

## Section 5. Comprehensive Documentation#

### 5.7 Case study 2: the Leptiminus geophysical survey#

by **Damian Robinson and Simon Clarke**

Leptiminus was a major port on the eastern seaboard of Tunisia, whose archaeology predominantly dates from the Punic to Byzantine periods. The city was at its apogee in the Roman period, when it was involved in the industrial production of ceramics and in shipment of agricultural produce to the rest of the Roman Empire.

The geophysical survey was a component of a larger research project that also incorporated field survey and selective excavation. The first season of geophysical surveys was undertaken at Leptiminus in the spring of 1995. Additional surveys were carried out in 1996, but are not included in the current archive. The aims of the survey were:

- Surface collection had indicated that Leptiminus was involved in the industrial production of African Red Slip fine ware pottery and amphorae. The primary aim of the geophysical survey was to examine the main areas of kiln debris and ceramic wasters and to investigate the scale of production at Leptiminus. It was hoped that the magnetometer survey could locate potential kiln sites for excavation.
- Early investigations of the city had suggested the existence of a forum and theatre at Leptiminus despite limited archaeological evidence. Hence, the second major aim of the geophysical survey was to investigate the potential monumental core of the city and its internal organisation.

Leptiminus is almost an ideal site for large-scale intra-site geophysical prospection. Today the site is almost entirely open agricultural land, being covered mainly by olive groves. Over fifteen per cent of the city was examined during the two seasons of work, which sampled a wide range of city environments: coastal and inland; city core and suburbs; industrial, public and residential areas.

In the field the geophysical data were downloaded from the surveying instruments (a Geoscan FM36) onto an IBM compatible laptop computer using Geoplot 1.4. The raw data files from Geoplot (dat) were then renamed as gpt files, using a standard file-naming convention and imported into Contors (Contors files being named dat again) for balancing and initial data processing. The data were then viewed using spike removal and bicubic interpolation. The images were screen captured and pasted into PhotoShop and then saved as Uncompressed Tiff files using a file-naming convention (e.g. AM\_-5-8c.tif = Area A, magnetometer, -5 to 8 nT range as used in the Contors display and 'c' for 'captured'). The screen images were then cropped to display only the area of the survey and saved with a filename omitting the ending 'c': AM\_-5-8.tif. These survey images were imported as raster backdrops into AutoCAD (R14) for coregistration and the generation of vectorised overlay interpretations of the geophysical anomalies. The geo-information was transcribed from detailed field notes. These CAD files were then exported as .dxf and imported into the field survey GIS for further data analysis.

The digital archive created by the Leptiminus geophysical survey project is a research level archive and has been deposited with the ADS. It will be released to coincide with, and support, the final publication of the survey. The archive consists of:

- geophysical survey metadata
- raw Geoplot files
- semi-processed Contors files
- archival (uncompressed tiff) raster images of each geophysical survey area

- dissemination (png) raster images of each geophysical survey area
- vector interpretations of the geophysical anomalies
- archive text reports and supporting documentation
- images of Leptiminus and the geophysical survey

The time lag between the completion of the geophysical survey and the publication of the larger Leptiminus project has altered the archiving strategy. The production of the digital archive was never originally envisaged and it is fortuitous that the raw Geoplot data could be salvaged after the destruction of the original survey laptop and the corruption of a set of back-up disks. All of the images were re-created in archival preservation file formats. The survey metadata had to be retrospectively created but the majority of the documentation was retrieved from the two end-of-season reports and earlier versions of the final project report. The archiving process involved both the limited creation of new digital data and gathering together old data.

| <b>Project Information</b>              |  |
|---|--|
| Survey name                             | Leptiminus Geophysical Survey Project  |
| Survey index                            | LAm ? Area A Magnetometer Survey   |
| Survey purpose                          | To examine an area with a high concentration of kiln debris and ceramic wasters  |
| Report summary                          | Geophysical surveys in Area A indicated that the banks of the Oued es Souk were lined with buildings, which are most likely dwellings with associated cisterns. Magnetometer surveys revealed a line of possible kilns running SW to NE across the line of the survey and at an angle to the line of the probable dwellings. |
| Bibliographic references                | Not reported   |
| Survey keywords                         | Leptiminus, Roman, city, Geophysical survey, kiln, African red slip, amphorae, ceramic wasters   |
| Spatial coverage                        | Withheld   |
| Administrative area                     | N/A  |
| State                                   | N/A  |
| Country                                 | Tunisia  |
| Solid geology                           | Not reported   |
| Drift geology                           | Fluvial deposits   |
| Duration                                | 29th April to 1st May 1995   |
| Weather                                 | Hot and sunny  |
| Soil condition                          | Dry  |
| Land use                                | Small fields of olive trees  |
| Monument type                           | Ancient city   |
| Monument period                         | Punic, Roman, Byzantine  |
| Scheduled Ancient Monument (SAM) number | N/A  |
| Surveyor                                | Robert McNaught, Mark Williams, Matthew Braithwaite, Damian Robinson, Simon Clarke   |
| Client                                  | Leptiminus Archaeological Project  |
| Depositor                               | Dr Damian Robinson, Department of Archaeology, University of York  |
| Primary archive                         | Archaeology Data Service   |
| Copyright                               | Damian Robinson and Simon Clarke   |
| Term list                               | Not reported   |
| <b>Geophysics metadata</b>              |  |
| Survey type                             | Magnetometer survey (land based)   |

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|--|--|
| Instrumentation                        | Geoscan FM36 Fluxgate Gradiometer  |
| Magnetic north                         | Magnetic north is 20° east of the geophysics grid's y-axis.  |
| Instrument drift                       | Not recorded   |
| Reasons for choice of survey technique | Magnetometer surveys of similar sites in Tunisia had been reported as being successful.  |
| Area surveyed                          | 35 data grids of 20 m x 20 m ? approximately 1.4 ha  |
| Method of coverage                     | Regular grid, Zigzag   |
| Traverse separation                    | 1 m  |
| Line separation                        | 1 m  |
| Reading interval                       | 0.5 m  |
| Sampling position                      | Centre of each 0.5 m x 1 m square  |
| Data grid size                         | 20 m x 20 m  |
| Accuracies                             | Some variation of grid layout occurred across the survey area: data grids furthest from the baseline are up to 1 m out? due to the uneven nature of the terrain and the difficulties in setting out data grids in olive groves. The estimated positional accuracy within the data grids is 0.1 m. Data were collected with automatic trigger while walking and 0.1 nT sensitivity.   |
| Survey methodology                     | All data grids have the same size and resolution. The arrangement of data grids is captured in the file LAm.csv (spreadsheet layout) and LAm.rep (Contours report file). Lines were walked from west to east, starting from the north-west corner of each data grid. Consecutive lines were recorded further south in a zigzag fashion, maintaining the same orientation of the magnetometer with respect to the surveyor (i.e. different actual orientation on subsequent lines). Individual data grid files are named according to the acquisition sequence, for example 'AM2.dat'.  |
| Data treatment                         | <ol style="list-style-type: none"> <li>1. Data downloaded from machine to field computer using Geoplot version 1.4</li> <li>2. Geoplot .dat files renamed as .gpt files</li> <li>3. .gpt files imported into Contors to produce Contors .dat files</li> <li>4. Data viewed in Contors using spike removal and bicubic interpolation</li> <li>5. Images screen-captured and saved as Uncompressed Tiff for preservation</li> <li>6. Images processed using PhotoShop</li> <li>7. Images imported as raster backdrops into AutoCAD for coregistration and the generation of vectorised interpretation files of the geophysical anomalies.</li> </ol> |
| <b>Report</b>                          |  |
| Report title                           | Leptiminus Area A: a brief report  |
| Report reference number                | LeptA-01   |
| Report author                          | Simon Clarke and Damian Robinson   |
| Report holder                          | Damian Robinson  |

| <b>Geophysics georeferencing</b>       |  |
|--|--|
| Geophysics coordinate system           | The geophysics grid was laid out to correspond to the already existing site grid with the geophysics x- and y-axes corresponding to easting and northing, respectively.  |
| Georeferencing                         | Total station measurements from the site grid were taken for corners of several data grids. The results are compiled in the spreadsheet corners.csv, showing discrepancies of up to 1 m for data grids at the far NW of the survey area. |
| <b>File description</b>                |  |
| Explanation of codes used in filenames | Contors files AM1 = Area A, magnetometer, grid 1<br>Image files AM_?5-8 = Area A, magnetometer, -5 to 8 nT range used in the Contors display.  |
| Description of file formats            | Contors .dat files for data, Contors .rep for grid location information  |
| List of all file names                 | Contors data files ? AM1.dat to AM35.dat<br>Contors report - LAm.rep<br>Image files ? AM_?5-8.tif<br>CAD file ? Area_A_Features.dxf<br>Text files ? Area_A_Metadata.doc,<br>Area_A:_a_brief_report.doc                                   |
| Date of last modification              | Initial survey and write-up in 1995. Data were re-examined in March 2001.  |

**Table 4:** Leptiminus Area A Magnetometer Survey Documentation

## Acknowledgement

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