RES3DINV - 3D RESISTIVITY & IP INVERSION software for Windows 98/Me/2000/NT/XP

Supports on land and underwater surveys
Supports exact and approximate least-squares optimisation methods
Supports smooth and sharp contrasts inversions
Supports up to 5000 electrodes
Now available as a combined package together with RES2DINV.

In areas with complex structures, there is no substitute for a fully 3D survey. The RES3DINV program is designed to invert data collected with a rectangular grid of electrodes (Loke and Barker 1996). The arrays supported include the pole-pole, pole-dipole, inline dipole-dipole, equatorial dipole-dipole and Wenner-Schlumberger and non-conventional arrays.

The RES3DINV program uses the smoothness-constrained least-squares inversion technique to produce a 3D model of the subsurface from the apparent resistivity data. A Pentium III or Pentium 4 based microcomputer with at least 256 megabytes RAM and a 20 gigabytes hard-disk is recommended. Depending on the size of the survey grid and the number of field measurements, as well as the speed of the computer system used, the inversion of a single 3D data set can take anywhere from a few minutes to more than 12 hours!

The program will automatically choose the optimum inversion parameters for a data set. However, the parameters which affects the inversion process can be modified by the user. Three different variations of the least-squares method are provided; a very fast quasi-Newton method, a slower but more accurate Gauss-Newton method, and a moderately fast hybrid technique which incorporates the advantages of the quasi-Newton and Gauss-Newton methods. Two different variations of the smoothness constrained least-squares method are provided; one optimised for areas where the subsurface resistivity varies in a smooth manner, and another optimised for areas with sharp boundaries. Topographic effects can be incorporated into the model by using a distorted finite-element grid such that the surface of the grid matches the topography (Sasaki 1994).

An example of the results obtained from an electrical imaging survey in an area with complex geology is shown in Figure 1. This survey was carried out at Lernacken in Southern Sweden over a closed sludge deposit using the pole-pole array (Dahlin *et al.* 2002). A fairly large survey grid of 21 by 17 electrodes was used. The former sludge ponds containing highly contaminated ground water show up as low resistivity zones in the top two layers. This was confirmed by chemical analysis of samples. The low resistivity areas in the bottom layer are due to saline water from a nearby sea.

The results from a 3D resistivity and IP survey over a copper and gold porphyry prospect in Southeast Asia is in Figure 2 displayed by a 3D Virtual Reality Modelling program to show selected regions of the model. The survey area covers a 5000 by 5000 meters grid. The main targets are regions with high IP values over 20 and 30 mV/V.

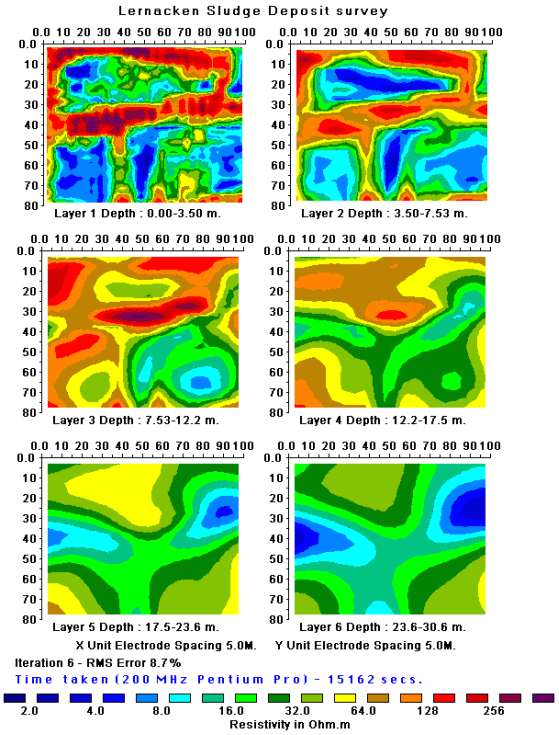

Figure 1. The 3D model obtained from the inversion of the Lernacken Sludge deposit survey data set. The model is shown in the form of horizontal slices through the earth.

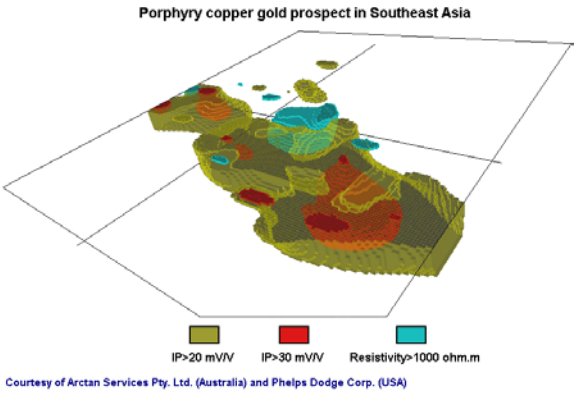

Figure 2. 3D view from the southeast of the resistivity and IP model from a survey over a copper and gold porphyry prospect in Southeast Aisa.

References

Dahlin, T., Bernstone, C. and Loke, M.H., 2002. A 3-D resistivity investigation of a contaminated site at Lernacken, Sweden. Geophysics, **67**, 1692-1700.

Loke M.H. and Barker R.D.,1996. Practical techniques for 3D resistivity surveys and data inversion. Geophysical Prospecting, **44**, 499-523.

Sasaki, S., 1994. 3-D resistivity inversion using the finite-element method. Geophysics, **59**, 1839-1848.