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BUILDING AN URBAN IMAGE

1. Introduction: the need for a geophysical survey of Wroxeter

One of the frustrations of urban archaeology is the inability to view enough of a town's remains to understand the overall layout and nature of its buildings. Often, all that is available provides no more than a key-hole into the construction and plan of the buildings making up the urban form. The interpretation of much urban archaeology can be aided considerably through the application of newly-developed scientific techniques and by the study of those few towns whose historic circumstances have led to their abandonment. The archaeological attractions of such sites are obvious since many are single period and thus provide a clearer understanding of the planning and typical buildings of the period in question.

For Roman Britain, there are three major towns whose near-total abandonment after the early middle ages has meant that they are available for such detailed study. Of these three towns, *Verulamium* (St Albans) and *Calleva* (Silchester) have been extensively excavated, the latter more completely than the former. The third, *Viroconium* (Wroxeter, in Shropshire), is less well understood and presents many opportunities for testing new techniques of archaeological prospecting and reconstruction. A three-year Leverhulme Trust-funded project led by Vince Gaffney and based at Birmingham University is keen to exploit these opportunities.

Viroconium was the fourth largest town by area in Roman Britain, the defences enclosing 78 ha. The southern end of the site is obscured by the modern village which in the mid-19th century consisted of thirty or more cottages covering approximately ten percent of the town's area. Isolated buildings within the town's defences mean that another five percent or so of the town is unavailable for study. Of the remaining eighty five percent of the intramural area, probably only ten percent has been excavated. These excavations have concentrated almost exclusively on the public buildings of the town: the forum and public baths on either side of the main street. Town houses have only been examined on three occasions: in 1912-14 by J.P. Bushe-Fox (1913, 1914, 1916), in 1953-4 by K. Kenyon (1980), and in 1968-9 by A.W.J. Houghton (1969). The last two excavations listed here were limited in scope and scale, precluding the discovery of all but the most obvious structures. Only Bushe-Fox's excavations were on a large scale and provided detailed information about a range of town houses, although one suspects that evidence of the latest periods may not have been recognised. Thus about three-quarters of the town has never been examined archaeologically.

Despite this, the impression given by plans of *Viroconium* is that very

little remains to be discovered. A recent English Heritage reconstruction by Ivan Lapper shows a Roman 'New Town', similar to its modern neighbour Telford, with isolated town houses set in extensive greenery, the centre dominated by the massive public buildings which have been the subject of so much recent study. The painting draws on the only reliable information currently available: a plan compiled from a set of vertical photographs of quite extraordinary clarity taken by the Cambridge University Committee for Aerial Photography (CUCAP) during 1975 (St. Joseph 1977; Wilson 1984). These have been supplemented by the (mostly oblique) photographs taken by Dr Arnold Baker and Jim Pickering.

The plan shows isolated and often substantial houses scattered over much of the town's interior, although smaller-scale and more densely-packed areas are shown towards the centre where the picture is supplemented by the excavated record. That the plan is by no means complete is shown by comparing the drawings of the northern part of the town by David Wilson with the version of the same area published by Philip Barker (Wilson 1984; Barker 1985; Figs.1a, 1b). One might also point out that of over 70 structures identified on the baths basilica site during Barker's excavations (Barker *et al.* in press) only one, the baths basilica itself, was known beforehand and only two (including the basilica) were built of stone. The rest of the buildings were constructed from organic materials and would thus be difficult to detect in air photographs. If this preponderance of timber buildings is in any way typical of the occupation at Wroxeter, then only the most sensitive techniques of archaeological prospection and excavation will detect them.

Even with the present rather basic level of knowledge, assumptions concerning the density of population and its cultural development have been made, based almost entirely on the town plan, itself constructed practically exclusively from aerial photography (Millett 1990, Webster 1991). The limitations of using a single form of evidence to reconstruct the density of occupation on the site are obvious and need not be developed further here. There is a need to improve substantially the quantity and quality of the evidence. Given that the greater part of the site is under the ownership and protection of the state through the agency of English Heritage, Wroxeter presents an ideal opportunity to pioneer techniques for the recovery of the urban form through geophysical prospecting on a sufficiently large scale.

The co-ordination of the work is being carried out by the Wroxeter Hinterland Project (WHP), the aim of which is to assess the impact that the imposition of the town had on the Iron Age landscape, a landscape that does not appear to have progressed towards urbanisation before the arrival of the Romans in the mid-1st century AD (Buteux *et al.* 1993). The importance of reconstructing the type and density of settlement in the town throughout the Roman period is of obvious concern to the project since this is certain to have determined the impact that the town had on its surroundings:

> «we cannot divide the city from the countryside, or the countryside from the city. They are both part of the Roman conceptual landscape» (LAURENCE 1994, 139).

2. THE AIMS OF THE GEOPHYSICAL SURVEY

Given that excavation of 78 ha of urban form is neither feasible nor desirable at the present time, the only practical method of recovery must be through geophysical work. The aims of such geophysical survey would be to determine the relative density of settlement both horizontally, across the town, and vertically to determine changes in the relative density of settlement, and also to detect any pre-Roman or pre-urban archaeology which might survive beneath the town. Given that the town's foundation lies in a legionary fortress of the period between Nero and Domitian, there is also an interest in determining both the impact of this fortress on the ultimate urban form, and in identifying areas of associated civilian settlement which might well have formed the nucleus of the later civitas capital.

A reconstruction of the overall horizontal density of settlement for a given period will enable some estimation of the town's population (although it is evident that such a figure can only be gross). The greater the town's population, then the greater would have been its impact on the surrounding landscape in terms of its requirements for raw materials both for consumption and production.

It has been an important aim of the geophysical campaign at Wroxeter to use as many techniques as possible to examine the site. This is for two principal reasons. First, it is to be hoped that the use of many techniques will generate a picture as complete as possible, and that this picture will be all the fuller through the various technologies which, we hope, will cross-fertilise and inform each other so that the sum of the final image is greater than the constituent parts. Second, through the promotion of Wroxeter as a geophysical test-bed, we hope to pioneer the use of new techniques of geophysical prospection and the testing of new geophysical hard- and soft-wares.

The need for such a test-bed is apparent to anyone working in the field since the unpredictability of geophysical results is notorious. For example, Prof. Paul Young of the Applied Seismology and Rock Physics Laboratory, University of Keele, has suggested that a continuous monitoring of the resistance on the site should be established for one year to investigate any electrical variations that may occur over a period. This could have wider implications in that it might indicate which times during the year might be more productive for resistivity work, thus leading to more accurate results both at Wroxeter and elsewhere.

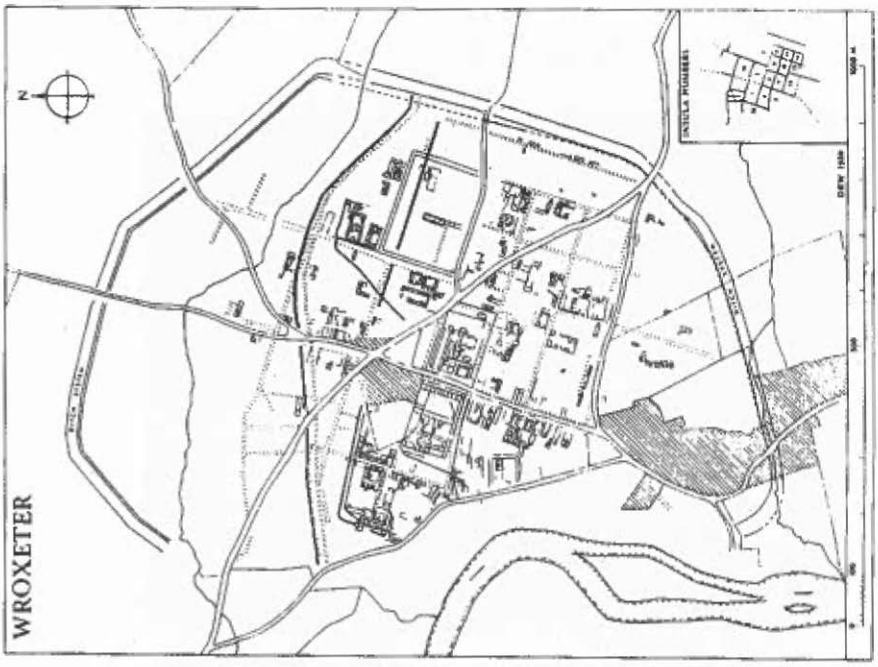
3. Methodology

Whilst the project has been co-ordinated through the WHP, most of the work has been carried out by a number of other organisations. Magnetometry throughout the town has been carried out by the Ancient Monuments Laboratory (AML) and Geophysical Surveys of Bradford (GSB) with smaller supplementary areas being surveyed by teams from the University of Liverpool. All teams have been using Fluxgate gradiometers at 0.25 m intervals. During the 1995 season, up to 40 ha of the town was surveyed using magnetometry, a considerable amount of the area available (Fig. 2).

The University of Keele has carried out work that is more experimental on smaller areas using proton magnetometers. We hope in the future to use a caesium magnetometer since this is a more sensitive instrument in detecting traces of timber buildings. Resistivity was carried out by Centre National des Rècherches Scientifiques (CNRS) at Garchey under the direction of Albert Hesse, using a multi-probe, automated, continuous-reading resistivity meter (Fig. 3). This has revolutionised the speed of survey allowing over 1 ha to be covered in day. By contrast, conventional resisivity survey using an RM15 and RM4 covered only 40 square metres in the same time. Both GSB and Keele have also carried out depth profiling using resistivity along selected transects to examine particular buildings detected in other surveys. A Ground Penetrating Radar (GPR) survey carried out by the National Cultural Properties Research Institute (NARA) led by Prof. Yasushi Nishimura and Dean Goodman of the University of Miami (Japan) produced the largest continuous area ever surveyed using this technique, nearly 3 ha, as well as profiles carried out across specific points on the site to evaluate known deep features such as the town's defences (Fig. 4).

This survey was supplemented later in the season by a smaller investigation by the University of Keele using a shorter wavelength. Finally, further survey was carried out by University of Keele using two types of conductivity meter to produce both area survey and profile data, and GSB carried out selected seismic survey over specific buildings located through the magnetometry work. The last element in the surface survey will be a full earthworks assessment which will be carried out on selected areas of the town, such as the defences, by the Royal Commission of Historic Monuments (England) led by Mark Corney.

To supplement the surface survey technologies, there is also a programme of aerial survey. This will use both conventional oblique aerial photography based on the superb collection of images taken by Dr Arnold Baker between the 1950s and 1980s which supply many otherwise unrecorded details of the known stone buildings of Wroxeter, and on the colour vertical stereoscopic images taken by the National Environmental Research Council (NERC). The same organisation is also responsible for the second arm of the aerial survey



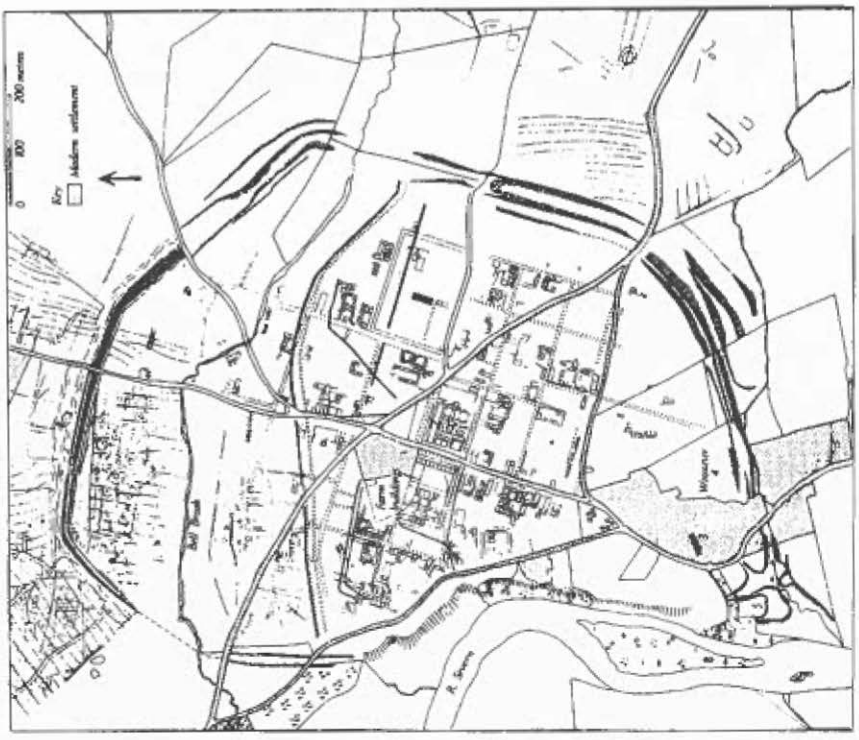


Fig. 1a – Plan of Wroxeter (after Wilson 1984).
Fig. 1b – Plan of Wroxeter (after Barker 1985).

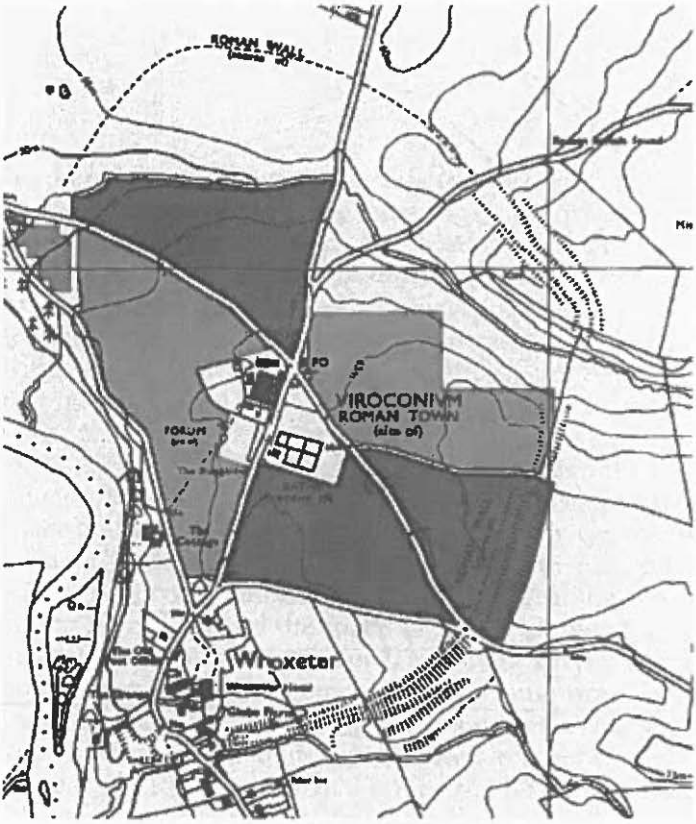


Fig. 2 – Extent of magnetometer survey by the end of 1995.

Fig. 3 – Albert Hesse using CNRS automated resistivity meter.

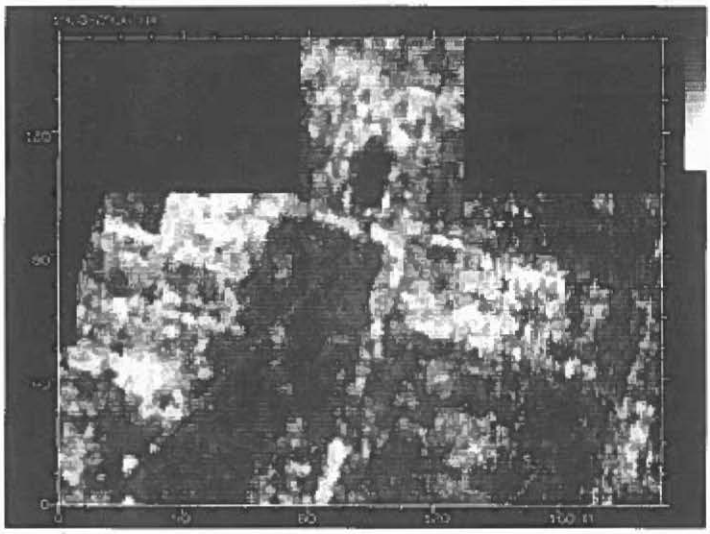


Fig. 4 – Ground Penetrating Radar time-slices through *insula* 10.

which comprises Airborne Thematic Mapping on 11 wavebands, and Compact Airborne Spectrographic Imager (CASI) on 77 bands for greater detail. The raw detail of the improved map of the town will still be based on the series of nine photographs taken by CUCAP in 1975. These have been scanned into the project's GIS system operated by the information technologist on the Leverhulme project, Martijn van Leusen, enabling their manipulation at any scale and level of detail.

They can also be superimposed on the digital terrain model to provide a keener understanding of the local effects of microtopography. Their detail will be further improved by the use of enhancing techniques including directional and Fourier filters which clean and define the buildings by increasing the contrast between the light and dark areas appearing on the photographs, enabling internal features such as partition walls and hypocausts to be identified (Fig. 5). Such enhancements will be of particular value for determining some of the stratigraphic details of the more complex structures. To this base map will be added the detail from the various geophysical surveys which are also being collated and prepared by Martijn van Leusen.

4. Problems

Inevitably with such a complex combination of technologies, there have been a number of problems with the survey carried out this year. Not least of these was the weather which, as ever in Britain, played a full role through creating drought conditions. While this meant that some survey re-

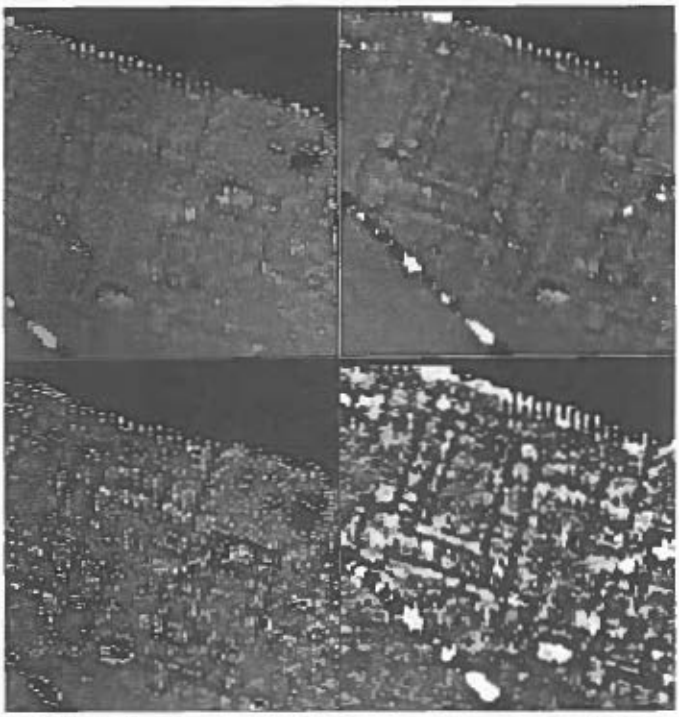


Fig. 5 – Detail of Fig. 6 showing results of computer enhancements of data.

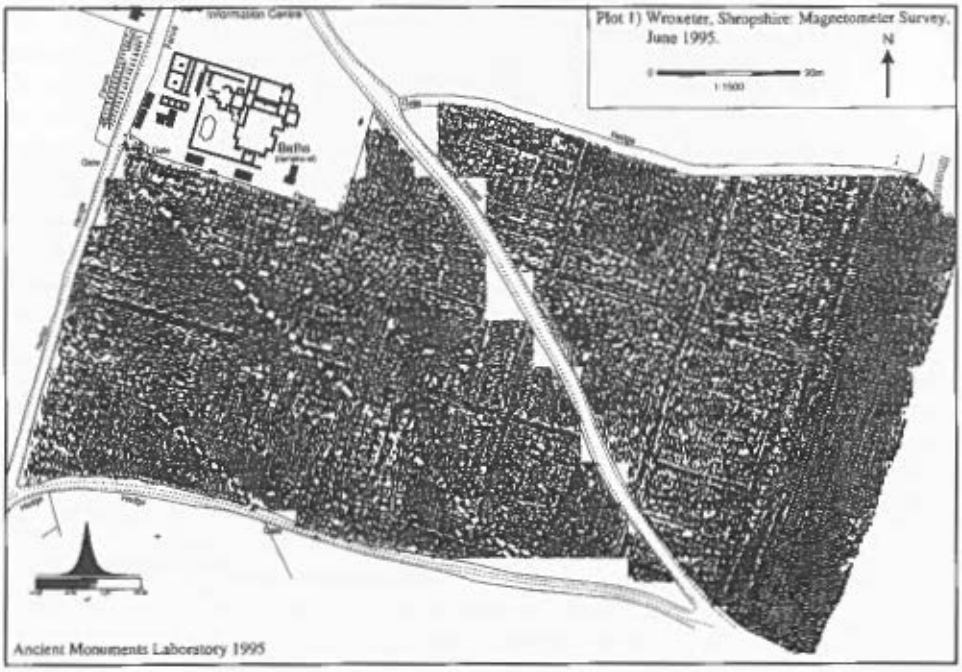


Fig. 6 – Magnetometer survey of *insulae* south of the baths by Ancient Monuments Laboratory.

sults improved (e.g. GPR) others were near useless (seismics and conventional resistivity). Indeed, only the timely intervention of a 12-hour thunderstorm allowed the automated resistivity survey to take place at all! The fact that the survey is programmed to continue throughout the year means that such problems should be kept to an absolute minimum, and should optimise the overall results of the various technologies.

There were also a number of technical problems with the equipment. Given the scale and intensity of work this was inevitable but will have to be taken into account in the future. Another potential problem with such a survey might be the problem of replication of results. Since there were a number of different groups working at different times, there was a great danger that the grid systems used by each survey would not exactly co-ordinate with the overall site grid. It was thus crucial to establish an adequately geo-referenced site grid to allow the easy repetition of survey and localised laying out of the grid. This was achieved by the laying out of 17 individual permanently anchored survey stations by Dr Glyn Barrett of University College London who geo-referenced each station to an accuracy of 3 mm using GPS. This should satisfy any future archaeological and site management requirements.

5. Results

The results of this, the first season of geophysical work on Wroxeter, have been spectacularly successful, not just in the discoveries, but also in the proving of new technologies. The magnetometry results in particular were of extraordinarily high quality with three new insulae added on the east side of the town and an extremely dense level of occupation identified (Fig. 6).

The GSB survey of *insulae* 2 and 3 showed reversal of the normal magnetic signal of the buildings which may indicate that parts of the town were destroyed by fire (as had already been detected by excavation in the forum) and that some of the buildings in this area had been rebuilt. The automated resistivity readings were also of exceptional quality and definition: the smooth operation of the equipment shows strong promise for the future. The GPR data was also consistently good despite technical difficulties and the time-slicing is showing promise as an effective tool in understanding the earlier phases of the town's development. As yet, it is too early to assess fully the results of the other techniques, but all involved in the project are certain that significant advances have been and will continue to be made.

6. Publication

The survey of Wroxeter is still in its early stages and the publication plans are by no means finalised yet but it is likely that the results will be

published as an atlas of plans covering either individual fields or *insulae* rather than as a single map. Accompanying the plans will be a detailed commentary and interpretation. We also aim to make the results of the geophysical surveys available on the World Wide Web so that they may be easily accessed by other researchers.

7. The future

Clearly, there is great potential at Wroxeter for recovering a considerable amount of new information relating to the site, and for elucidating much of its history and development. A primary aim after the completion of the project will be to test key areas of the town to check the quality and veracity of the data collected by the geophysical survey and this will form part of a larger programme of continuing research into the town of *Viroconium Cornoviorum*.

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ABSTRACT

Abandoned towns have long been recognised as one of the most important resources for understanding the development and decline of the urban environment. In Britain, the number of opportunities for studies into abandoned Roman towns is limited as most have continued in use until the present day. The *Wroxeter Hinterland Project* is currently engaged in research on the best-preserved deserted Roman town in Britain: *Viroconium Cornoviorum*, in Shropshire – modern Wroxeter. The approach has been to use a broad range of geophysical prospecting methods to elucidate the nature and density of occupation on the site. Standard geophysical techniques such as magnetometry and resistivity have been extensively deployed alongside the newer technologies of Ground-penetrating radar, multi-probe, continuous-reading automated resistivity, seismology and conductivity. Airborne survey is adding another dimension through multi-spectral scanning and conventional aerial photography, while sub-surface surveys are being hatched up with ground-truthing data collected through conventional survey methods. The results are being processed on the Project's GIS database and will provide as full an insight into the nature of occupation at Wroxeter as is possible without further extensive excavation. It is intended that the results will be published in an atlas and will also be accessible via the World-Wide-Web.