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Presses universitaires de Rennes | « ArcheoSciences »

2021/1 n° 45-1 | pages 79 à 81

ISSN 1960-1360
ISBN 9782753585874

Article disponible en ligne à l'adresse :

https://www.cairn.info/revue-archeosciences-2021-1-page-79.htm

ArcheoSciences
Revue d'archéométrie

45-1 | 2021
14th International Conference of Archaeological Prospection

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OpenEdition Journals

Electronic version
URL: https://journals.openedition.org/archeosciences/8653
DOI: 10.4000/archeosciences.8653
ISSN: 2104-3728

Publisher
Presses universitaires de Rennes

Printed version
Date of publication: 16 August 2021
Number of pages: 79-81
ISBN: 978-2-7535-8587-4
ISSN: 1960-1360

Electronic distribution by Cairn

CAIRN.INFO
CHERCHER, REPÉRER, AVANCER.

Electronic reference
Stephen Kay, Ian Haynes, Paolo Liverani, Salvatore Piro, Elena Pomar and Gianfranco Morelli, "Urban Investigations in the Heart of Rome: The Rome Transformed Project", *ArcheoSciences* [Online], 45-1 | 2021, Online since 16 August 2021, connection on 30 August 2021. URL: http://journals.openedition.org/archeosciences/8653 ; DOI: https://doi.org/10.4000/archeosciences.8653

Urban Investigations in the Heart of Rome: The Rome Transformed Project

Stephen Kay [a], Ian Haynes [b], Paolo Liverani [c], Salvatore Piro [d], Elena Pomar [e] and Gianfranco Morelli [f]

Highlights:

- *Investigating the archaeology of Rome between first and eight centuries using non-invasive techniques.*
- *Methodology combining structural analysis, laser scanning, geophysical prospection, drone photography, photogrammetry and environmental coring.*
- *Application of GPR and ERT across 68 hectares in a modern urban environment.*

Keywords: Rome, GPR, ERT, cores, urban.

'Rome Transformed' is a five-year ERC funded research project that began in 2019 with the aim of developing an understanding of Rome and its place in cultural change across the Mediterranean world by mapping political, military and religious changes to the eastern Caelian from the first to eight centuries (see Haynes *et al.,* 2020 for a description of the project). The project has brought together a team of specialists in non-invasive methodologies for the investigation of a complex modern urban environment. Beginning with extensive archival and bibliographic research, the project is conducting detailed structural analysis of all the standing monuments in the area. This includes structures such as the Aurelian Walls, the Claudio-Neronian aqueduct and the Sessorian Palace complex.

A central component of these investigations is the high-resolution geophysical prospection of the study area which covers around 13.7 km^2 in central Rome (Fig. 1). The use of these non-invasive methodologies in central Rome led to several challenges, in particular the significant topographical changes that have occurred since antiquity. To the west, underneath the Basilica of Saint John Lateran (Fig. 1, 1), nine metres of vertical stratigraphy are preserved, ranging from Republican houses at the lower level through to the Castra Nova of Septimius Severus and the Constantine Basilica.

Likewise, there were significant challenges in conducting geophysical prospection in a dense urban area. The majority of the accessible areas were public highways, beneath which lay a range of modern services (gas pipelines, water pipes, electrical cables, sewers, fibreoptic cables), many of which are unmapped. Furthermore, a section of the underground system (the Metro A line underneath Via Emanuele Filiberto, Fig. 1, 2) crosses the study area. The study area has a dense amount of urban infrastructure including tramlines, bus stops, trees and benches as well as dense habitation creating significant electromagnetic disturbance. These factors, together with the complex stratigraphy associated with the many chronological phases in the centre of Rome, required careful planning in order to minimise these effects.

Alongside the geophysics undertaken on the public highways, data has also been collected in the formal gardens

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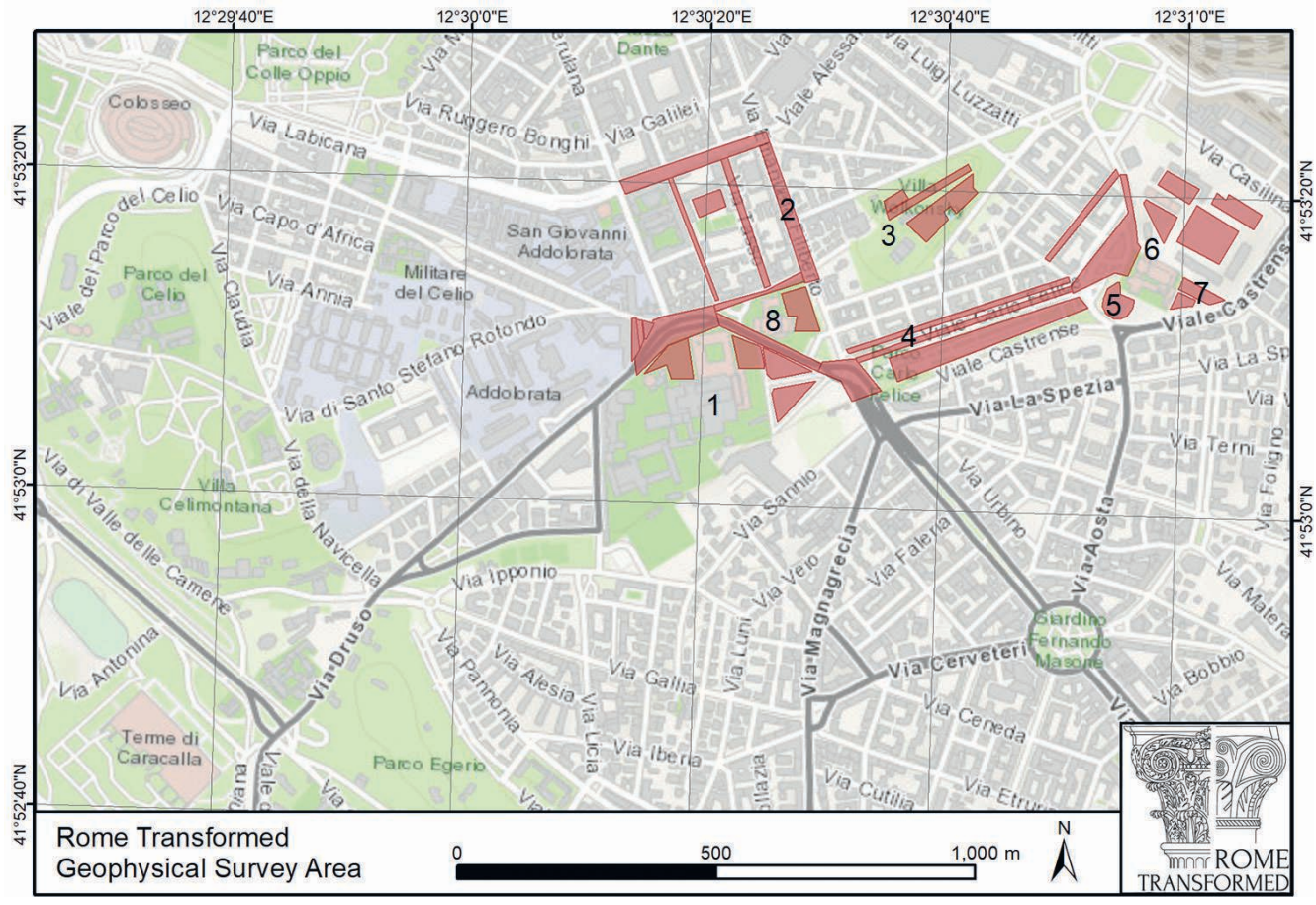

Figure 1. The geophysical survey areas (red polygons) of the Rome Transformed project. 1. Basilica of Saint John Lateran; 2. Via Emanuele Filiberto; 3. Villa Wolkonsky; 4. Viale Carlo Felice; 5. Castrense amphitheatre; 6. Sessorian Palace; 7. Circus Variano; 8. Scala Santa.

of Villa Wolkonsky (the residence of the British Ambassador to Italy and San Marino, Fig. 1, 3), in the local municipal park of Viale Carlo Felice (Fig. 1, 4) and in the open areas around the Basilica of Saint John Lateran (Fig. 1, 1), in total covering an area of around 68 hectares. The geophysical research builds upon initial GPR work conducted both inside the basilica as well as to the north and east (Piro *et al.*, 2020) which used a 400 MHz bistatic antenna and a 70 MHz monostatic antenna. The results to the east, at an estimated depth of 1.35 m were of great interest as an apse structure was recorded, potentially part of a *triclinium* built on the order of Pope Leo III around AD 800. However, as limited data was collected beyond this depth, the Rome Transformed project has used a range of GPR antenna frequencies and ERT in order to investigate the deeper deposits.

The GPR surveys have used both single antennas as well as motorised multiple antennas. In restricted areas, such as inside the Castrense amphitheatre (Fig. 1, 5) a single 400 MHz antenna was used (Fig. 2), whereas in more open areas, such as parts of the Sessorian Palace complex (Fig. 1, 6), it was possible to use a 70 MHz (Subecho Radar) monostatic antenna. The surveys along the public highways used the multi-channel, multi-frequency IDS Stream Up GPR system, equipped with 20 antennae at 200 MHz and 10 antennae at 600 MHz. The system allows for rapid data collection, compatible with moving through traffic in Rome where closure of roads for data acquisition was unfeasible.

The Rome Transformed project has also made widespread use of ERT to investigate areas of deep and complex stratigraphy (Fig. 3). Areas that were targeted include the municipal park inside the Aurelian Walls, parts of the circus at the Sessorian Palace (Fig. 1, 7) and the gardens of the Scala Santa (Fig. 1, 8). Previous environmental coring, as well as recent work ahead of the new Metro C underground, has revealed these area as having a deep stratigraphy with Roman levels recorded over 10 m below the modern ground surface. ERT has also been used to supplement and enhance the

Figure 2. 200 MHz GPR survey in the area of Santa Croce, Rome.

Figure 3. ERT and GPR survey in the area of Santa Croce, Rome.

results of the GPR surveys, an important addition in areas where there was significant attenuation of the GPR signal.

This paper, as well as presenting preliminary results of the geophysical surveys, will also discuss some of the solutions for geophysical prospection in complex urban environments. For the study of the Eastern Caelian, the collation of information regarding previous excavations has been fundamental, which has been greatly assisted by a collaboration with the municipal authority archaeological service and access to their ArcheoSITAR database. Through the combination of this GIS data together with plans of known locations of buried services and bibliographic information, it was possible to adjust the techniques in accordance with the local conditions. Complementary information that will also be obtained from a new campaign of targeted environmental coring, providing fundamental data concerning the subsurface layers and the depth of features. This information, together with data from laser scanning and drone recorded SfM, is being managed within a 3D environment in order to maximise the 3D nature of these datasets.

In conclusion, whilst the aim of the Rome Transformed project is to better understand the eastern Caelian between the first to eight centuries, the scope of the project allows the application of a range of geophysical techniques in a unique and complex urban environment. The methodological approach requires a detailed examination of many external factors prior to the field survey to limit disturbance, in order the techniques and their settings can be tailored to the environment. Such an approach, often combing different techniques, has allowed the project to begin to build a detailed understanding of a crucial area in central Rome.

Acknowledgements

The geophysical surveys are conducted by a joint team from the British School at Rome, the Consiglio Nazionale delle Ricerche and GeoStudi Astier led by Stephen Kay, Salvatore Piro and Gianfranco Morelli. The project is funded as an Advanced Grant by the European Research Council (ERC) under the European Union's Horizon 2020 research and innovation programme (grant agreement no. 835271).

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