Hidden histories of Roman towns

Seeing beneath the surface of Falerii Novi and Interamna Lirenas

PHOTO: L Verdonck

How can we unpick the development of Roman towns? Even large excavations only open up modest areas, while traditional geophysical survey superimposes countless different phases of activity. But now ground-penetrating radar (GPR) has come of age, it can provide a virtual slice through the underlying soil. **Giovanna Rita Bellini, Alessandro Launaro, Martin Millett, Lieven Verdonck**, and **Frank Vermeulen** provide a breathtaking new view of the Roman towns of Falerii Novi and Interamna Lirenas.

A big issue for archaeologists interested in the Roman world is the origin and early development of the towns and cities on which the Roman system of government relied. Excavation is limited both by the sheer scale of the towns, and by the fact that the earliest deposits lie deep beneath the often monumental remains of their later phases. This is especially true for towns that have remained in continuous occupation ever since. For these reasons, there has been a developing tradition of using archaeological remote-sensing to examine Roman urban sites that have since been abandoned and now lie beneath agricultural land.

About 20 years ago, the first complete plan of such a Roman town was obtained through the use of magnetometry survey at Falerii Novi, a city founded in the 3rd century BC in south Etruria – about 50km north of Rome and close to the town of Civita Castellana. There, a survey led by Simon Keay and Martin Millett with the British School at Rome produced an exceptionally clear plan of the whole town, enabling us to understand many new things about its layout, and to think about its original plan and subsequent

ABOVE Today, the site of Falerii Novi is dominated by the farm and church established in a former monastery. Under the fields lie the buried remnants of a Roman city founded in 241 BC. Although excavating the urban area would be prohibitive in terms of time and funding, ground-penetrating radar offers the key to understanding the relationship between these buried buildings.

development. In the period since that survey, many other urban sites have been extensively surveyed, providing a wealth of new information about Roman urban systems. Notable successes have included the large-scale survey of Rome's harbour complex – Portus – at the mouth of the Tiber, and the extensive urban remains at Aquileia at the head of the Adriatic Sea, but a wealth of other sites have been explored and published too.

Despite these successes and the widespread use of magnetometry as an effective method of rapid survey, it has limitations as a technique for the exploration of Roman towns. First, as it measures minute variations in magnetism, the technique does not always produce results as clear as those from Falerii Novi, since different building materials produce stronger or weaker magnetic signals, and these can be masked by signals from the underlying geology or surface interference. Second, the image that is produced from magnetic surveys is effectively two-dimensional, and thus provides an aggregate picture of the various structures, which are not differentiated by date. Although a skilled interpreter of such images can infer a sequence and make suggestions about the identification, phasing, and dating of the visible structures, this evidence is not always reliable and generally needs some form of verification. Hence, although we now have a large number of good magnetic surveys on Roman cities, they have been less useful in revealing aspects of their early histories than might have been hoped.

While this revolution in survey practice has been taking place, technical developments have gradually been improving the performance of other types of geophysical survey and remote-sensing methods. So developments in the use of satellite and aerial photography, as well as LiDAR, have become increasingly widespread, with notable work done by Ghent University on sites in the Potenza Valley in eastern Italy, complementing the use of magnetometry. Slower, ground-based survey methods have also been developed further, with interesting new results from the use of electrical-resistance survey for looking at features beneath the surface in three-dimensions.

Creating time-slices

The most spectacular progress, however, has come with the development of ground-penetrating radar (GPR). This method has been in use since the 1980s and involves sending a radio pulse into the ground and measuring the signals returning to the sensor as they are reflected back by buried features. It is an approach that has the great advantage of being able to distinguish buried features at different depths – in other words, producing a 3D image of the buried archaeology. However, in early work with this method, the results were limited by two factors. First, speed: with an antenna dragged or wheeled across the surface, it was necessary to make a series of closely spaced passes across a site, so the process of survey was very slow and laborious. Second, processing the results in order to see the archaeology required complex analysis and the results produced were not easy for the non-specialist to understand.

In recent years, several research teams have been developing the use of GPR, benefiting from the advantages of combining a series of sensors mounted on a cart towed by a quad bike, with accurate surveying using satellite positioning systems, and fast and powerful computing to process the results. This means that the reflected radio pulses can be processed to provide 'time-slices' – images that show plans of the buried features at different depths below the surface. Such developments now make it possible to think about surveying large areas – for instance, whole Roman towns – at very high resolution. This offers the potential of mapping Roman urban sites in a way that may help us to understand their origins and early development rather better, which is the aim of the work we have been doing in Italy for the past three years.

Our team (funded by the AHRC) comprises archaeologists from the Faculty of Classics in Cambridge and the Department of Archaeology of ▸

BELOW An aerial view of the site of Interamna Lirenas. Here, degradation over the centuries has been so severe that some had wondered whether the site should really be classed as a town at all.

PHOTO: G Murro

Ghent University in Belgium. Dr Lieven Verdonck, at Ghent, has been developing a multiple-channel GPR array that can take readings over large areas at 6cm spacing, and produce very high-quality images of the buried archaeology. In practice, doing this over large areas of arable land can be tricky – rain can cause problems, if we want the best results, since soil moisture (in combination with the presence of clay minerals) can attenuate the GPR signal, and it is also very important for the sensors to have good contact with the ground surface. It has thus been vital to wait for the ground conditions to be optimal for survey, even in Italy. Our initial response to the problem of ground contact was to arrange to cut the vegetation short and remove stones and other debris by hand – a very laborious process. We have now adopted a different method, using a road roller to push stones back into the surface topsoil after the vegetation has been cut. We are claiming this as the first use of the road roller in archaeological research!

The two town sites chosen for our work are both cites founded in Italy in the mid-Republican period. Falerii Novi, where we completed our large-scale magnetometry survey in 1998, is one of the sites. This was established by Rome after their defeat of the Faliscan revolt in 241 BC, but the exact nature of the town they founded has remained uncertain. Its impressive Republican town walls now surround an area of farmland occupied only by a church and former monastic buildings used as a farm. Remarkably, there has been little excavation here, with the exception of work in the early 19th century and a large trench excavated in the 1960s.

Our other site, Interamna Lirenas, lies in the Liri valley about 100km south of Rome, not far from Monte Cassino. A Roman colony was established there in 312 BC following the Roman conquest of the area. Today the site is occupied by arable fields, on a slight ridge between two streams, with the course of the Roman via Latina running along its axis. There has been little past archaeological work here and, unlike Falerii, there are no major visible structural remains. Indeed, the paucity of evidence for monumental buildings had led some to wonder whether it should be classed as a town at all. The University of Cambridge began research at Interamna in 2010 in collaboration with the Italian Soprintendenza and soon completed a full magnetometry survey of the settlement. Although the results were less spectacular than those from Falerii, it was clear from the range of structures present that Interamna deserved its urban status. Small-scale GPR work was undertaken by the British School at Rome as part of this project in 2012-2013, leading to the identification of a hitherto unknown roofed theatre that we excavated from 2013 to 2017. Both Roman towns are relatively small in size, under 30ha in extent, and our aim was to complete GPR surveys of the whole of them both.

The project began in 2015, and we completed the fieldwork in the summer of 2017 with outstanding results. There is so much new information provided by these surveys that it is impossible to do full justice to them both here. At a general level, what is remarkable is just how much can be seen when such surveys are done at very high resolution – in our case with measurements taken every 6cm across

BELOW The GPR technique is based on the reflection of electromagnetic waves at transitions between materials with a different moisture content (a). The instrument measures the amplitudes and travel times of the reflected waves, resulting in a trace (b). Traces measured at regular distances produce a vertical profile (c). By combining several parallel profiles, horizontal slices can be extracted at different depths (d-e).

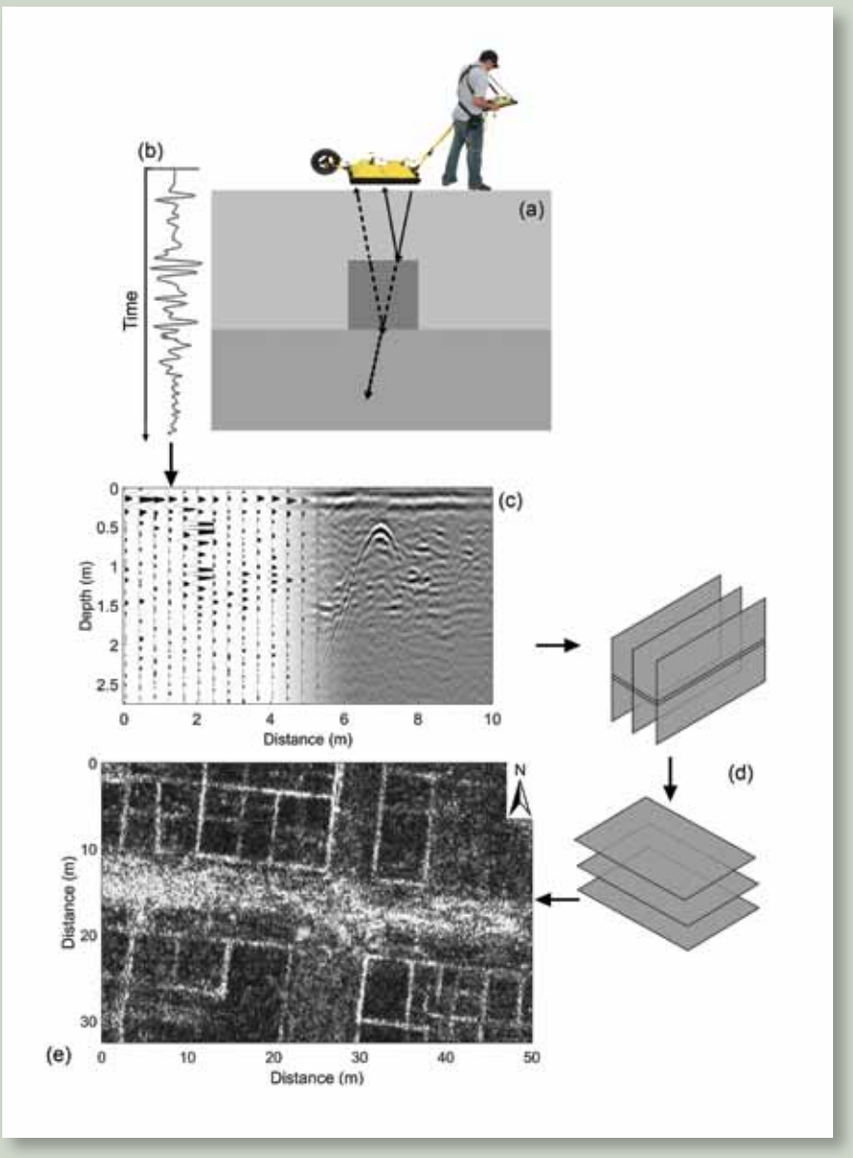


IMAGE: Sensors & Software, Canada and L Verdonck

PHOTOS: M Millett

the whole of both towns. The two sites can be used to illustrate complementary strengths in the evidence.

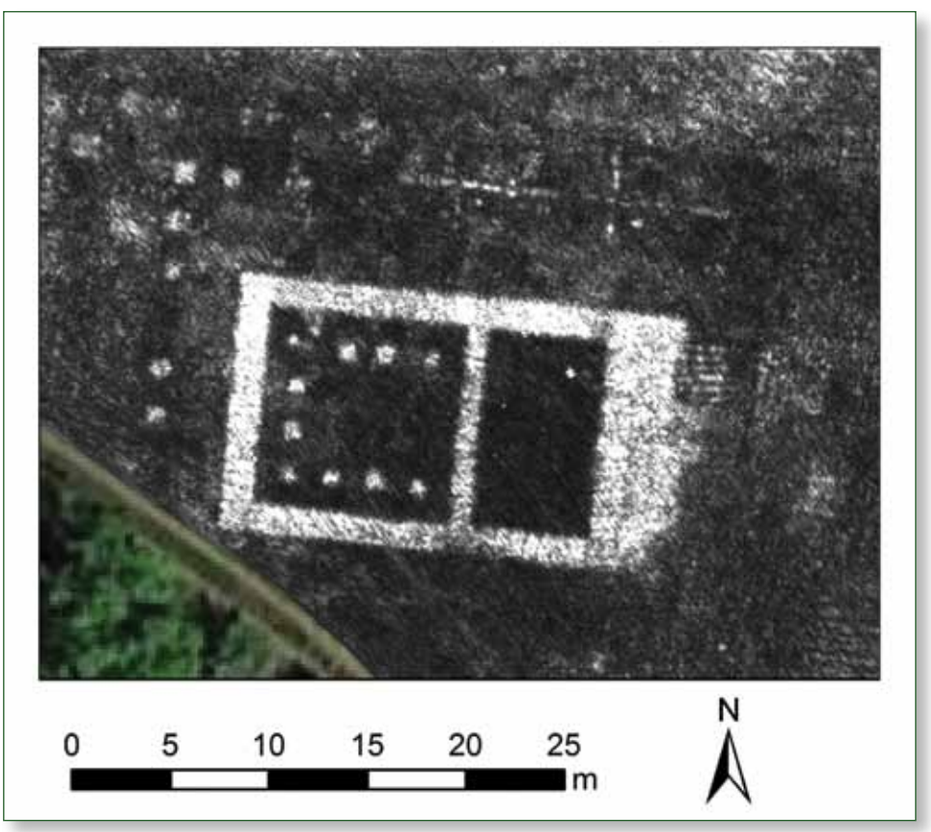
Falerii Novi

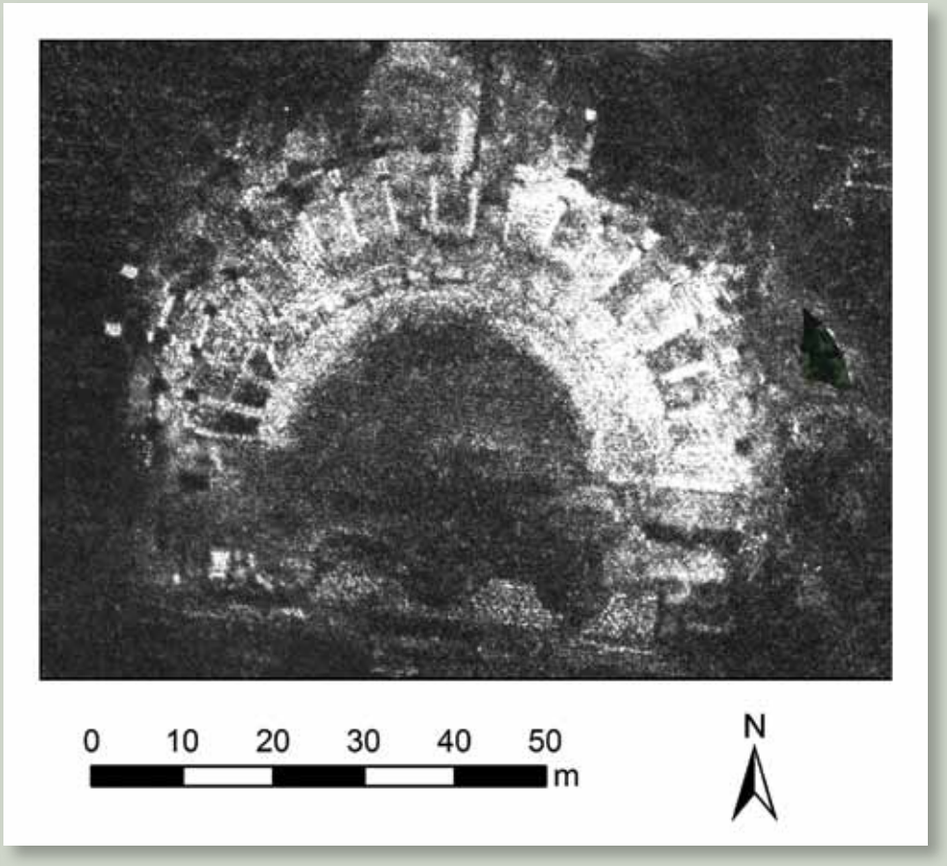
In the absence of modern excavation, our evidence for the town comes almost exclusively from geophysics. The 1990s magnetometry survey revealed the overall layout of the original town with its regular primary block of streets, and it also suggested how this had expanded in later periods, filling the area between the original grid and the town walls. That survey also revealed unexpected details, especially the course of an irregular street that ran around three sides of the initial town grid, a short distance inside the walls. Along this street, we identified a series of temples spaced around the town. The GPR survey provides very detailed new evidence for the layout of these temples, and has also resulted in the identification of another one, just beside the gateway through which the via Amerina from Rome entered the city.

Elsewhere the magnetometry and GPR reveal complementary views of the site. The forum and associated structures were clearly comprehensible in the magnetometry survey, but certain elements – especially the shop units surrounding the forum show up poorly in the GPR. However, the GPR provides excellent new detail of the temple and associated buildings at the east end of the forum, while also demonstrating that a street we previously thought pre-dated the forum must be late Roman or post-Roman, as it can be seen to have been built across the top of the temple. Similarly, the details of the layouts of a number of houses in the centre of the town, as well as the structure of the theatre, are revealed in incredible detail by the GPR survey. With the houses, on the basis of the magnetometry, we had suggested that the original system of land allotment could be discerned. Although we are at an early stage in interpreting the GPR, it is now very clear that this is indeed the case, allowing us to piece together the structure of the original urban foundation.

The GPR at Falerii has also produced a series of surprises, revealing big buildings that did not show up in the magnetometry. Notable are the baths complex with its octagonal central hall, a probable *macellum* or market hall, and a substantial three-sided portico set just inside the North Gate. This has a pair of internal structures, perhaps nymphaea, but its overall function remains uncertain.

ABOVE LEFT The multiple-channel GPR array employed by the project, utilising a cart towed by a quad bike. ABOVE RIGHT Is this the first use of a road roller in archaeological research? Here it is in action at Interamna Lirenas, ensuring the GPR sensors achieve good contact with the ground surface. BELOW GPR survey has revealed a previously unknown temple (seen here at a depth of 110-115cm) at Falerii Novi, just beside the road linking the city with Rome.





ABOVE The theatre at Falerii Novi, as seen at a depth of 80-85cm. The curved seating for spectators, D-shaped orchestra, and the *scaenae frons* or ornate backdrop to the stage are all clearly visible.
LEFT The recently discovered theatre at Interamna Lirenas: (top to bottom) the results of the 2010-2012 magnetometry, the GPR time-slice (depth: 66-70cm), and a plan based on the information revealed by the excavation (2013-2017).

These examples illustrate how our work has completely remapped the town, and contributes a new dimension to the understanding of Roman urban centres more generally.

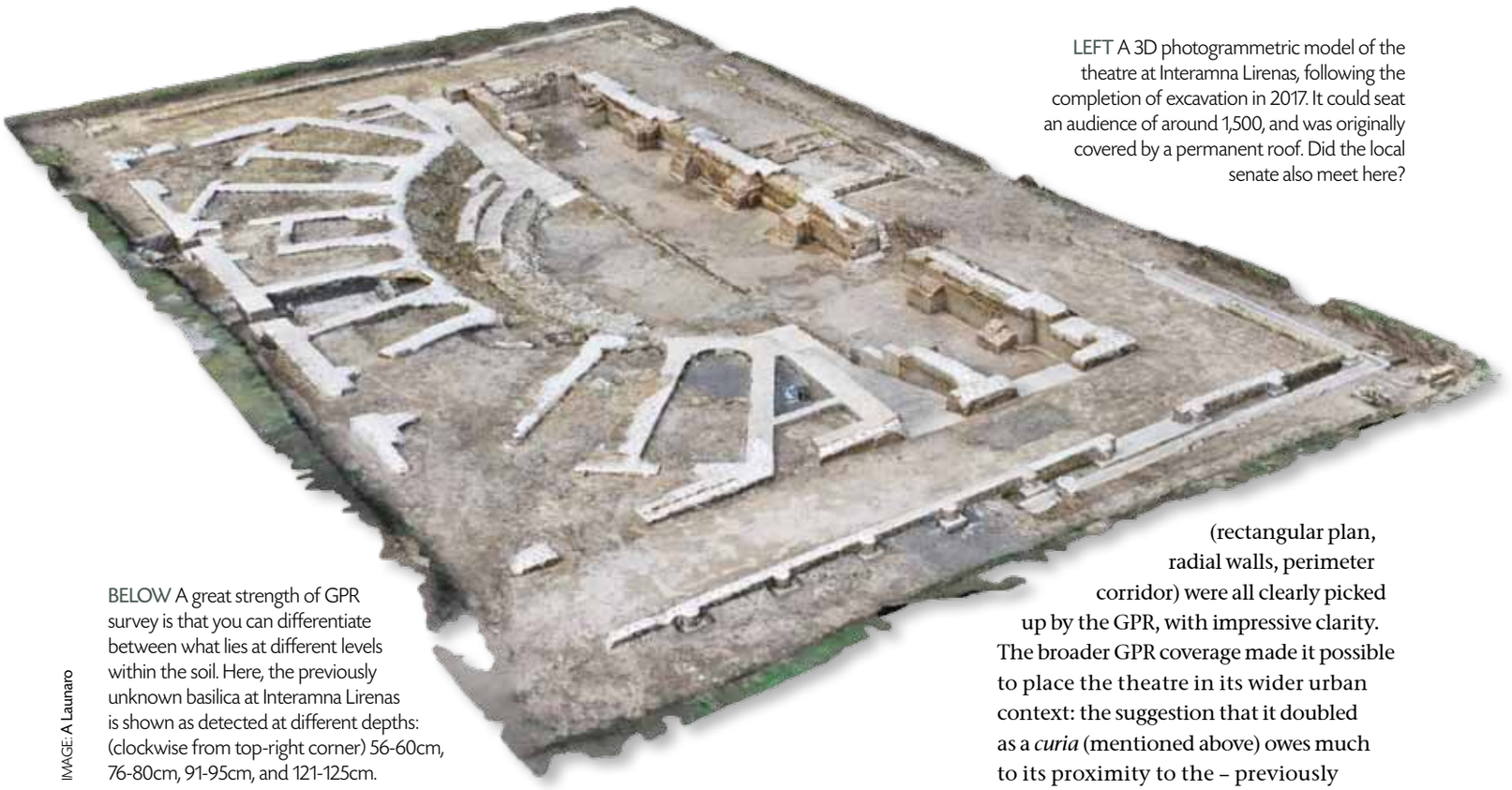
Interamna Lirenas

At Interamna, the GPR survey has been integrated with a broader study of the town and its immediate hinterland, including excavation, and so illustrates how this sort of GPR survey can enhance a project. Although the results were less spectacular than those from Falerii, they helped establish the overall street layout and the location of the forum, also detecting the presence of one large building at its north-western corner. The GPR, by contrast, does not show the streets very well, but provides excellent details of the structures, and has also identified the presence of a previously unknown town wall.

Of key importance has been the identification of the forum and basilica, as well as the adjacent theatre. The layout of this public centre of the town is now clearly understood, and finds parallels with other mid-Republican foundations in Italy. The basilica is particularly clearly visible in the GPR survey, as was the theatre.

Thanks to a collaboration with the Comune and the Soprintendenza, we have been able to excavate the theatre, bringing to light its entire plan over seven fieldwork seasons (2013-2017). The main hall covers 45m by 26m, and could have seated an estimated 1,500 spectators: it features eight pairs of brickwork pillars along its long sides, originally supporting a roof spanning about 24m across. Interamna's theatre was a *theatrum tectum* (or *odeum*), an architectural type that was relatively less common than its open-air counterpart. Given its vicinity to the forum, it is quite possible that the building doubled as a venue for the assembly of the local senate (*curia*). The main hall was also surrounded on three sides by a covered corridor, acting as both a passageway and an elegant reception space, bringing the overall size of the building to 55m by 31m. The theatre dates to the last decades of the 1st century BC – during the Augustan period – but must have undergone at least one further construction phase later on, when the stage (*scaena*) was radically altered with the addition of a rich architectural decoration (*columnatio*). This latter development might have been made possible by the generosity of a wealthy freedman (a certain Anoptes), whose name features prominently on a large inscription found inside the theatre.

This excavation provided an excellent opportunity to appreciate the true potential of the most recent GPR survey. Although here the GPR could only penetrate about 1m below the surface because of the high clay content of the soil, within this depth the results were exceptionally clear, allowing the excavation to proceed very effectively because of the accuracy of the survey. The main features of the building



LEFT A 3D photogrammetric model of the theatre at Interamna Lirenas, following the completion of excavation in 2017. It could seat an audience of around 1,500, and was originally covered by a permanent roof. Did the local senate also meet here?

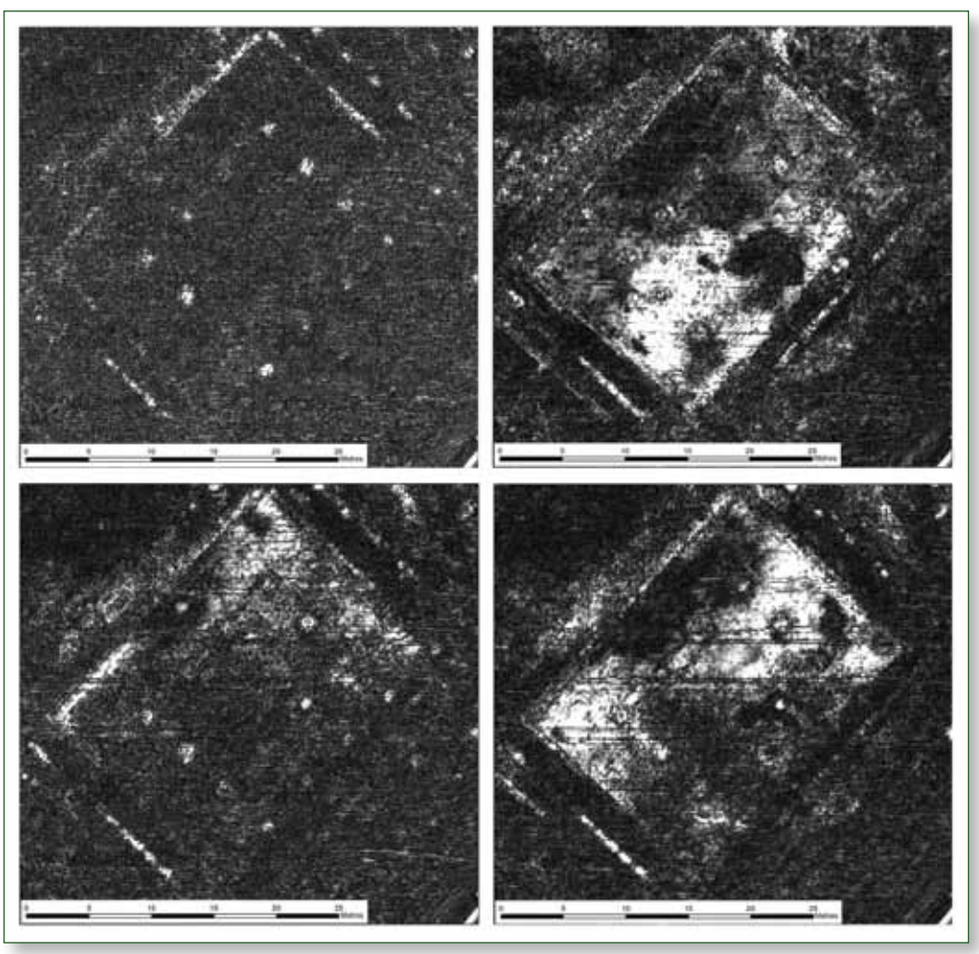


IMAGE: A Launaro

BELOW A great strength of GPR survey is that you can differentiate between what lies at different levels within the soil. Here, the previously unknown basilica at Interamna Lirenas is shown as detected at different depths: (clockwise from top-right corner) 56-60cm, 76-80cm, 91-95cm, and 121-125cm.

(rectangular plan, radial walls, perimeter corridor) were all clearly picked up by the GPR, with impressive clarity. The broader GPR coverage made it possible to place the theatre in its wider urban context: the suggestion that it doubled as a *curia* (mentioned above) owes much to its proximity to the – previously unknown – basilica.

Elsewhere the character of Interamna contrasts with that of Falerii. It was dominated by domestic buildings, including a good number of large townhouses, but there were also a surprising number of porticoed enclosures set back from the streets, which are probably best interpreted as markets. These suggest a much more commercial landscape than within Falerii. The other main contrast is the absence of religious buildings at Interamna. With the exception of one certain temple precinct, the town is remarkably secular in its character.

Broader perspectives

Our work has not only provided a wealth of new information about two particular Roman towns, shedding important new light on their origins and development, but it has also shown that GPR survey has come of age. In the same way that magnetometry advanced to provide spectacular evidence on whole Roman towns in the 1990s, so too can GPR now. We believe that its more widespread use has the potential to change almost literally the landscape of Roman urbanism. ◘