RES2DINV - 2D RESISTIVITY & IP INVERSION software for Windows 98/2000/NT/XP/Vista

Supports on land, underwater and cross-borehole surveys
Supports smooth and sharp contrasts inversions
Supports exact and approximate least-squares optimization methods
Supports up to 16000 electrodes with almost any electrode arrangement
Fast seamless inversion of very long survey lines using sparse inversion techniques

Two-dimensional (2D) electrical imaging surveys are now widely used to map areas of moderately complex geology where conventional 1D resistivity sounding surveys are inadequate. The RES2DINV program uses the smoothness-constrained least-squares method inversion technique (Sasaki 1992) to produce a 2D model of the subsurface from the apparent resistivity data. It is completely automatic and the user does not even have to supply a starting model. On a Pentium based microcomputer, the inversion of a single pseudosection is usually completed within minutes. It supports the Wenner (α,β,γ), Schlumberger, pole-pole, pole-dipole, inline and equatorial dipole-dipole, gradient and non-conventional arrays.

The program will automatically choose the optimum inversion parameters for a data set. However, the inversion parameters 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 and accurate hybrid technique. The smoothing filter can be adjusted to emphasize resistivity variations in the vertical or horizontal directions. It can also be optimized to produce models with smooth boundaries (for eg. chemical plumes), or with sharp boundaries (for eg. fracture zones). Resistivity information from borehole and other sources can also be included to constrain the inversion process. Three different techniques for topographic modeling (Loke 2000) are available in this program.

Figure 1 shows an example from an electrical imaging survey in an area with fairly complex subsurface geology and significant surface topography.

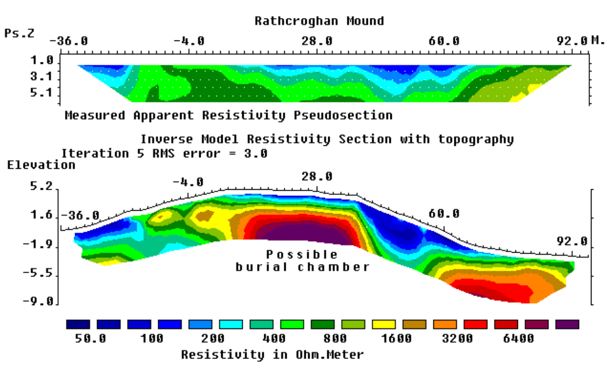

Figure 1 Rathcroghan mound survey (a) apparent resistivity pseudosection, and (b) computer inversion model.

This survey was carried out across a circular mound which is thought to contain some important Irish archaeological burial chambers (Waddell and Barton 1995). The inversion of this data set, which has 67 electrode positions and 339 data points, took about 24 seconds on a 3.4 GHz Pentium 4 computer.

The second example is from a combined resistivity and IP survey over the Magusi River massive sulphide ore body (Edwards 1977). This survey was conducted with 30.5 meters, 61.0 meters and 91.4 meters dipoles. The resulting pseudosection has a very complex distribution of the data points with overlapping data levels measured with different dipole spacings. The apparent resistivity and IP pseudosections, together with the model sections obtained are shown in Figure 2. The ore body shows up as a distinct low resistivity body with high IP values near the middle of the survey line in the model sections. Note the sharp boundaries between ore body and the surrounding rocks.

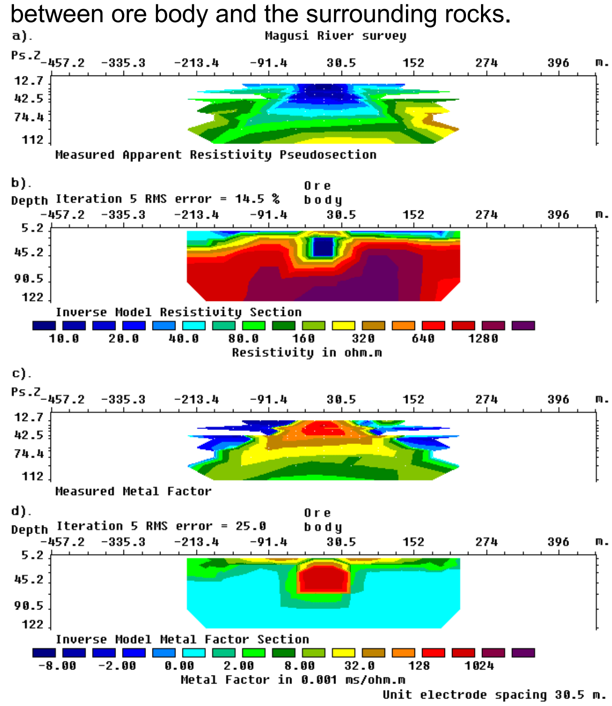

Figure 2. Magusi River ore body survey. (a) Apparent resistivity and (b) model sections. (c) Apparent metal factor and (d) model sections.

References

Edwards, L.S., 1977, A modified pseudosection for resistivity and induced-polarization. Geophysics, 42, 1020-1036.

Loke, M.H., 2000. Topographic modelling in resistivity imaging inversion. 62nd EAGE Conference & Technical Exhibition Extended Abstracts, D-2.

Waddell, J. and Barton, K, 1995, Seeing beneath Rathcroghan. Archaeology Ireland, Vol. 9, No. 1, 38-41.

Sasaki, Y. 1992. Resolution of resistivity tomography inferred from numerical simulation. Geophysical Prospecting, **40**, 453-464.