A Gradiometer Survey of South Park, St Clements, Oxford

For The East Oxford Archaeology and History Project

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1. Summary Of Results.

A gradiometer survey of South Park was undertaken by the East Oxford Archaeology and History Project in late 2012/early 2013. The survey was carried out in part to locate the possible remains of parliamentarian earthworks from the English Civil War that are believed to be located in the Headington Hill area. Although the survey failed to conclusively locate these earthworks, a number of possible candidates were identified. The survey does show traces of ridge and furrow cultivation at the western end of the park and the remains of post-medieval field boundaries shown on 1880's mapping. The large amount of magnetic interference across the majority of the surveyed area has made identifying archaeological features extremely difficult. As a result few features have been identified in-spite of the large area surveyed

2. Introduction.

2.1 Background.

The survey was carried out as one of a number of geophysical surveys undertaken by the East Oxford Archaeology and History Project or ARCHEOX. ARCHEOX is a community archaeology project hosted by Oxford University's Department for Continuing Education, and funded by the Heritage Lottery Fund and Oxford University's John Fell Fund. South Park was chosen as a survey location as it is one of the largest open spaces in the project's study area, as well as being the potential location of earthworks relating to the siege of Oxford during the English Civil War (1642-3).

2.2 Site Location

The site is located near the western extent of the project's study area at the eastern edge of St Clements parish. It lies on the south side of the A420 (Headington Hill) and to the north of Morrell Avenue (see figure 1),

2.3 Description of the site

The area surveyed covers 11.8ha of public parkland in the north-west of East Oxford. The survey area comprises approximately the western three quarters of South Park and lies at between c. 60 and 95 m OD. It covers the western end of Headington Hill as it slopes westwards towards the lower lying land of St Clements. The park comprises two roughly level areas separated by a steep slope (see figure 2). Both flat areas are frequently used for holding public events.

2.4 Geology and soils

The study area is underlain by a range of geologies all of Jurassic date (see figure 3)

2.5 Site history and archaeological potential

There are no known prehistoric or Roman finds from within the survey area (Oxford City Council 2011a; b; c; d). A small number of Roman finds are recorded to the north of the survey area close to St Clements church (Oxford City Council 2011d, 55-57). The parish of St Clements has its origins in the 11th century (Oxford City Council 2011e), and appears to have built up on the eastern side of Magdalen Bridge. This is shown initially on a 16th Century map as a small cluster of houses around the old church (Salmon 2010, fig 2). Prior to the 18th Century the settlement lay outside the eastern boundary of the city.

The area of South Park is approximately 500m to the east of the historic core of St Clements and is likely to have constituted unenclosed farmland on the southern slope of Headington Hill until the mid-nineteenth century (Salmon 2010, 10-11).

South Park contains extremely well preserved ridge and furrow earthworks that are clearly visible, and in some cases survive to over 0.5m in depth from bottom of furrow to top of ridge. Although assumed to be Medieval in origin these earthworks are currently undated.

During the English Civil War St Clements formed the main front during the siege of Oxford from 1643-1646. In 1644 the Parliamentarians constructed an entrenchment or '*great work*' to receive and lodge 3000 men (Lattey *et al*. 1936, 172). A source on Oxfordshire HER (PRN6008) indicates that the location of the *'great work*' is just below the break of slope in the northern edge of South Park (HER Record Card PRN 6008). Similarly a 1667 landscape drawing looking west across Oxford from Headington Hill appears to show the fortification in the foreground in the general area of South Park (see figure 4).

Based on their interpretation of Bernard de Gomme's 1644 map of Oxford (see figure 5), Lattey *et al.* (1936, 172) suggest that a line of Parliamentarian defences ran from the fort across South Park towards the junction of Morrell Avenue and Divinity Road. They hypothesise that the lines of partially removed field boundaries across South Park may in part be based on this defensive line.

An archaeological desk based assessment undertaken in advance of the development of new accommodation blocks for Oxford Brookes University (OAU 1999) concluded that the area immediately to the north of South Park had a low archaeological potential. Although elements of the Civil War fortifications could fall partially within the area of development, their location was considered poorly defined and likely to fall outside the footprint of the development (OAU 1999, 2-15).

The combination of cartographic, pictorial and historical sources all point towards the presence of Civil War fortifications within South Park. The gradiometer survey was positioned to include the break of slope area of the park thought most likely to contain these features.

3. Methodology

3.1 Survey Objectives

The survey has three main objectives:

- To carry out a geophysical survey of one of the largest green spaces in East Oxford
- To train volunteers from the local community in gradiometer survey
- To locate and map archaeological features including a fortification of Civil War date thought to be in this area.

3.2 Date of fieldwork

The fieldwork was undertaken throughout December 2012, January 2013 and early February 2013 in a wide range of weather conditions including rain, freezing fog, snow, sleet, as well as some dry clear days.

3.3 Grid Location

The location of the survey is shown in figure 2. The survey was based on a series of 30x30m grids. Survey grids were established in the field using a Leica Smart Rover RTK GPS to within +/- 0.01m of the Ordnance Survey National Grid.

3.4 Survey Configuration

Date of survey	Dec 2012-Feb 2013
Grid size	30x30m
Area of survey	11.8ha
Traverse direction	North/south
Traverse separation	1m
Reading interval	0.25m
Instrument type	Fluxgate gradiometer
Instrument model	Bartington Instruments Grad 601 (2)
Sensor element separation	1m
Number of sensors	2
Sensor separation	1m
Sample range	1nT
Processing software	Geoplot version 2.5.16
Processes	clip (1 SD), despike, destagger (-2 intervals), destripe (median), interpolate (x), interpolate (y), clip (2 SD), compress (log scale)

3.5 Data collection and volunteers

One of the main reasons for undertaking the survey was to train a group of volunteers in gradiometer survey. As a result survey data was collected by a number of individuals, both project staff and volunteers, with a wide range of experience in gradiometer survey. To ensure high standards of data collection the collection speed of the gradiometer was varied to suit the pace of each individual, and data was collected along beaded traverse lines. The instrument was re-zeroed between users, and all data was collected under the close supervision of project staff. Each new operator was scanned prior to using the gradiometer to maintain a consistently high level of magnetic hygiene. The location, traverse configuration and name of operator were recorded in the field for each grid surveyed. When necessary grids affected by poor data collection or poor magnetic hygiene were recollected.

3.6 Processing and presentation of results.

Survey data was downloaded to a laptop computer, roughly processed and checked for operator error on site. Data was then backed up to a networked desktop computer at the end of each day. Data was downloaded, assembled and processed using Archeosurveyor version 2.5.16.0. Full processing of the data was undertaken on completion of the survey using the clip, despike, destagger, interpolate and compress processes. Once processed data was exported to ArcGIS 10.0 as a georeferenced ASCII file and combined with other datasets for presentation

3.7 Interpretation

The processed data without interpretation can be seen in figure 6. Once processed magnetic anomalies were digitised and assigned to one of the following five

interpretative categories.

- Archaeology: Magnetic anomaly considered to be definitely archaeological in origin on either morphological grounds or correlation with features on historic mapping.

- Probable archaeology: Magnetic anomaly considered on morphological grounds to be probably archaeological (less certain than archaeology/more certain than possible archaeology).

- Possible archaeology: Magnetic anomaly considered on morphological grounds to be possibly archaeological (less certain than probable archaeology).

- Ferrous material: extremely strong dipolar magnetic signal either discrete caused by a single ferrous item or linear caused by ferrous services (pipes/cables).

- Bonfire disturbance: Area of enhanced magnetic signal caused by annual city council bonfire.

Anomalies of particular interest have been assigned numbers and are discussed at greater length in section 5 and are illustrated on figures 6 and 7.

5. Results

Modern ferrous contamination

The magnetometer survey undertaken over the western area of South Park has yielded a small number of potentially archaeological anomalies.

Throughout the majority of the survey area there was a high proportion of magnetic interference caused by small magnetic items producing readings when passed over with the magnetometer. This can best be seen in figure 6, and is perhaps best highlighted by the region identified in figure 7 as bonfire disturbance. Each year the park hosts a firework display and bonfire to celebrate the fifth of November. The successive construction and dismantling of the bonfire for many years has increased the level of magnetic interference in the area of the park. The high proportion of interference in the remainder of the survey area is likely to stem from public use of the park. The western region of the park in particular is often used for public events such as circuses and musical performances, all of which will leave magnetic detritus during the set-up and taking down of temporary structures.

Park railings

Anomaly 1, (highlighted on figure 8) is a highly magnetic curvilinear features with an approximate radius of twenty metres. It is located within a cluster of trees in the modern park, which when compared to the first edition Ordnance Survey map (figure 9) appear to be part of field boundaries. A possible interpretation of feature 1 is that it is caused by the residual remains of iron railings enclosing a portion of the boundary around the base of a tree/trees and subsequently removed.

Ridge and Furrow

The magnetic interference has enhanced the visibility of the ridge and furrow in the

survey results. The ridge and furrow can be seen as WSW/ENE bands in the data. Where a band shows a high level of magnetic interference this suggests a furrow, as small objects magnetic items are, over time, likely to gravitate towards the lowest point of the furrow, whilst fewer magnetic anomalies are present at the crest of the ridges. From this an interpretation of the patterns of ridge and furrow can be made. The ridge and furrow is highlighted in figure 10 by green lines following the lines of the furrows. When the furrows are marked in this way it can clearly be seen that one of the fields, the one containing the bonfire does not show signs of ridge and furrow. There are two possible reasons for the lack of ridge and furrow, the ridge and furrow has been eroded due to the increased activity on this part of the park, or that following its enclosure in the nineteenth century and prior to its incorporation into the park in 1930s, this particular field was farmed differently to others in the survey area resulting in the localised levelling of the earthworks.

Removed field boundaries

When the interpretation of the results is overlaid on the 1880 first edition Ordnance Survey map (figure 9) it becomes clear that a number of the linear anomalies correspond closely to field boundaries shown on the map. These anomalies are relate to field boundaries probably built at the time of enclosure in St Clement's parish and removed when the area became a park in the 1930s.

Possible Civil War features

The linear anomaly identified as anomaly 2 on figure 8 also appears to correspond to the line of the post medieval field boundaries, seen on the first edition Ordnance Survey maps however, when observed on the processed results it is significantly different to the other linear anomalies identified as field boundaries. Across some sections it is almost twice as thick as the other linear anomalies and towards the south end there are three smaller linear elements oriented East to West. It is possible that this feature could form a portion of the Parliamentarian siege works known to be present in the region. The feature is located just below the crest of the modern slope of the park and is visible as an earthwork (see figure 11). It is suggested that this may have originally been a part of the Civil war defences and was later adopted as a field boundary. This feature is discussed further section 5 below in relation to LiDAR data.

Anomaly 3 (Figure 8) is a rectilinear feature that appears to run parallel to one of the anomalies identified as post-medieval field boundaries and is of uncertain providence. The feature is located in the south eastern area of the survey and is cut off at the eastern limit of the survey area. It is possible that this feature could relate to the civil war or be related to the function of the nineteenth century field that it abuts.

5.1 LiDAR

In summer 2012 the project conducted some experiments in creating a digital terrain model of South Park using a survey grade Smart Net GPS set to collect data at regular intervals and attached to an Oxford City Council grass-cutting tractor (see figures 12 and 13). Whilst the results were promising it would have required multiple grass-cutting sessions to achieve anything like the density and regularity of coverage possible with airborne laser scanning/LiDAR. In March and April 2013 the project was able to acquire detailed topographic information for the entire East Oxford study area. This was based on 1m resolution Digital Terrain and Digital Surface Models derived from LiDAR data supplied by the Environment

Agency/Geomatics Group. Figures 14 and 15 show the survey area as a slope model created from a LiDAR digital terrain model.

The slope model shows topographic features in the park ranging from earthworks that are obvious on the ground (ridge and furrow), to some of the very slight traces left by the excavation of service trenches, which whilst prominent in the gradiometer survey data, are almost indiscernible on the ground. Of particular interest are a series of NNW/SSE linear earthworks running along the break of slope in the park.(figure 14 features a, b and c). Some of these features relate closely to geophysical survey anomalies and the field boundaries shown on the 1880's mapping (features a and b). Feature c standing approximately 0.5m high by 20m wide is not fully covered by the line of a removed boundary or gradiometer anomaly, and if not geological in origin may be a considered of possible contender for a Civil War earthwork.

6. Discussion.

The data produced from the geophysical survey of South Park has yielded some information about its archaeology. However, the high amount of background interference, probably produced as a result of the use of the park as a public place, has made the interpretation of magnetic survey data very difficult. The magnetic interference makes it more difficult to spot features that may be visible were the interference levels reduced. The effects of magnetic interference are not entirely negative, the clarity of the ridge and furrow in the results is largely due to the increased level of magnetic detritus collecting in the furrows. Whilst an interesting study, gradiometry in South Park does highlight the problems of using gradiometry in an urban public place, the results are very different to those one may expect from gradiometry on rural agricultural land.

The most successful information learned from the survey is how closely the field boundaries on the first edition OS map correlate with the features that are present on the geophysics. The survey has also identified two potential features that could be the subject of further investigation. The completion of the survey to cover the far eastern extent of the park could provide further clues about the nature of anomaly 4. Both anomalies 3 and 4 are potential targets for small-scale exploratory excavation such as test pitting or small scale trenching.

Geophysical survey should not be used as the sole factor when determining the presence or absence of archaeological features. Due to the size of this survey, and the difficulties in interpretation encountered due to ferrous contamination, this document should be seen as having identified larger and more obvious features. Should further archaeological investigation or other intrusive works be undertaken in the survey area it is recommended to check for unidentified features in the survey data (figure 6). Although much more time consuming that gradiometer survey, it is also recommended that targeted earth resistance survey be undertaken.

7. References

Lattey, R.T, Parsons, E.J.S, and Philip, I.G. 1936. 'A contemporary map of the defences of Oxford in 1644'. *Oxoniensia,* Volume 1, 161-172.

Oxford City Council. 2011a. 'Oxford Archaeological Resource Assessment: The Palaeolithic and Mesolithic'. Available online at http://consultation.oxford.gov.uk/consult.ti/OARAAC/ (downloaded 13/08/2013).

Oxford City Council. 2011b. 'Oxford Archaeological Resource Assessment: The Neolithic and Bronze Age'. Available online at http://consultation.oxford.gov.uk/consult.ti/OARAAC/ (downloaded 13/08/2013).

Oxford City Council. 2011c. 'Oxford Archaeological Resource Assessment: The Iron Age'. Available online at http://consultation.oxford.gov.uk/consult.ti/OARAAC/ (downloaded 13/08/2013).

Oxford City Council. 2011d. 'Oxford Archaeological Resource Assessment: Roman'. Available online at http://consultation.oxford.gov.uk/consult.ti/OARAAC/ (downloaded 13/08/2013).

Oxford City Council. 2011e. 'Oxford Archaeological Resource Assessment: Anglo Saxon and Scandinavian'. Available online at http://consultation.oxford.gov.uk/consult.ti/OARAAC/(downloaded 13/08/2013).

Oxford City Council. 2011f. 'Oxford Archaeological Resource Assessment: Norman'. Available online at http://consultation.oxford.gov.uk/consult.ti/OARAAC/ (downloaded 13/08/2013).

Oxford City Council. 2011g. 'Oxford Archaeological Resource Assessment: Medieval'. Available online at http://consultation.oxford.gov.uk/consult.ti/OARAAC/ (downloaded 13/08/2013).

8. Acknowledgements

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Figure 1: Survey location

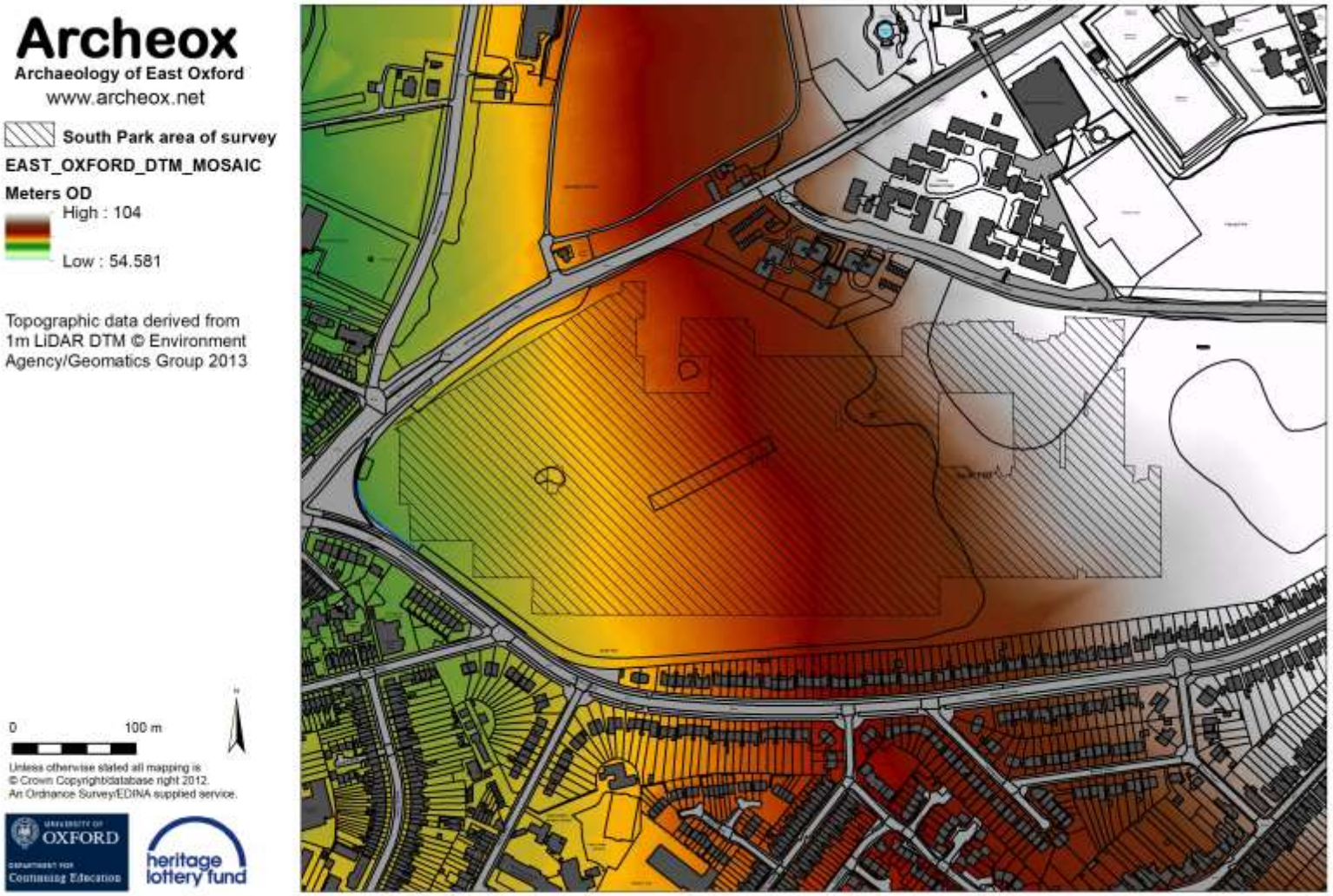


Figure 2: Survey location and topography

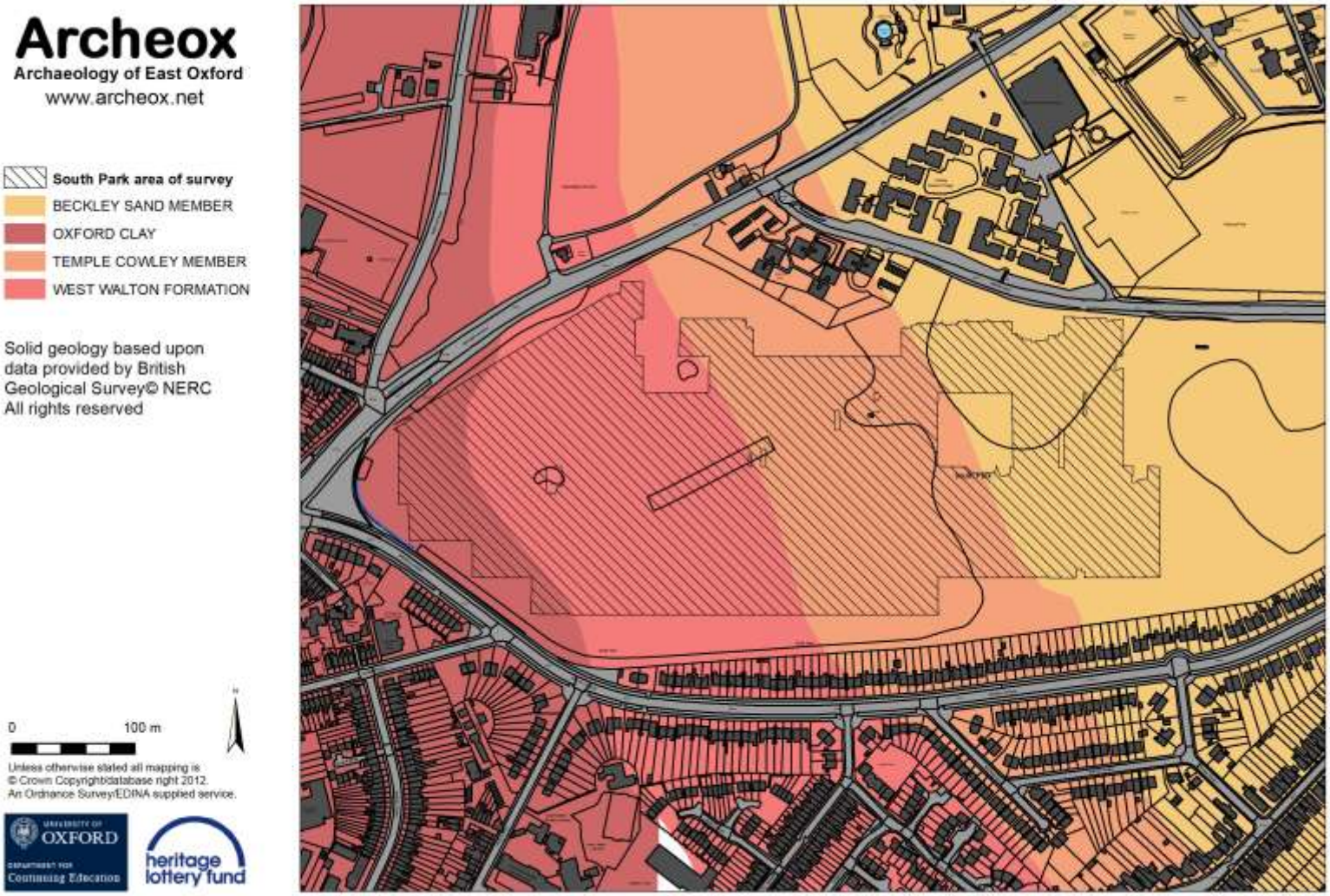
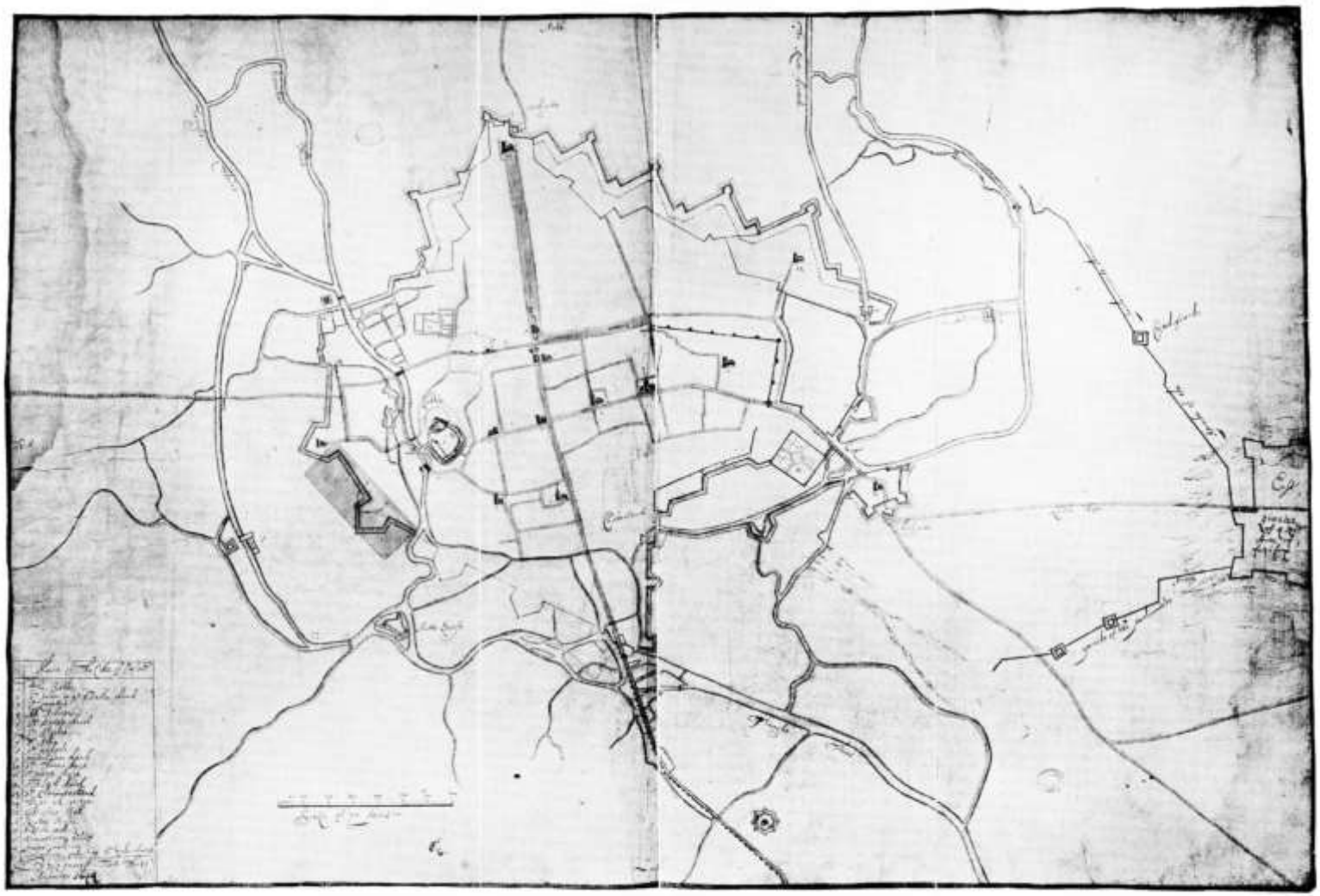


Figure 3: Survey location and geology

Figure 4: Looking west across Oxford from Headington Hill in 1667 by Pierre Maria Baldi for Cosimo III Medici, original in Laurentian Library Florence



CONTEMPORARY PLAN OF THE DEFENCES OF OXFORD, 1644, BY SIR BERNARD DE GOMME.

Figure 5: Sir Bernard De Gomme's map of Oxford in 1644 (after Lattey *et al.*1936, 172).

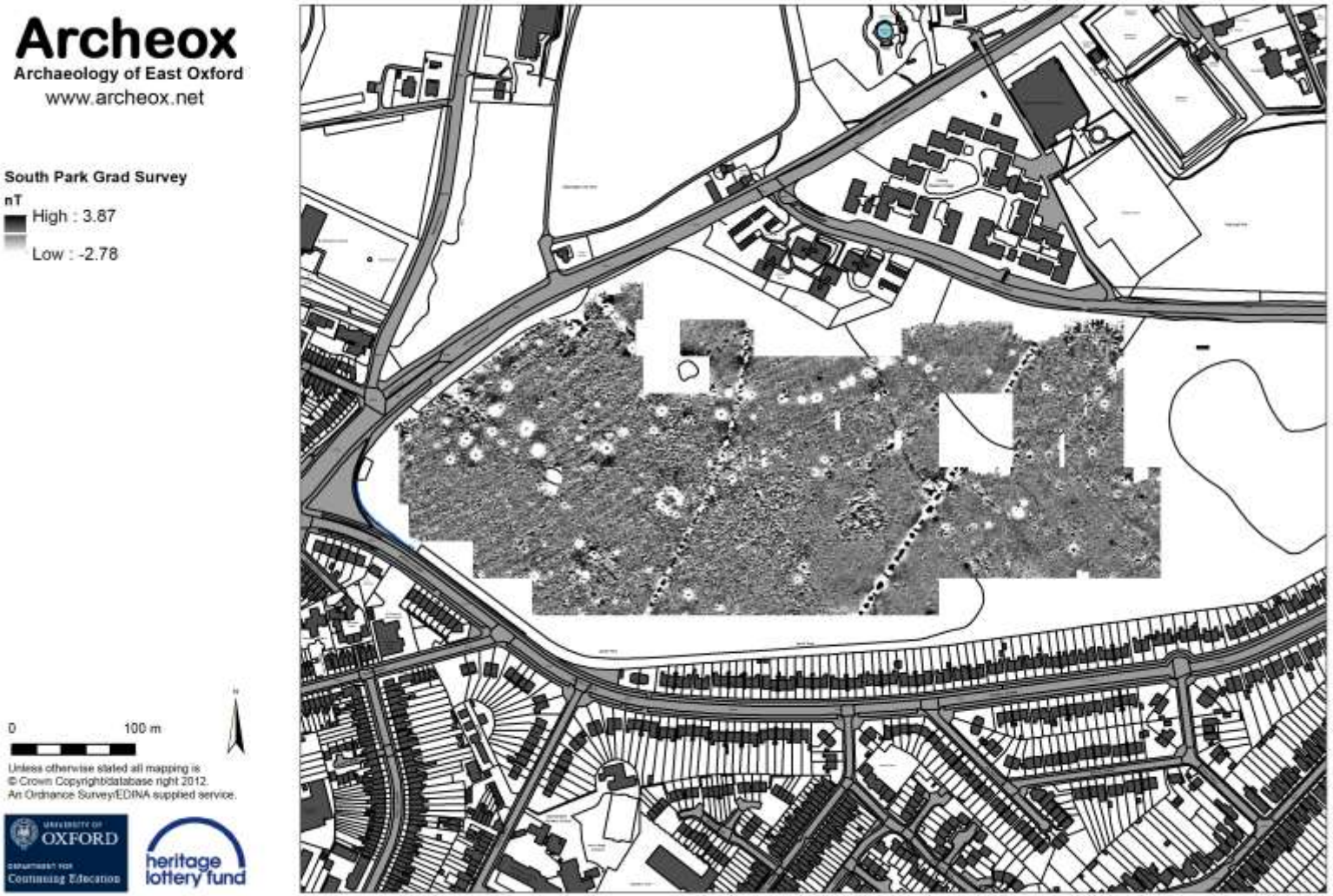


Figure 6: Gradiometer survey results

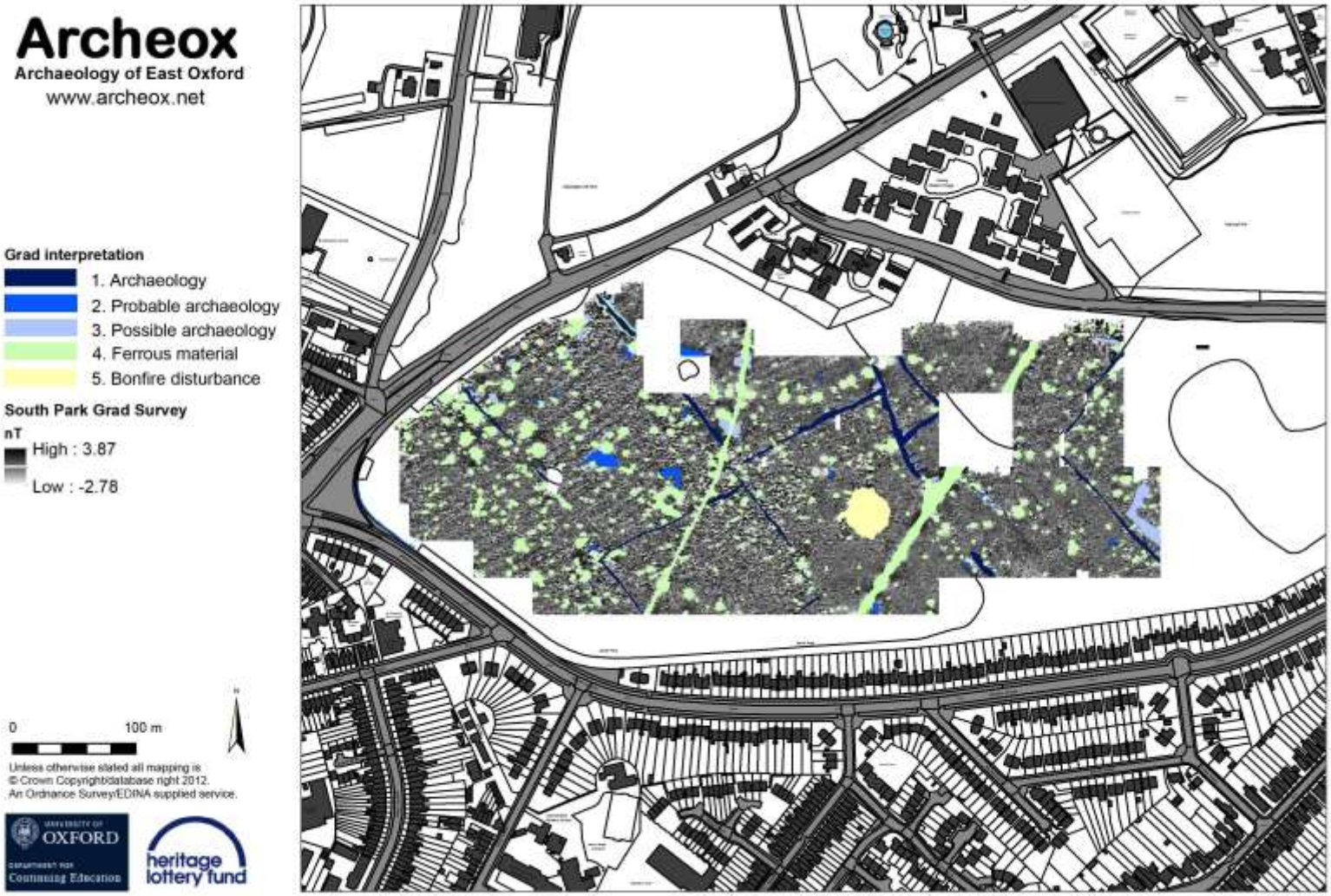


Figure 7: Gradiometer survey results and interpetation

Figure 8: Interpretation of gradiometer survey results

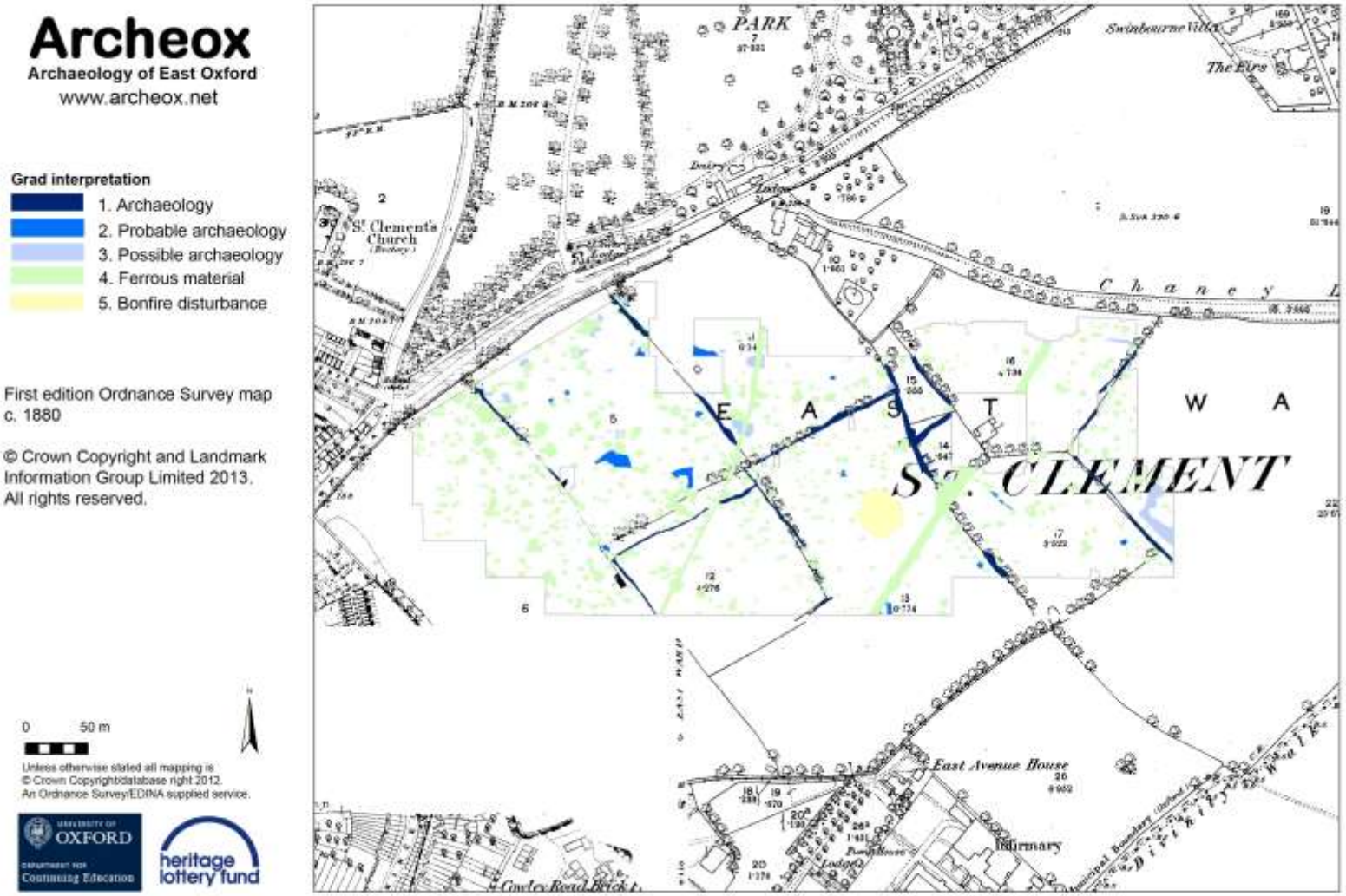


Figure 9: Gradiometer survey results and post-enclosure field systems c. 1880

Figure 10: Interpreted geophysical survey results and line of ridge and furrow

Figure 11: Earthworks on the break of slope in South Park, viewed from the southwest.

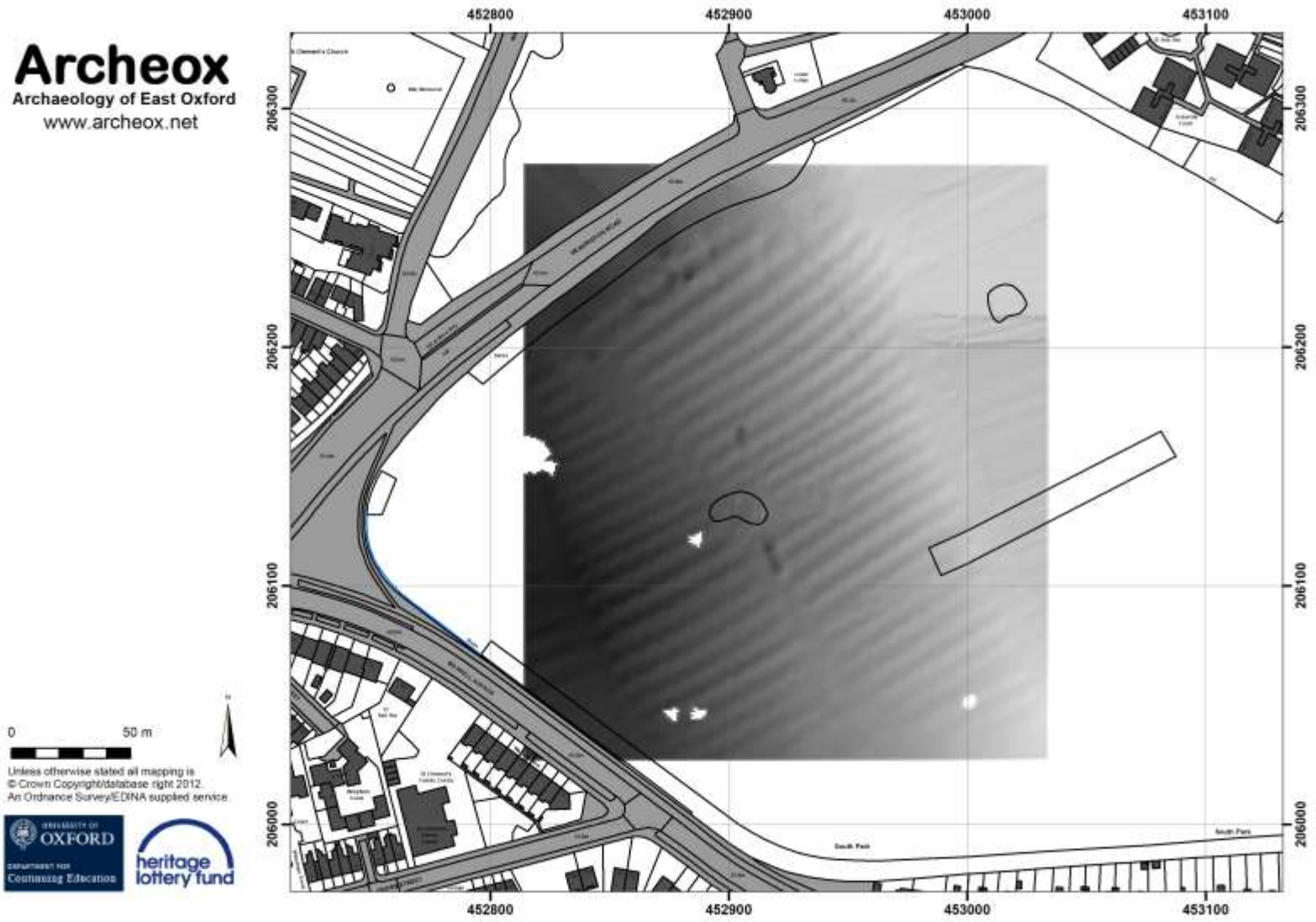


Figure 12: Digital terrain model of ridge and furrow collected with GPS attached to lawn mowing tractor

Figure 13: GPS attached to front of Oxford City Council Tractor

Figure 14: Slope model (darkest = steepest) derived from 1m LiDAR DTM

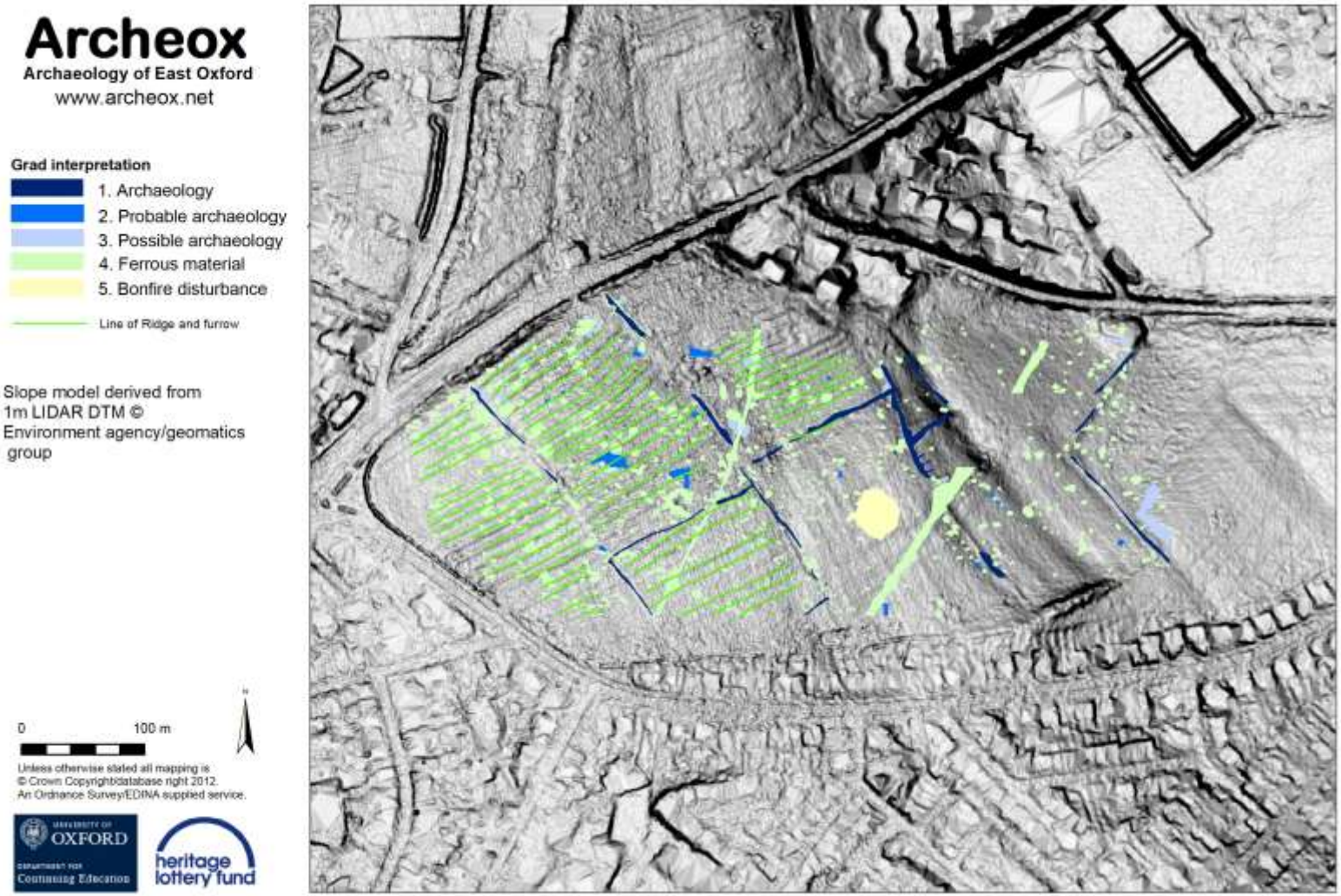


Figure 15: Slope model (darkest = steepest) derived from 1m LiDAR DTM and gradiometer survey results