

High-Resolution Integrated GPR Surveys in the urban Archaeological Sites. The cases of Palatino Hill and St John Lateran Basilica (Roma, Italy)

Salvatore Piro¹, Daniela Zamuner¹

¹ *Istituto per le Tecnologie Applicate ai Beni Culturali. ITABC-CNR*

Abstract – To enhance the knowledge of the subsoil of some portion of the Palatino Hill (Rome), and to locate the unknown buried structures below the actual studied levels, a scientific collaboration between La Sapienza University of Roma (Department of Archaeology), the Soprintendenza Archeologica di Roma and the Institute of Technologies Applied to Cultural Heritage (ITABC-CNR) has been developed, starting from 2001 and it is still in progress. Palatino Hill is characterised by a sequence of complex buildings, related to its history, from the foundation to the VIII century a.C.

In this complex site, taking into account the results of previous surveys a new series of GPR surveys employing different frequencies were carried out during the period September 2009 to October 2010, with the aim at first to verify the stability of excavated archaeological remains locating the presence of shallow cavities, and at second to reconstruct the overlapping of archaeological structures in some portion of the Palatino Hill.

In St John Lateran Basilica (Rome) to locate the unknown archaeological structures below the actual studied levels, a scientific collaboration between Newcastle University (UK), the Dipartimento di Scienze dell'Antichità (Università di Firenze) and the Institute of Technologies Applied to Cultural Heritage (ITABC-C.N.R.) has been developed, starting from 2006 and it is still in progress.

I. INTRODUCTION

There are many important research and technical issues related to the investigation in urban area to locate subsurface cavities and/or archaeological remains, to produce hazard mapping, that is of the highest priority, and archaeological risk map. This is especially so in civil engineering where it is of key importance for managing safe urban and civil construction. In many cases, cavities, such as subsidence features, voids and collapses represent disruptions to the geometry of an originally near-horizontal layered system. Geophysical techniques can be

used to identify the feature geometries by contrasts in the physical properties.

In the present paper the GPR surveys carried out in two urban archaeological sites characterised by different conditions are presented and discussed.

A. Palatino Hill

During the archaeological investigations made subsequent to the geophysical surveys, from 2001 to 2004, between the N-E foot of Palatino Hill and the Colosseum Valley and nearest Elagabalo's Thermae, a sequence of complex buildings, related to the Roman period between the late Republican and Severo's age were discovered. The oldest building is a *domus* of the late Republican period located in front of a line of buildings called *tabernae* which were used for shops and living quarters. This corridor of buildings connected the Colosseum Valley and the Roman Forum. The fire-raising of 64 A.C., signed the destruction of these buildings and the development of Neronian urbanism. The archaeological excavations have located a portion of the foundation of a portico, and a portion of a sewage system with S-N direction and a foundation with E shape, which defines and closes Elagabalo's Thermae.

In this complex site a series of GPR surveys employing different frequencies were carried out. For the field measurements two different GPR SIR Systems (GSSI); one equipped with a 500 MHz bistatic antenna and the other employing a 70 MHz monostatic antenna, were used. Acquisition was made using a high-resolution approach in which parallel profiles were recorded very closely across the site. Signal processing, image processing, and visualization techniques have been used in conjunction with data modelling, elaboration, and interpretation of the recorded subsurface amplitudes, Fig.1.

B. St. John Lateran Basilica

The Basilica of S. Giovanni in Laterano (St. John Lateran) is the Pope's Cathedral and the first public building constructed for Christian worship. Alongside it

lies the first Baptistery in western Christendom. The complex has been the focus of sundry excavations since the 1730s. These have revealed traces of the earliest phases of both buildings, along with parts of the *Castra Nova* of the Imperial Horseguard, a bath complex and palatial housing. Interpretation of these excavations is, however, difficult; and most are either undocumented or only partially recorded.

The Lateran project is investigating the entire complex to integrate information from standing buildings, excavated structures and sub-surface features. It seeks to understand the stratigraphic, spatial and functional relationships of the different elements underlying the modern complex.

The GPR surveys provide information on the spatial context and identification of phasing of subsurface features while the laser scanning provides a spatially accurate, detailed representation of the many materials, textures and structures of the Lateran and archaeological remains.

During January and July 2012, a series of GPR surveys were conducted below the basilica, inside the archaeological area, and outside the basilica, to demonstrate the potential of this method for this analysis and to locate the expected archaeological structures, Fig.2.

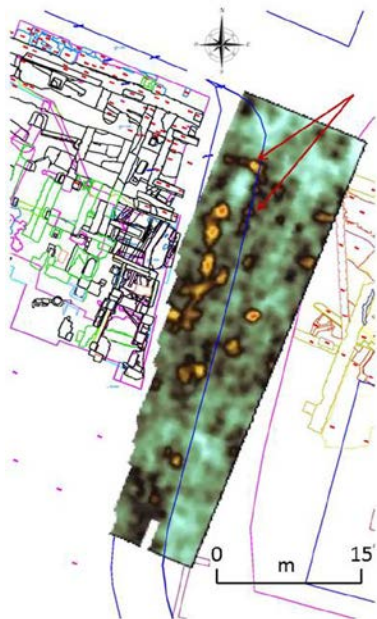


Fig. 1. Coliseum Valley, Rome. Survey 2008. GPR time-slice at the depth of 2.70 m. The arrows indicate the remains of the front of a temple, partially found in the excavated area..

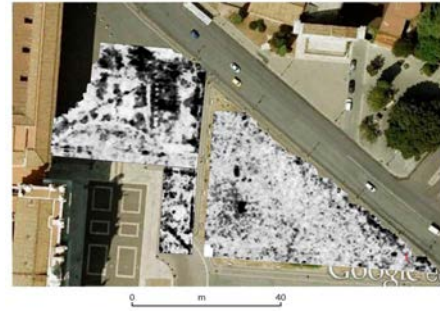


Fig. 2. S. Giovanni in Laterano square. GPR time slices in the time window 58-61 ns twt (estimated depth 2.4 m) for the 400 MHz antenna.

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