



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



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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.

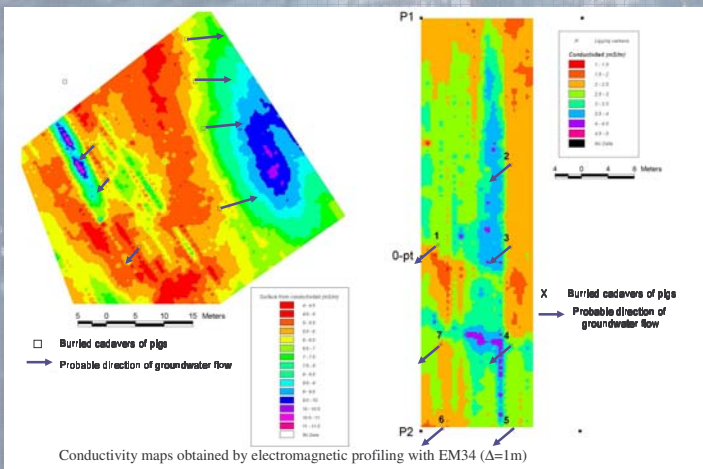
To diminish the danger for new collapses, the cavities were filled as much as possible. Only a part of the subsurface cavities can be mapped because part of the tunnels are not accessible. For this reason a mapping method from the surface was needed. Drilling holes is the most efficient method but very pricey. In order to locate the drillings as efficiently as possible, geophysical models can be used. In this case the best results are obtained by geo-electrical methods rather than seismic and gravimetric methods.

Measured resistivities obtained for 6 geo-electrical profiles with modified Schlumberger configuration for $L=100m$ (measuring step $\Delta = 1m$)

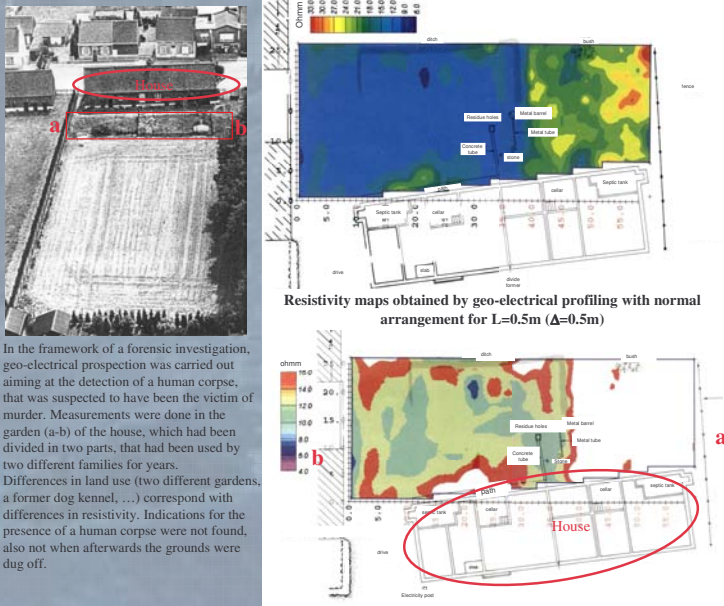
APPLICATIONS IN NECROSEARCH

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.

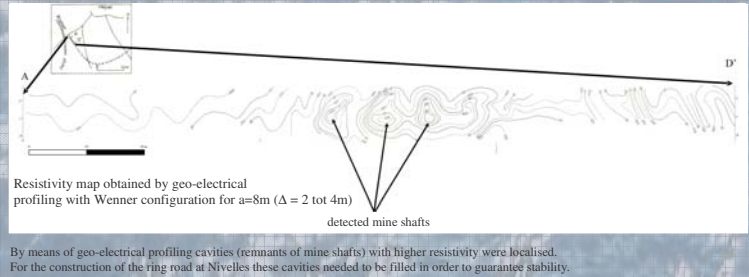


2) SEARCH FOR HUMAN CORPSE AT EVERGEM



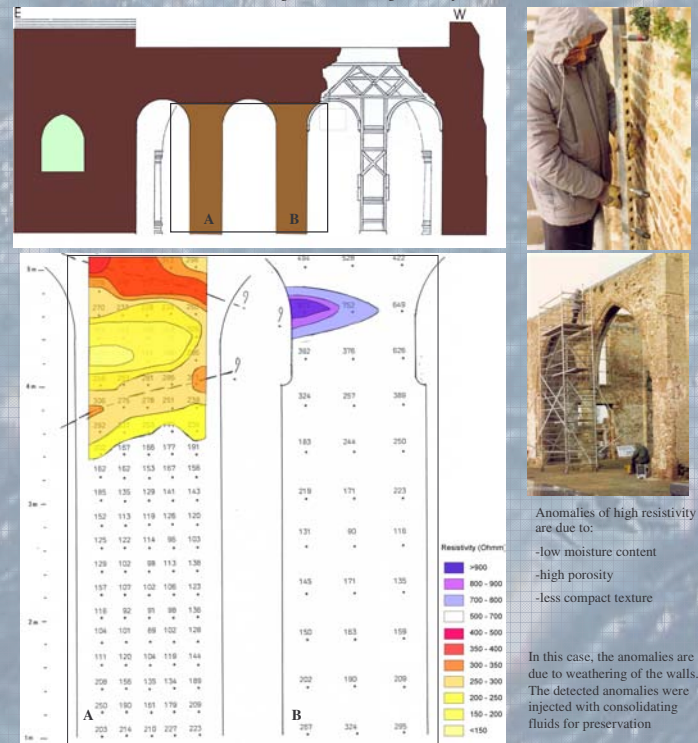
2) LOCATION OF UNDERGROUND MINE SHAFTS AT NIVELLES

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



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.



Acknowledgment

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