by the structural and decorative features. The quality of the decorations makes it one of the most valuable examples of private urban construction in central and southern Italy, comparable to those of Rome and the Vesuvian area.

Until the end of last century, the building was almost completely filled with earth. The actual situation is the result of a first excavation and restoration (1998-2001) and of later minor interventions; all walls stay under the ground level, in direct contact with the ground; the vault and part of the 'atrium' are covered by a protective roof. However, the layout of the area and the artificial roofing of the structure have shown serious shortcomings over time: the lack of isolation from the hillside puts the building under constant pressure, no longer counterbalanced by the filling of the interior; moreover, the structure has remained in direct contact with the ground, favouring the infiltration of moisture in the absence of a system of drainage upstream of the structure itself. The modern roofing has revealed to be of insufficient width, ending up channelling part of the water drain to the outside of the walls. Painting and mosaic surfaces are affected by serious phenomena of detachment and degradation. Over the years, new lesions and clear signs of failure of statically important