Exploring the interface between modern and traditional information systems: the case of Great Zimbabwe

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Introduction

In 1987 archaeologists from 9 African countries and colleagues from Sweden began a co-operation programme to study Urban Origins in eastern and southern Africa. Three themes focusing upon 1) chronology, 2) geographical context and 3) ?ntra-site spatial organisation of urban sites were agreed upon. The programme involved 22 parallel field projects throughout the West Indian ocean region and the southern Africa interior. The scale of the programme as well as the need for comparative results necessitated a rethinking of previous approaches to urban archaeology in Africa which had focused on large scale but stratigraphically detailed excavations of stone built urban centres on the one hand or wider ranginginferences about the extent of towns based on isolated test pits on the other. Given the geographical extent of our co-operation programme and the large number of participants each with their own specific site preferences it was not possible to undertake large scale excavations in all 22 research areas.

In fact the new questions which were being asked of the urban sites in Africa some of them being discovered for the first time necessitated a different approach to data acquisition. How large is the site? How deep are the cultural deposits? What range of finds occur in the deposits? Is it possible to differentiate different activity areas? How many people lived there?

Our approach to such questions was based upon the recognition that archaeological investigations must be conducted at the same scale that people lived in the past. To this end a combination of detailed ground mapping and near surface soil sampling was used as a primary spatial delimiter of the extent of the urban sites. The soil samples located using statistical sampling techniques were aimed at assessing geochemical and geophysical variability as well as the distribution of archaeological features and finds. In addition a new approach to sub-surface micro-stratigraphic investigations was developed using different augering techniques. With the addition of computer aided three dimensional interpolation and visualisation both in the field and under laboratory conditions these approaches comprise a powerful array of applied technology to interface with traditional knowledge of the extent, layout and function of the urban sites of eastern and southern Africa. In the present paper examples of the work conducted at the site of Great Zimbabwe by a joint team of Zimbabwean and Swedish researchers under the Urban Origins in Eastern Africa programme for a eight week campaign in will be used to illustrate these points.

Great Zimbabwe

Great Zimbabwe is without doubt one of the premier archaeological sites in sub-Saharan Africa. It has been archaeologically investigated for more than 100 years by among others Randall MacIver 1906, Caton Thompson 1931, Robinson, Summers and Whitty 1961, Garlake 1973, Huffman 1977, 1996 and Chipunza 1992 as well as the present campaign (Sinclair et al 1993). The site comprises a stone built centre dominated by the famous Great Enclosure and the Hill Complex and a surrounding periphery of ca 150 Ha in extent. The chronology of the site has been steadily refined and the period of urban expansion is now thought to begin in the 13th century (Huffman and Vogel 1991). The spatial extent of the site has been investigated by Huffman 1977. The maximum extent of the site was apparently reached in the 15th century and then followed a rapid decline. Evidence does however exist of rather widespread post 16th century occupation augmenting the spatial layout of the previous ones (Sinclair et al 1993) see figure 7.

Work carried out under the Urban Origins programme aimed at investigating the spatial variability of a range of soil parameters and to view these in relation to previous conclusions on site extent. Further the aim was to investigate the depth and spatial distribution of archaeological finds fromsub-surface deposits from selected areas of the site. Ultimately we hoped to derive a diachronic or long termmodel of urban growth and decline.

Mapping

Mapping work has gone on at Great Zimbabwe from the earliest scientific investigations. In the 1990 campaign we used a Geodimeter 400 total station for topographcal mapping (see figure 2) and setting out of cores (figure 9). A digital terrain model of the core area was produced. Recently detailed photogrammetry coverages from flights at 300 m and 500m altitudes have become available and are currently being rectified. Contour maps with 10 cm resolution have also been produced from selected areas of the site by K. Lindfors (MT-Survey, Helsinki) and are stored as ARCINFO coverages. E. Matenga (National Museums of Zimbabwe) and W. Ndoro (University of Zimbabwe) have also developed a strong GIS capacity at the site.

Soil sampling

The soil sampling programme aimed at identifying the gross spatial extent of the site. The sampling universe was chosen to coincide approximately with the National Park Area ca 650 Ha. The sampling (figure 3) was carried out initially on a standard NS EW cross and this was extended using the drunken grid technique which combines systematic and random sampling (the X co-ordinate of any particular sample is held constant while the Y co-ordinate is allowed to vary). A sampling density of 1/Ha was chosen for a preliminary estimate and this proved quite adequate to the task of identifying extensive occupation areas. More detailed sampling is of course to be recommended for refining the results presented here (see figure 9). Soils samples were divided and submitted separately for geochemical and geophysical analysis (see below). In addition soil colour was determined using Standard Munsell soils charts and a pinch of soil from each sample was fixed to paper labels which were then glued onto a board. The final representation shows clearly that the darker soils are concentrated in the inner zones of the sample area (see slide).

Geophysics

Measurements of magnetic susceptibility were carried out by Mr H. Frej also of the Stockholm Archaeological Research Laboratory using equipment of his own design. Results are presented here in figure 4. The areas of high magnetic susceptibility (the degree to which a magnetic field is transmitted through a sieved soil sample of standard volume) represent areas where a high degree of burning has taken place. Once again these overlap the phosphate concentrations but only in part. Current work at Great Zimbabwe involves the application of magnetometry and ground radar techniques.

Geochemistry

Phosphate

An importantpart of the field programme was to test the suitability of phosphate mapping in southernAfrican conditions. Current modifications of the technique which has been used in Sweden since the 1930's (Arrhenius 1931) was the responsibility of K. Persson of the Archaeological Research Laboratory University of Stockholm and M. Petrén of Uppsala University. Both the Spot test and the citric acid test were applied to measure the phosphate content of the soil samples. (Gundlach 1961; Österholm S. and Österholm, I. 1982; Petrén 1996). The different techniques show very similar results (see figures 5 and 6) and this is significant as the Spot test method which is limited to 5 grades of phosphate can be processed in the field for a fraction of the cost of citric acid samples. K. Persson has recently developed a method of colour calibration for phosphate samples which greatly improves the accuracy of the field technique.

The maps in figures 5 and 6 both show clearly defined areas of phosphate concentrations. These correlate quite well with the known distribution of surface finds but with some exceptions (see figure 7) and one is left with the impression that the phosphate maps provide a significant addition to the spatial definition of the occupied areas of the site.

Micro-stratigraphical Investigations

An important part of the methodological developments seen under the Urban Origins programme involves the micro-stratigraphical investigation of sub surface deposits. The idea is to reduce the investigative unit as much as feasible and to spread the investigative units through the site. Beginning with trials at the Swahili urban site of Mtwapa on the Kenya coastin 1987 we have adapted the technique of augering to urban sites in African contexts. The BORROS motorised screw auger provides a continuous but slightly

disturbed sample 50 mm in diameter in 1 m sections. It is capable of penetrating hard clays to depths in excess of 10 m as we found in the inland Niger delta in Mali (MacIntosh, Sinclair, Togola, Petrèn and MacIntosh 1996). At Great Zimbabwe deposits rarely reached more than 2 metres and more than 200 cores were located using a random stratified sampling procedure with two cores chosen for each 20*20 m block. The drill zone was chosen to assess a range of deposits from the periphery to the centre of the site and in particular to assess deposits immediately outside the inner perimeter wall of the site.
The cores were recorded by visible colour unit in the field and data was transferred to the Rockware Logger module (see figure 8) running under Windows. The different core units were grouped using an adaptation of the Harris matrix approach which links core units together on the basis of assumptions of spatial continuity between recorded core units. This in turn facilitated a three dimensional interpolation and stratigraphic reconstruction of the cored area. A range of archaeological finds including, pottery, burned daub house remains, glass and metal fragments as well as faunal and floral samples were recovered from wet sieving the core units (see figs 8 and 9 for examples). Mapping of these and other distributions has been done using SURFER. Further advanced three dimensional analysis using DATA EXPLORER on a RISC 600 Workstation has been carried out at IBM scientific centre in Winchester (Reilly and Thompson in preparation).

Conclusions

The results briefly presented here show clearly the need for a multivariate assessment of the spatial distributions of large scale urban sites in Africa. The combination of the different approaches and superimposition of the results will result in new maps which should then be assessed in relation to current attempts at defining cognitive maps of the site surrounding (see Huffman 1981 and 1996 for examples). Current work focuses upon the multivariate statistics necessary to achieve this. Earlier work using correspondence analysis to seriate stratigraphic units atthe Zimbabwe tradition site of Manyikeni in southern Mozambique and fuzzy set cluster analysis to identify multi-scalar site clusters on the Zimbabwe plateau (Sinclair 1987, Sinclair et al 1993) is being extended. Further work is also underway to reassess the cognitive models derived from work on oral tradition and anthropological research on Shona world view and knowledge systems. Ultimately the success of these efforts to better understand one of the largest and most interesting urban sites in sub-Saharan Africa rests on the sensitivity with which we can integrate the information from these different sources.

Acknowledgements

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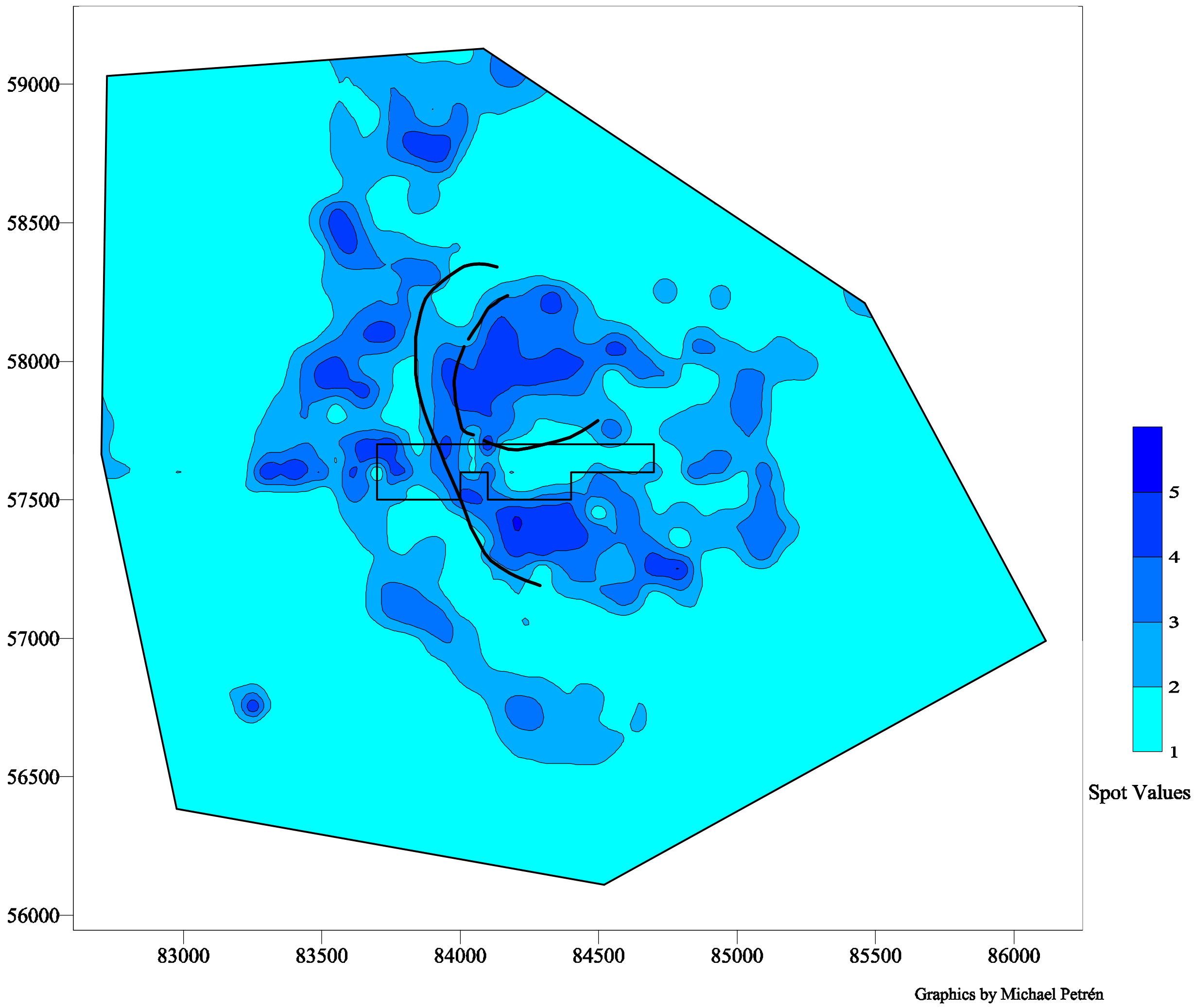
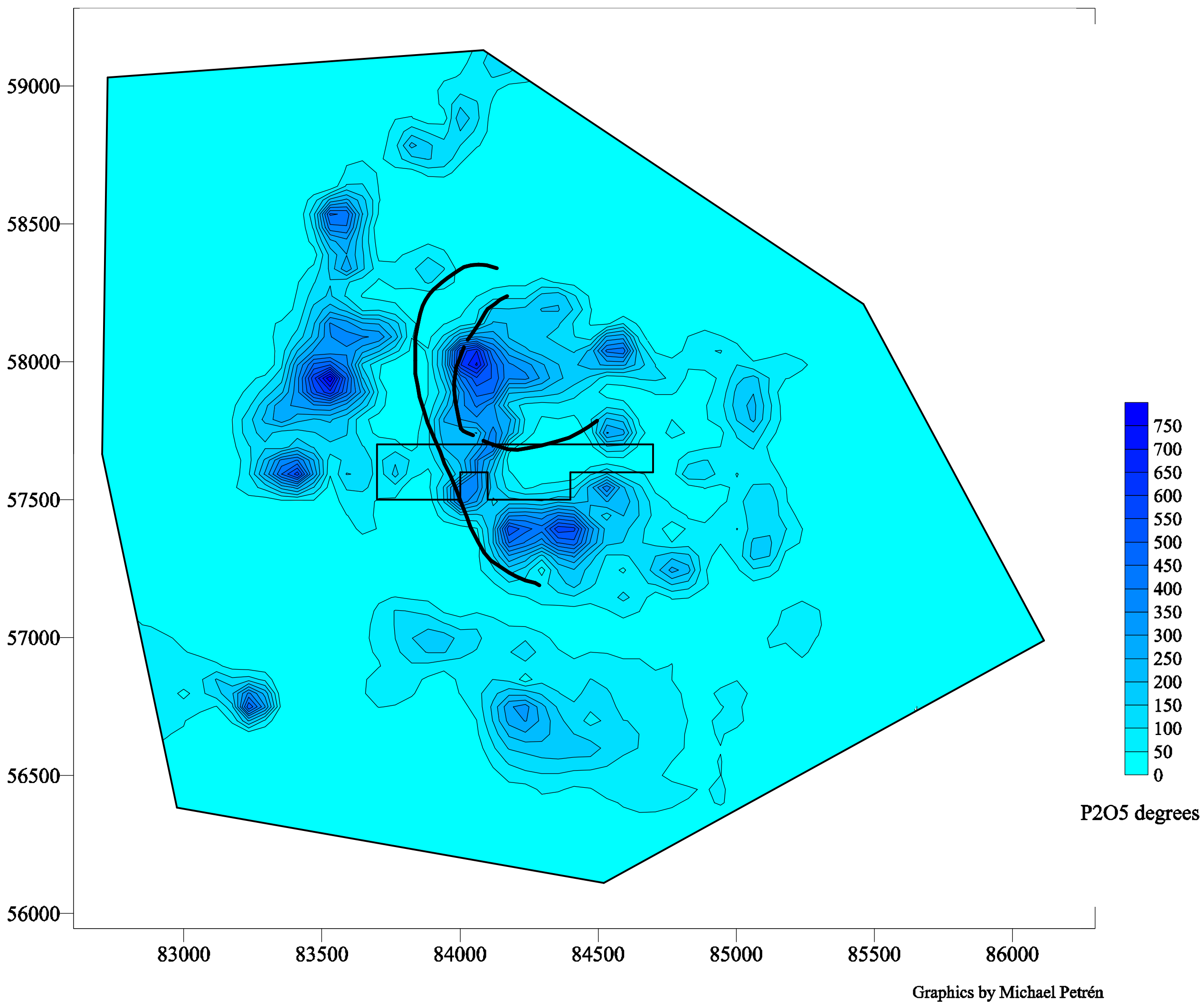
Great Zimbabwe



Phosphate content measured by the Spot Test method, with cored area and perimeter walls

Great Zimbabwe



Phosphate content measured by the Citric Acid method, with cored area and perimeter walls

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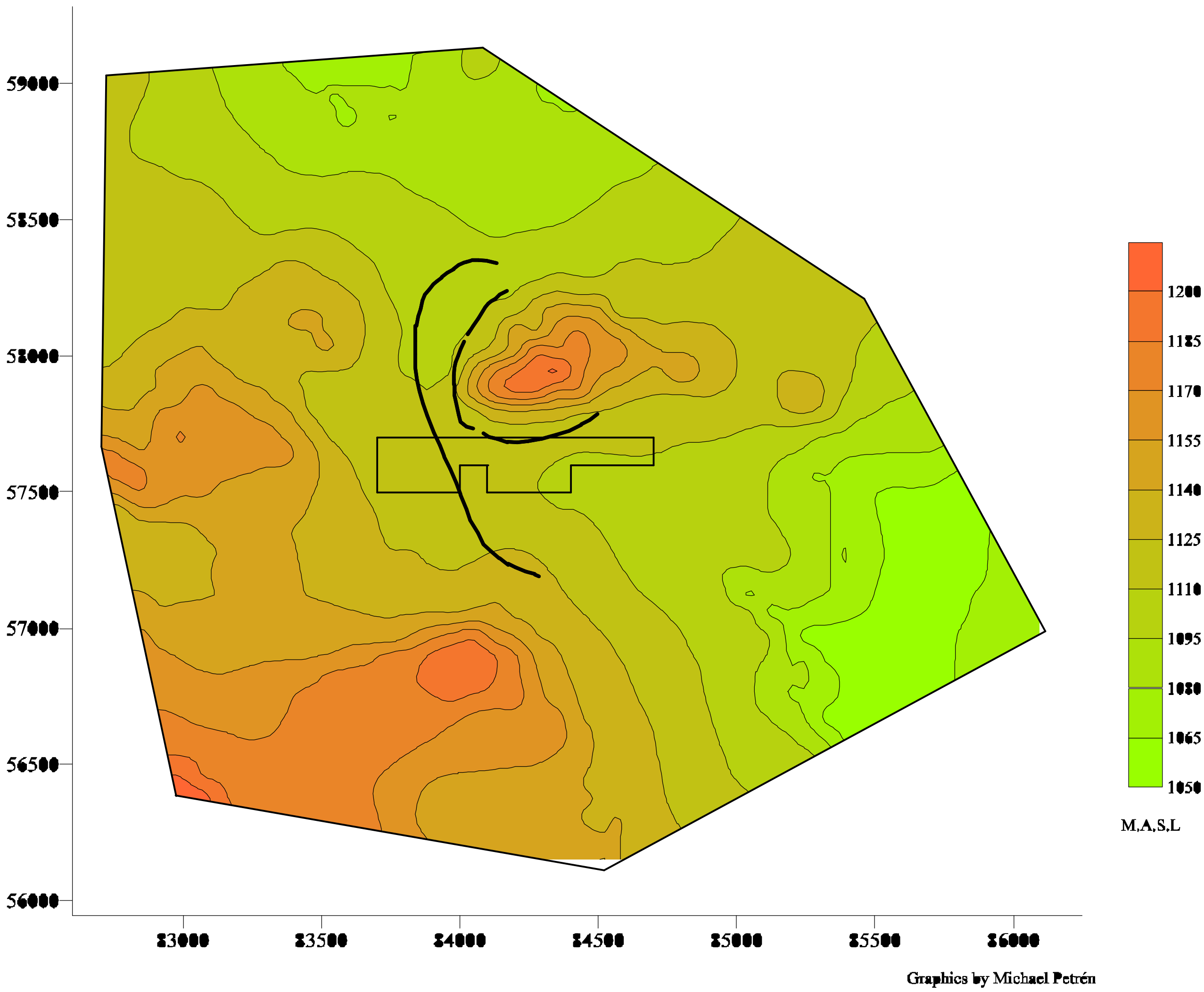
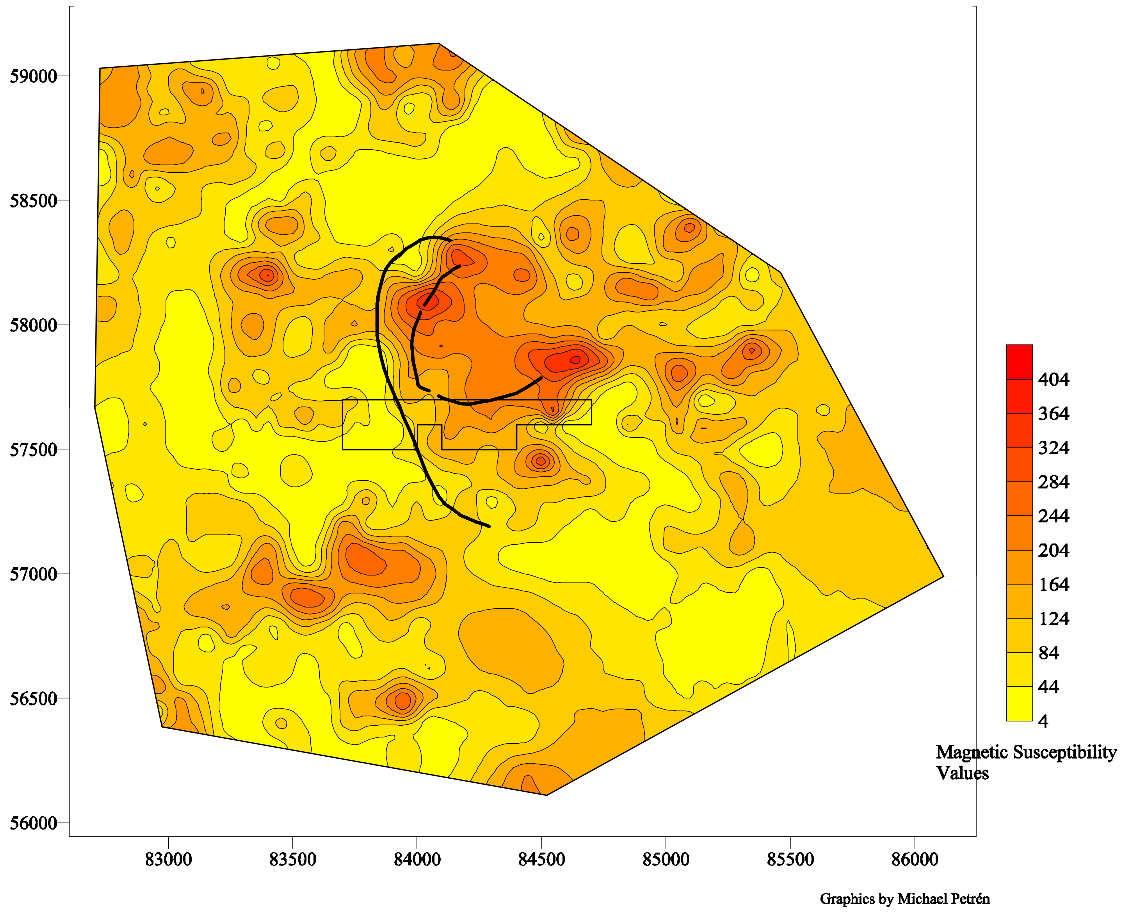
Great Zimbabwe



Digital terrain model with cored area and perimeter walls

Great Zimbabwe



Magnetic susceptibility and perimeter walls

Great Zimbabwe

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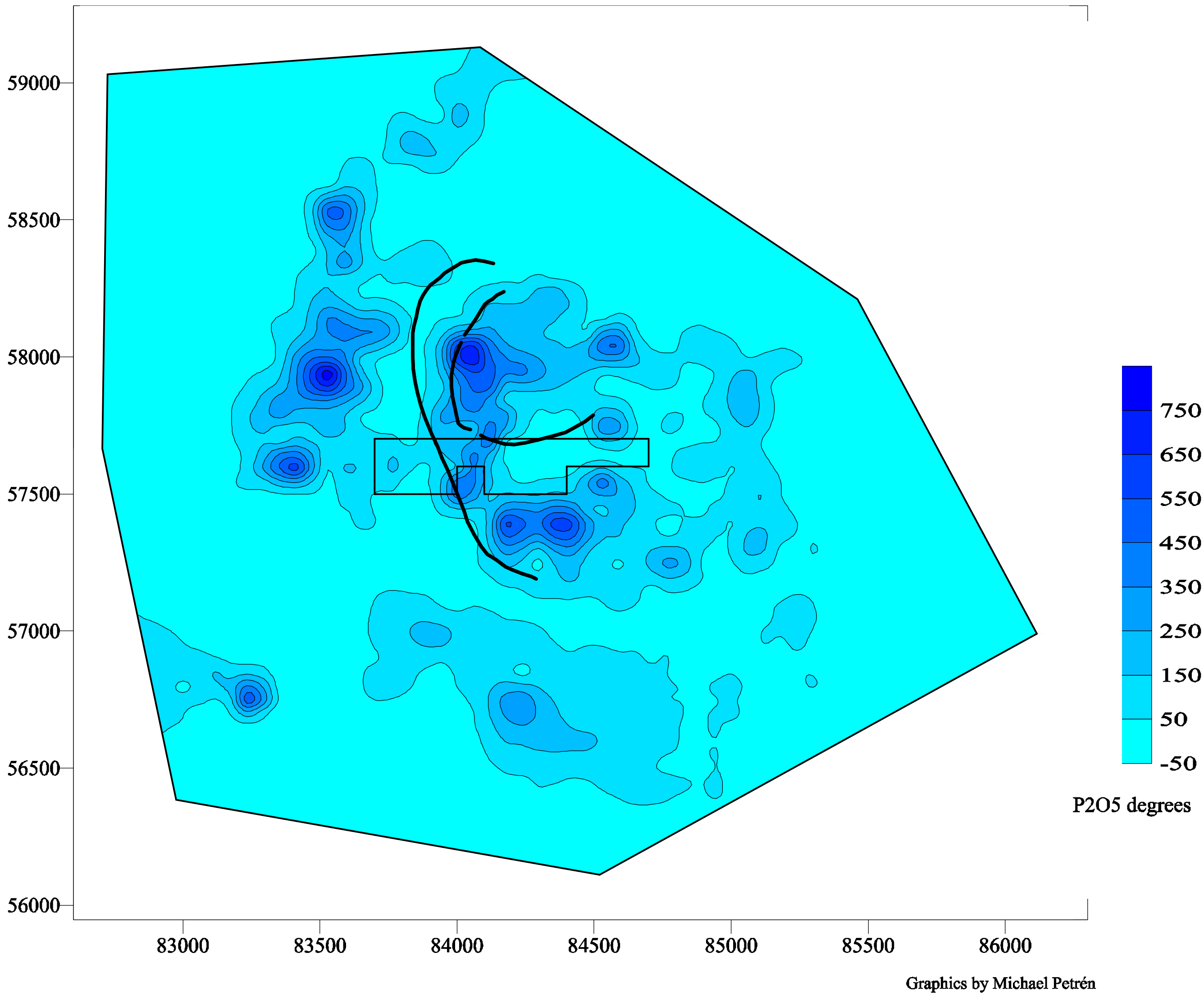
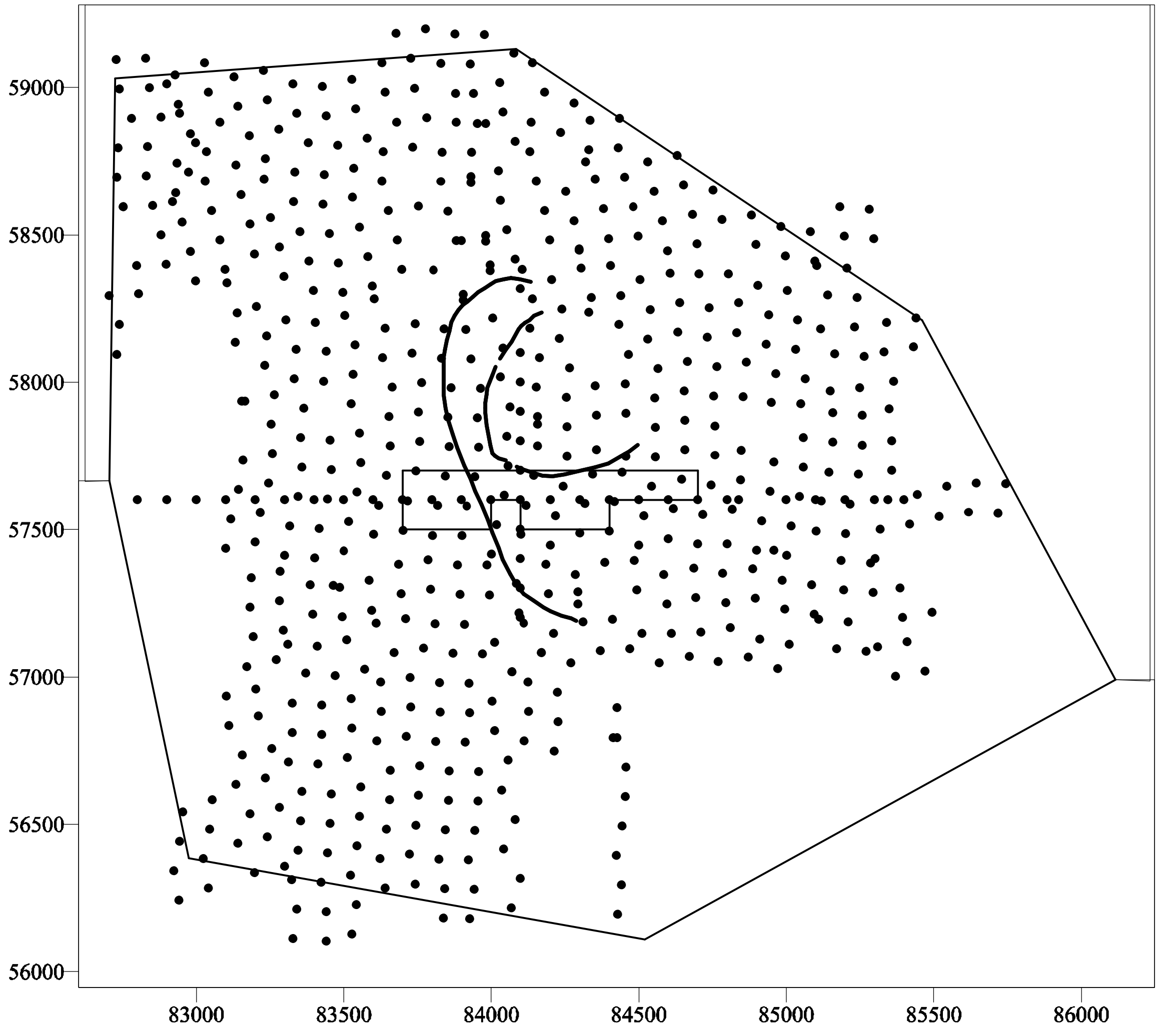


Phosphate content measured by the Citric Acid method, with cored area and perimeter walls

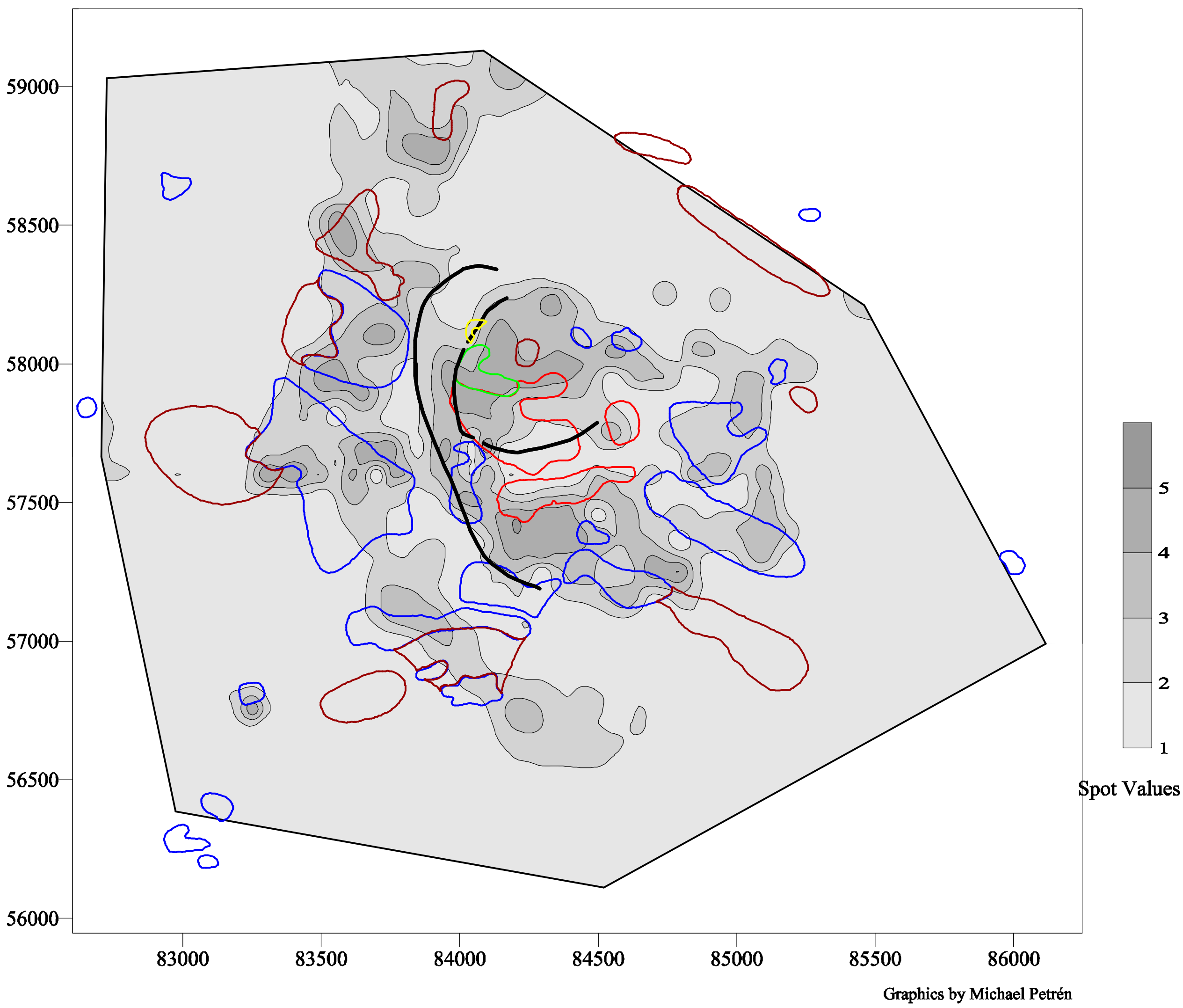
Great Zimbabwe



Graphics by Michael Petrén

Soil sample location, perimeter walls and cored area. Soil sample location based on N/S, E/W lines complemented by combined random/systematic sampling. Density 1/ha.

Great Zimbabwe



Phosphate content measured by the Spot Test method, settlement distribution (Zhizo to post Period 4) and perimeter walls.

Zhizo — Period 2 — Period 3

Period 4 — Post Period 4