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A GPR Study in the Roman Villa of Tourega, Portugal

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SUMMARY

Several radar surveys were conducted on the site of the Villa Romana da Tourega with a Sensors and Software ground penetrating radar (GPR). The main objective of the work was to test new GPR acquisition method. For this purpose, this site is ideal as it offers already excavated structures and very clear evidence of still buried continuation of these structures. For a successful completion of the tests in a timely manner it was necessary to have a high degree of certainty that buried structures were indeed present in the selected area. Only a portion of the results obtained during the field work are shown.

Introduction

In the process of locating and mapping the most appropriate archaeological site for testing new ground penetrating radar (GPR) acquisition techniques, a subsurface survey of the surroundings of exposed structures was conducted in the Villa Romana da Tourega, near Evora, Portugal.

A summary of the results of these surveys is presented here as they contain useful information on the location and possible extension of still buried structures.

The location and depth information is of sufficient quality to be used in the planning of future excavations and in the planning of more extensive geophysical surveys with the sole objective of mapping archaeological remains.



Figure 1 Picture of the remains of the Villa Romana of Tourega about 12 km southwest of the town of Evora in central Portugal.

Method

A Sensors & Software Noggin 500 MHz GPR system was used for the main subsurface mapping survey. The survey was constrained to an area delimited to the North and West by the fence enclosing the archaeological site, to the East by the excavated site itself and areas of high grass and thick shrubbery, and to the South by another fence and zones of slightly more abrupt topography.

To make the acquisitions more convenient, a grid was laid out interdependently of the archaeological grid and subdivided in several square or rectangular sub-grids. The most common line spacing used was 1 m, which is generally too coarse for 500 MHz data but was sufficient in our case for locating test areas. Three sub-grids were re-acquired using a more appropriate 0.50 m line spacing to assess the reliability and resolution degradation of the main data set. GPR lines were collected in both orthogonal directions (X and Y); the X axis approximately corresponds to the N-S direction and the Y axis approximately corresponds to the E-W direction. The radar antennas were dragged directly on the ground and data acquisition was generally complicated by the high grass. A regular progression in a straight-line was difficult to achieve, and a consistent and even pacing of the profiles was hard to maintain throughout the survey. This inevitably results in a degraded positioning accuracy which is difficult to quantify. Overall, the 500 MHz data consist of a total line length of 2,180 m in the “N-S”

direction and 1,470 m in the “E-W” direction, plus an additional 220 m for the slanted grid. This represents a total of 3,870 m.

A maximum time window of 75 nanoseconds (ns) was used, which, based on average wave velocity, corresponds to a maximum depth of investigation of approximately 3.5 m. 200 MHz and 500 MHz common-offset and 200 rapid multi-offset data were collected for processing experiments. Processing was standard and consisted of dewowing, time-zero shift, spherical and exponential gain, bandpass filtering, and fk migration.

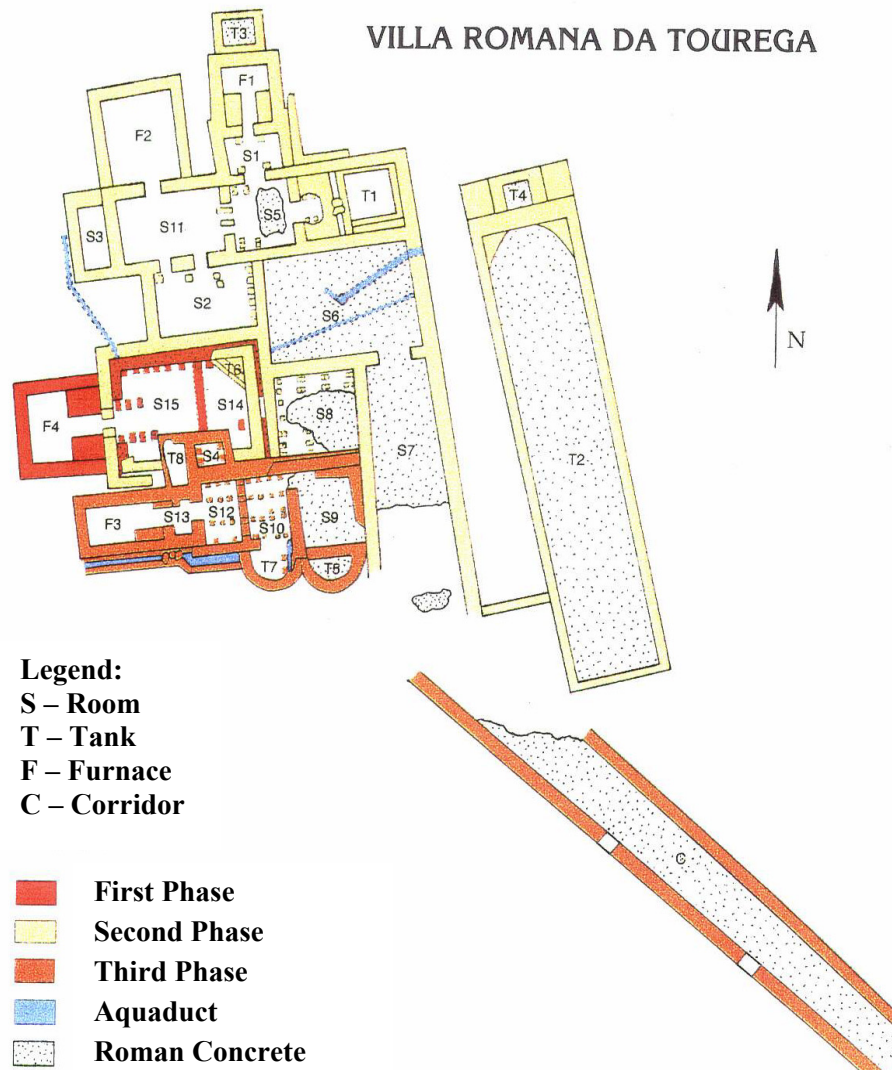


Figure 2 Cartoon of the excavated portion of the site. There were three main phases of construction which are represented by a different colour.

Some results

The Fig. 3 and 4 show time slices for 8 and 10 ns, respectively. A velocity of 0.12 m/ns was used.

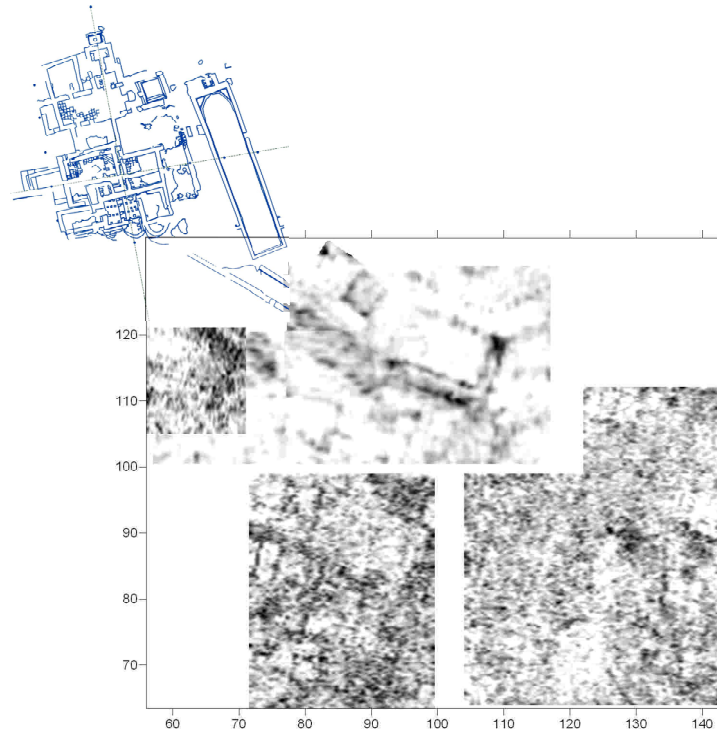


Figure 3 Collage of the sketch of the excavated area and 8 ns (about 0.48 m depth) GPR slices for different areas surveyed. Distance in m.

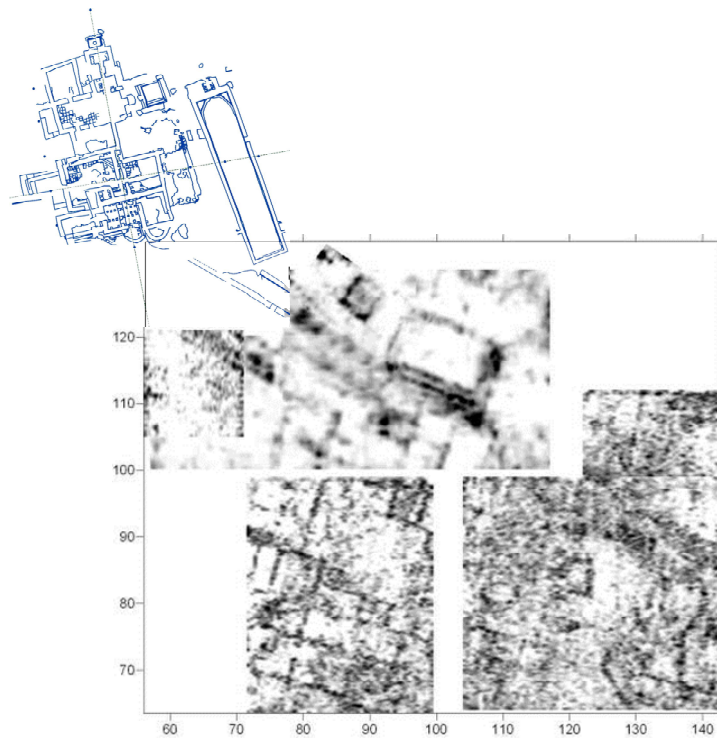


Figure 4 Collage of the sketch of the excavated area and 10 ns (about 0.69 m depth) GPR slices for different areas as in Fig. 3. Distance in m.

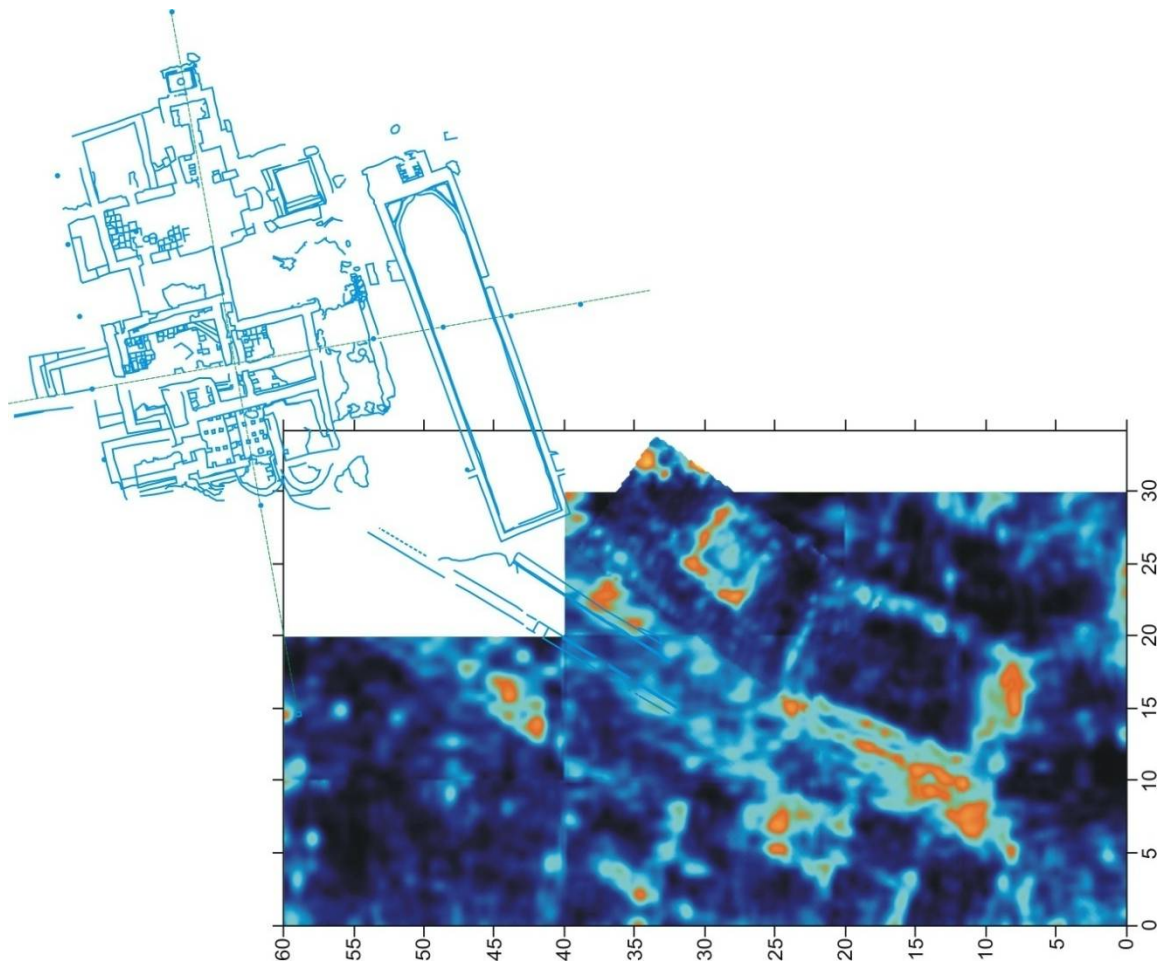


Figure 5 Colour detail of Fig.4. The continuation of the structures already excavated is obvious. Distance in m.

Conclusions

The most obvious result is that GPR has proven successful in imaging buried stone structures at the Tourega site. GPR is used fairly routinely for the prospection and study of Roman period sites in areas with well developed soils and sedimentary bedrock, mostly in Northern Europe. The success in the case of structures built directly onto granitic bedrock with relatively little soil was not assured. The Tourega results are therefore important as they demonstrate that this technique can be used very effectively in a wider variety of conditions. An abundance of buried structures can be seen in direct connection with the end of the current excavation (Fig. 1). The corridor does seem to end at the end of the excavation; it appears to be connected to another structure that makes an angle with it. It is clear that the south fence does not mark the end of the site in this direction. There is an obvious continuation of the structures S and W of the fence. The continuation of the structures to the E of the surveyed area is not so obvious but is likely. The results by themselves provide very clear evidence that significant structures will be found if the excavation is resumed. If desired, they can help provide a very strong case for obtaining support for new excavation work.

Acknowledgements

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