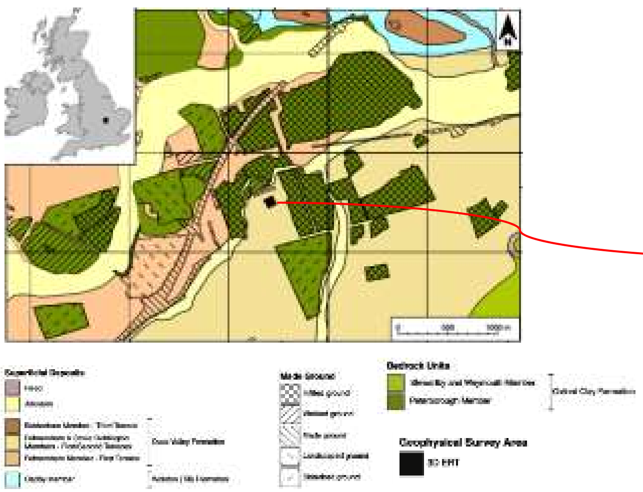
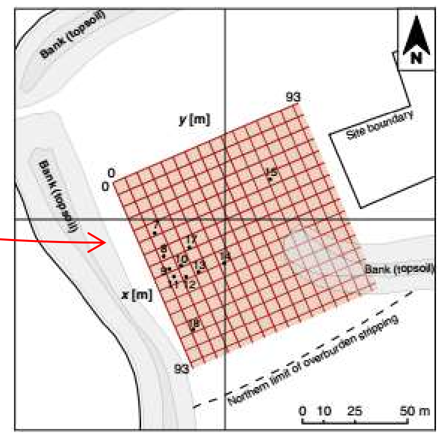
MINING INVESTIGATION

Bedrock Detection Beneath River Terrace Deposits Using 3D-ERI

River terrace deposits are a focus of considerable scientific, archaeological, and economic interest. These deposits are a particularly rich source of archaeological artefacts preserving a record of Paleolithic human activity and are also a major economic resource of groundwater and sand and gravel aggregates for construction. River terrace deposits can be highly variable and difficult to characterize in terms of structure and lithology, particularly where the deposits of multiple or dissected terraces are present. Typical the most detailed and commonly undertaken subsurface investigations of river terrace deposits are for mineral exploration, where drilling is the principal investigative tool. However, because of the complexity of some deposits, even drilling using densely spaced boreholes can fail to adequately reveal the three-dimensional (3D) structure of a deposit in terms of thickness and composition.





Objective: Bedrock detection beneath river terrace deposits .
Survey site: Near the village of Willington, UK, November 2009
Instrument: SuperSting R8/IP at 3 m electrode and 6m line spacing with total 32x2D lines using dipole-dipole array.
Software: EarthImager 3D and EarthImager 3DCL (64 bit).
Reference: Chambers J.E. et al.2012,Bedrock detection beneath river trace deposits using three-dimensional electrical resistivity tomography. Geomorphology 177-178

Data courtesy of British Geological Survey NATURAL ENVIRONMENT RESEARCH COUNCIL

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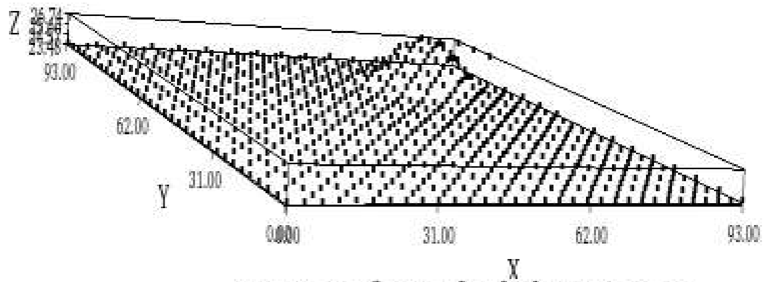
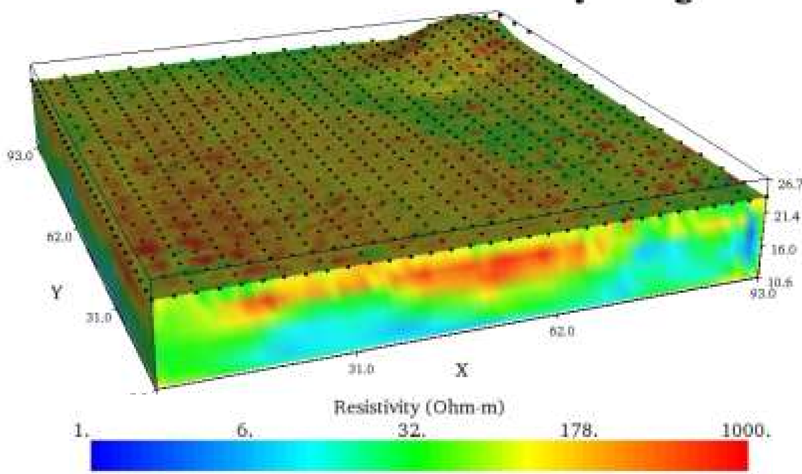
The 3D Electrical resistivity data were collected on a network of 32 orthogonal survey lines positioned at 6-m intervals in X and Y directions of 93m by 93m area. The Dipole-Dipole array with 3 and 6m dipole separations of 1 to 8 levels were used with normal and reciprocal of 11,270 measurements. The combined 3D data set illustrates as low resistivity clay-bedrock below more resistive and highly heterogeneous mixed sand and gravel deposits of fluvial valley-fill terraces.

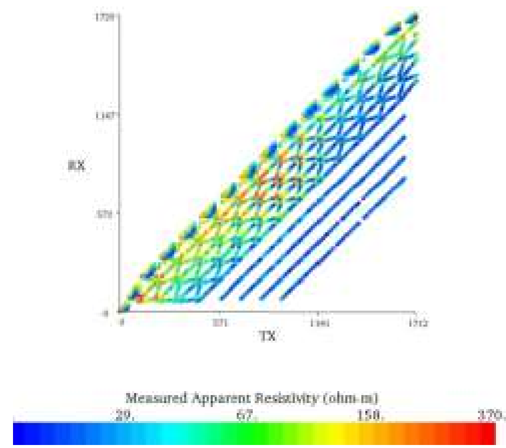
Electrode Layout



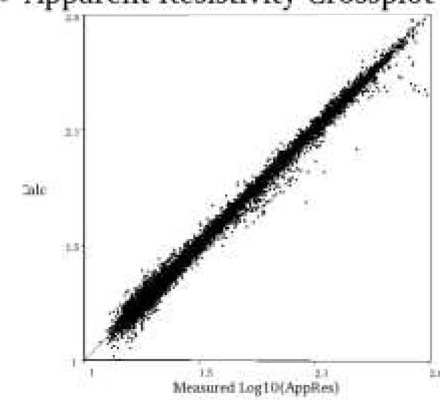
Inverted Resistivity Image



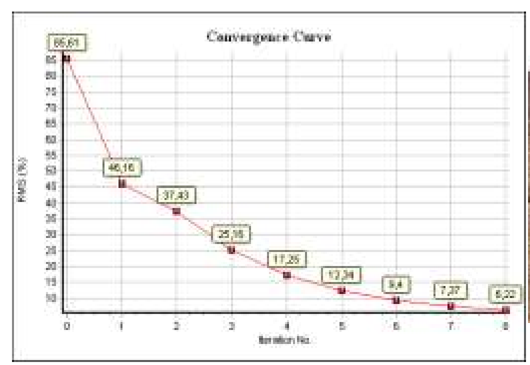
Apparent Resistivity Scatterplot



Apparent Resistivity Crossplot



Iteration No. 8. RMS = 6.2%. L2 = 1.5



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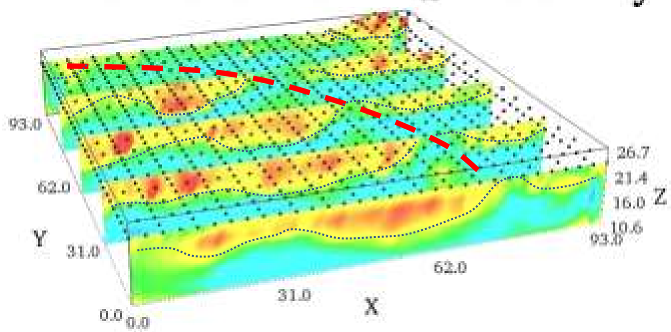
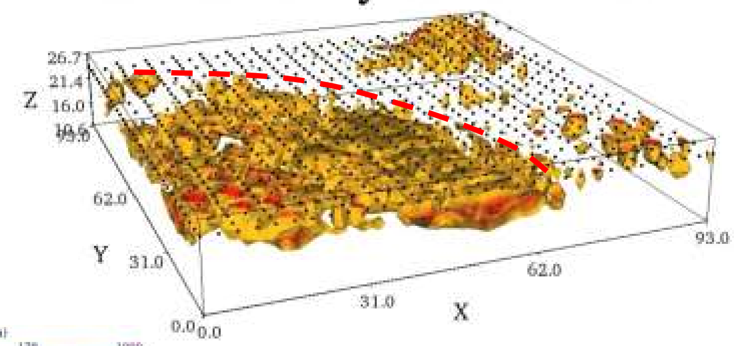
The results provide a high spatial resolution that enabled a previously unknown erosional bedrock structure, associated with the change from deeper first terrace to second terrace deposits, to be identified in the Great Ouse valley. Borehole data provide a useful ground truth data set to assess the performance of 3D ERT for river terrace deposit characterization and bedrock detection. Subsurface geological variations (including the distribution of major formations, and lithological heterogeneity, and river terrace deposit thicknesses) were captured within the 3D ERT model. A major erosional feature on the bedrock surface was identified as the boundary between first and second terrace deposits of the Great Ouse valley.

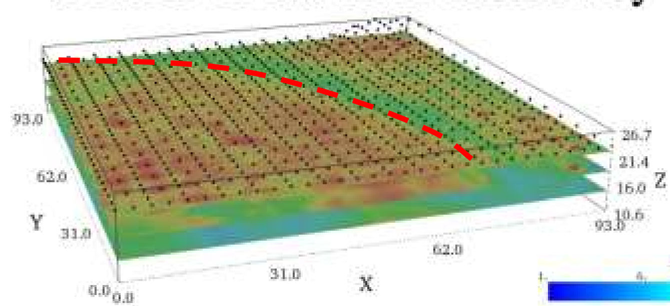
Y Slices of Inverted Resistivity



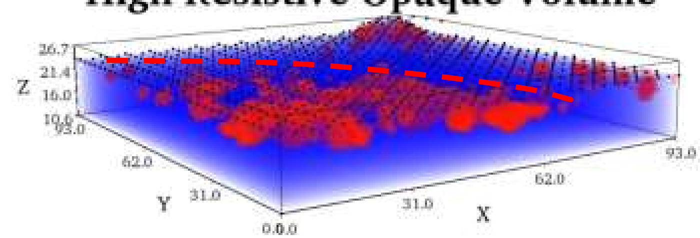
3D Resistivity Contour Plot



Z Slices of Inverted Resistivity



High Resistive Opaque Volume



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