

New data from an urban archaeology project on a medieval town site. High-resolution GPR surveys in Piazza delle Carceri, Prato (Florence, Italy)

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GEOPHYSICAL SURVEY

GPR surveys were performed, employing the SIR3000 (GSSI) to investigate selected areas in the Piazza delle Carceri. The instrument was equipped with a 400 MHz (GSSI) bistatic antenna with constant offset and a 70 MHz (Subecho Radar) monostatic antenna. The horizontal spacing between parallel profiles at the site was 0.50 m, employing the two antennas. Radar reflections along the transepts were recorded continuously, with different length, across the ground at 60 scan s⁻¹ for 400 MHz antenna and at 30 scan s⁻¹ for 70 MHz; horizontal stacking was set to 3 scans.

In the investigated area (A-B-C, in Fig. 1), a total of 303 adjacent profiles across the site were collected alternatively in forward and reverse directions, employing the GSSI cart system equipped with odometer. All radar reflections within the 105 ns for 400 MHz antenna and 185 ns for 70 MHz antenna (two-way-travel) time window were recorded digitally in the field as 16 bit data and 512 samples per

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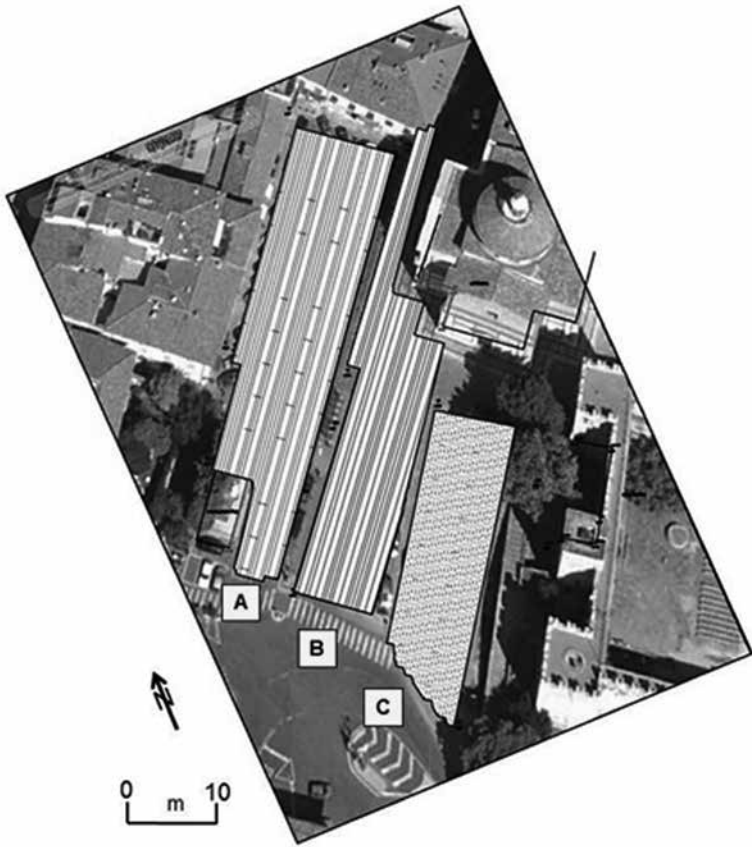


Fig. 1. Prato, Piazza delle Carceri. Location of the A-B-C area, investigated with the GPR system

radar scan. A nominal microwave velocity of about 8 cm/ns was determined from fitting hyperbolas to the raw field data. This was used in estimating a penetration depth for GPR survey.

All the GPR data were processed in GPR-SLICE v7.0 Ground Penetrating Radar Imaging Software (Goodman 2013). The basic radargram signal processing steps included: (i) post processing pulse regaining; (ii) DC drift removal; (iii) data resampling, (iv) band pass filtering, (v) migration and (vi) background filter. With the aim of obtaining a planimetric vision of all possible anomalous bodies, the time-slice representation technique was applied using all processed profiles (Goodman and Piro 2013). The squared amplitudes were averaged horizontally every 0.25 m along the reflection profiles 4 ns (for 400 MHz antenna) and 6 ns (for 70 MHz antenna) time windows (with a 10% overlapping of each slice). The resampled amplitudes were gridded using the inverse distance algorithm with a search radius of 0.75 m.

Time-slices (in depth windows from 0.40 to 0.60 m for the 400 MHz antenna) are shown for the investigated area (Fig. 2). Individualized anomalies on this map are correlated with structures located in the archaeological excavations in sectors D and E.

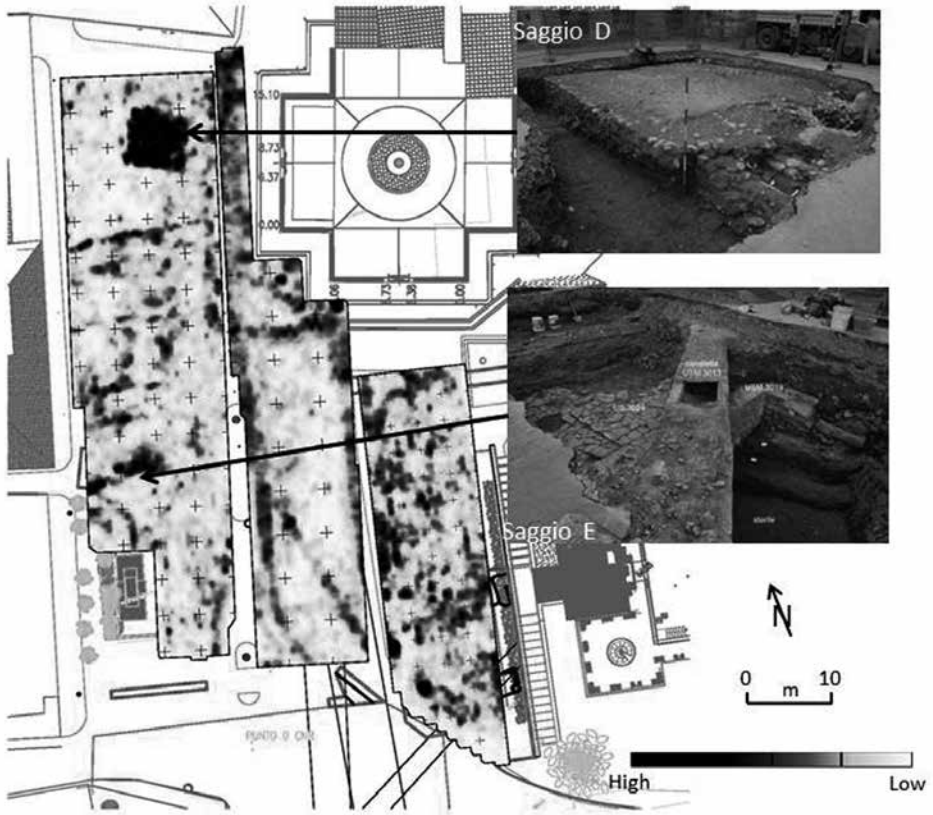


Fig. 2. GPR time-slices, in depth windows from 0.40 to 0.60 m for the 400 MHz antenna. On the right, two views of ongoing archaeological excavations

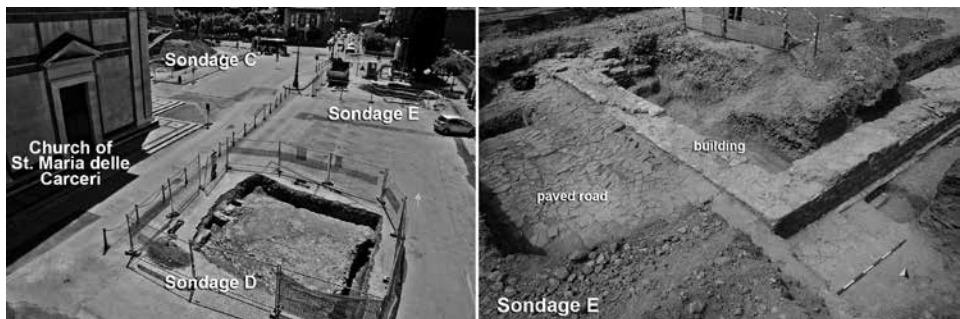


Fig. 3. Prato, Piazza delle Carceri. Archaeological sondages C-D-E

ARCHAEOLOGICAL RESULTS

To summarize, archaeologists tested three areas of particular interest (Fig. 3). In the first area (sondage D), a quadrangular structure was found, well visible in the geophysical survey. It has been identified as the basement of a big wooden winch, probably used for the construction of the Santa Maria delle Carceri church at the end of the 15th century.

In the second area (sondage E), a stretch of paved road was found, aligned E–W, running to the Palazzo Banci where another paved road and a house were excavated in 2003–2006. The paved road in Piazza delle Carceri was found at a depth of 1.15 m; it measured 3.30 m in width and was only a few centimeters thick. The house near the paved road was a large residential building, probably a former tower transformed into a *domus* and then abandoned in the first half of the 14th century. Archaeologists matched data from the geophysical survey (two walls were recognized) and the excavation, and were able to reconstruct the original dimensions of the *domus*, that is, 7.45 m by 11 m.

In the third area (trench 1 and sondage 2-2b), a second paved road aligned N–S was found. It is of great importance for the history of the medieval town of Prato owing to its construction technique and size (5.30 m wide). This road just a few centimeters thick and located at a depth of 1.50–2.20 m has been recorded for a length of 38 m.

The excavations have been backfilled and data processing is still in progress. The results have been extraordinary with new archaeological evidence of fundamental significance for the pluriannual project of urban archaeology dedicated to Prato. The documentation will help in designing a new museum for the medieval town.

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