



The implementation of geophysical prospection in the frame of criminal soil forensics



K. Walraevens, J.P. Cnudde, M. Coetsiers, M. Van Camp & K. Martens
Laboratory for Applied Geology and Hydrogeology, Ghent University, B-9000 Gent, Belgium
Kristine.Walraevens@UGent.be

THEORETICAL BACKGROUND

Geo-electrical measurements

Normal arrangement
B • L profile line
N • A M
B and N at "infinite" distance
Current electrodes A & B

Schlumberger configuration
L profile line
+I A M N -I
Potential electrodes M & N

Wenner arrangement
L profile line
A M N B

Detection of cavities
Effect of a higher resistivity anomaly (e.g. cavity) on the electrical current and potential lines

Electromagnetic measurements
For EM34: $H/H_0 = \sigma$
 σ : conductivity
 σ is directly read

Electrical current (full lines) is orthogonal to equipotential lines (dotted)
 $\rho = k (\Delta V / I)$
 I = electrical current
 V = potential difference
 K = geometric factor determined by configuration
 ΔV and I are measured
 ρ is deduced.

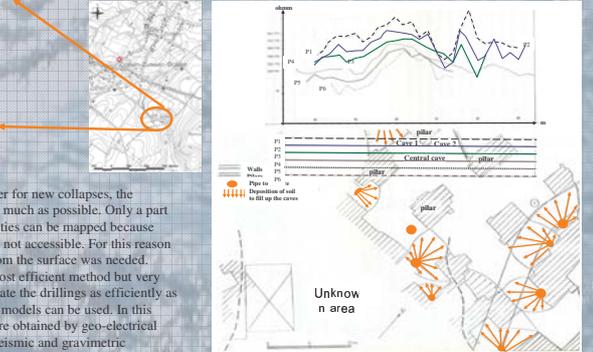
Profiling is performed by moving electrodes along profile line

LOCATION OF UNDERGROUND CAVITIES

1) LOCATION OF UNDERGROUND CAVITIES BY MEANS OF GEO-ELECTRICAL PROFILING AT RIEMST



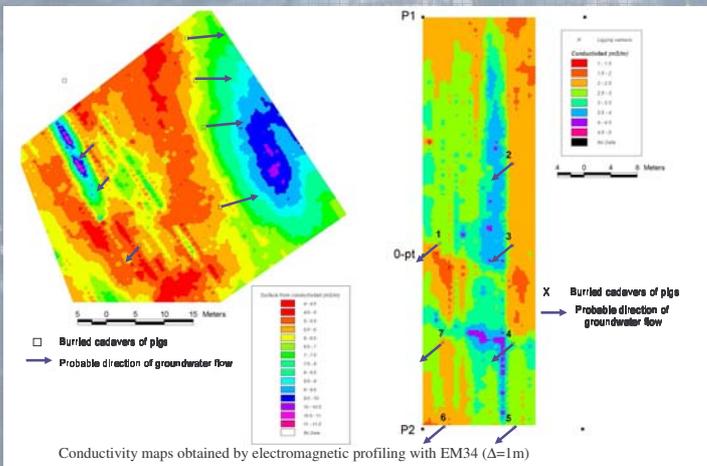
The area of Zichen-Zussen-Bolder is undermined by a dense network of cavities. These cavities were excavated in Cretaceous sediments since Roman times for marl that was used as construction material. After the second World War the caves were used for mushroom growing. In order to let in large lorries the tunnels were enlarged. On December 23th 1958 a real disaster happened when 4 ha collapsed, causing the death of 18 people.



APPLICATIONS IN NECROSEARCH

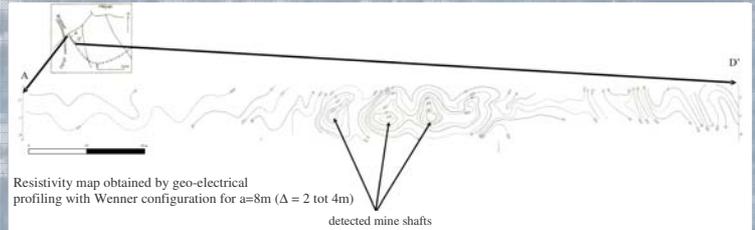
1) EXPERIMENTAL PROSPECTION FOR BURIED PIG CORPSES

Electromagnetic profiling was used to locate 8 buried pig bodies in the dunes near Lombardsijde, and 7 pig bodies in a loamy soil at Meerdal. These pigs were buried at the end of 1997 by the Disaster Victim Identification (DVI) team of the Federal Police of Belgium in the frame of the BABE project. The depth of the bodies varies between 10 and 100 cm below ground level. Pig bodies can serve as good analogues for human corpses. Some of them had been "dressed", and/or wrapped in plastic, others were naked. The electromagnetic measurements were carried out at the end of 2002, five years after burying. During this period, the bodies had been decomposing, releasing fluids to the surroundings. These fluids have migrated downward to the water table, after which they have moved with groundwater flow (downgradient). Increased conductivities were found downgradient from the burial sites.



2) LOCATION OF UNDERGROUND MINE SHAFTS AT NIVELLES

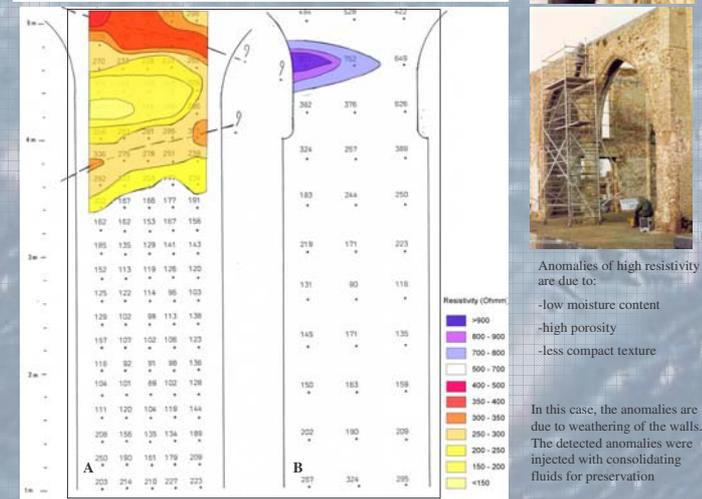
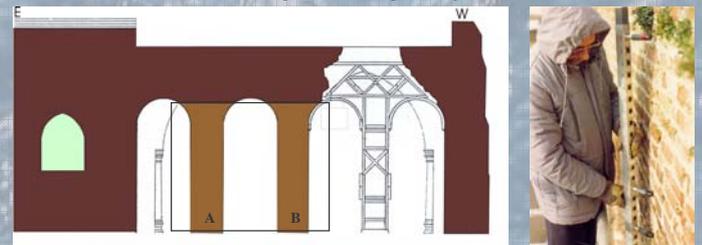
Underneath a section of the planned ring road around Nivelles, geophysical prospection was called upon for the detection of possible forgotten mine shafts.



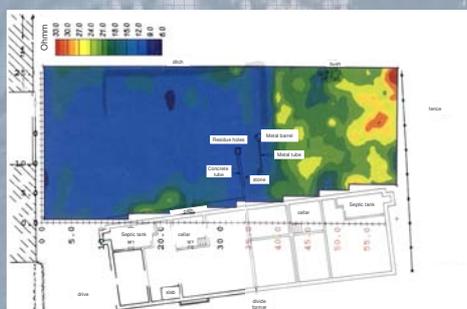
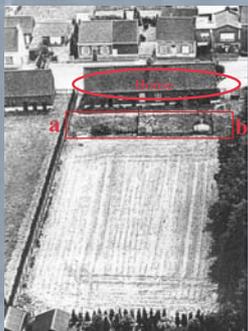
By means of geo-electrical profiling cavities (remnants of mine shafts) with higher resistivity were localised. For the construction of the ring road at Nivelles these cavities needed to be filled in order to guarantee stability.

PROSPECTION OF ANOMALIES IN WALLS

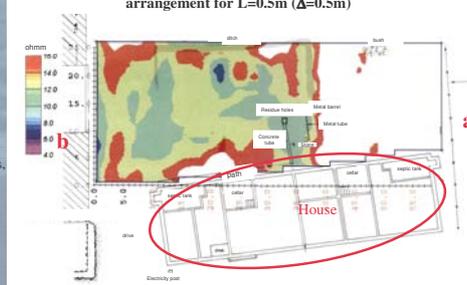
For the restoration of the ruin of the Roman St-Eligius church at Ettelgem, weak parts in walls had to be located.



2) SEARCH FOR HUMAN CORPSE AT EVERGEM



In the framework of a forensic investigation, geo-electrical prospection was carried out aiming at the detection of a human corpse, that was suspected to have been the victim of murder. Measurements were done in the garden (a-b) of the house, which had been divided in two parts, that had been used by two different families for years. Differences in land use (two different gardens, a former dog kennel, ...) correspond with differences in resistivity. Indications for the presence of a human corpse were not found, also not when afterwards the grounds were dug off.



Acknowledgment

The authors gratefully acknowledge the support of Chief of Police Joan De Winne and Chief Inspector Dirk Maes of the DVI-team of the Belgian Federal Police, who provided access to the test sites Lombardsijde and Meerdal of the BABE project.