perfiles

...YOUR GEOPHYSICAL NEWSLETTER

Published by: José Arce Geofísicos S.R.L. **November 2002**

induced polarization – electrical resistivity – self-potential – magnetics – electromagnetics - seismics – well-logging
MINING – GROUNDWATER- ENGINEERING - ARCHAEOLOGY

¡CHEERS!

Welcome to the latest edition of our periodic newsletter!, after the awaited *XI Congreso Peruano de Geología*, where we presented our Orcopampa case history, and we had the chance to assist to numerous technical presentations. We salute the *Sociedad Geológica del Perú* for this event and for keeping it free of comercial presentations, thus favoring research and development of new techniques and technologies applied to our sciences.

This time around, we will discuss a controversial issue: how to compare and decide between 1, 2 and 3 dimensional electrical surveys, and in case you want to discuss these brief ideas any further, please get in touch with us.

José R. Arce

EQUIPMENT AND SOFTWARE

To be able to do an IP/Resistivity survey with our widely known 1D sounding applications, a relatively small requirement of power and a one channel IP receiver are the only requirements. About 95% of 1D exploration cases may be performed with 200 watts of maximum energizing power, reason why a battery-operated transmitter is sufficient. The modelling software we use for these applications, named Sondex, was developed by our company and ran its very first inversión around 1984 with an Apple II computer. Today, it is a 32-bit Applications and runs in various Windows platforms.

For 2D applications, usually a larger amount of energizing power is required, so a larger transmitter is preferable, depending on the chosen electrode array. For instance, Dipole-Dipole requires some 30 times more power than Pole-Pole along profiles, reason why we prefer the last one, to obtain a stable reading with minimum subsurface distortion. The use of an IP receiver with multiple simultaneous channels like our state-of-the-art Elrec PRO unit simplifies the field operator's job, but is not a definite requirement. To mathematically invert a 2D section, there are several alternatives for software available. Our preference on software basically permits any type of field array that we may design, and gives control over most inversión parameters, so the final result not purely a computer interpretation. We must emphasize the importance of topographical compensations, for which several methods are available; this will be the discusión subject of a future newsletter.

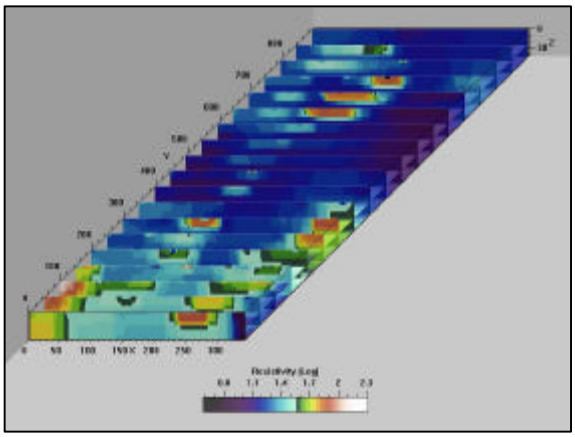
The equipment required for a 3D survey is the same as that for a 2D. The main differences are field methodology and inversion software. A mistaken common practice is to correlate depth-levels or penetrations between 2D profile inversions and present them as 3D. A true 3D inversion takes into account Chargeability-Resistivity variations in all directions, as well as topographic deformations, so the inversion process tends to take several hours of computer time to complete. Our last 3D inversion took around 6 hours with a 2GHz Pentium IV processor and 1Gb of RAM memory.

HOW TO CHOOSE...

Ideally, each Geophysical survey should be designed with the appropriate methodology to fit local Geology. Large mineralized targets such as copper porphyry systems or targets in early stage's reconnaissance surveys are excellent applications for 1D vertical electrical soundings (VES) in the Wenner or Schlumberger arrays. VES's allow the field operator great flexibility, allowing for on-site decisions to locate sounding stations to pursue a specific anomaly. Thus not depending on previously staked lines or on following specific alignments. Each VES station studies directly under its center so an electrical column is inverted for each individual station. The main disadvantage in the use of VES stations is that they are fairly insensitive to small bodies or structures such as faults or veins.

A two-dimensional survey may be performed with the Pole-Pole, Pole-Dipole, Dipole-Dipole or Gradient arrays, or with virtually any combination/design of field electrodes. For this case, a higher horizontal resolution is obtained, usually with greater power requirements for the energizing field. Other disadvantages are dependance on previously staked grids or lines as well as longer time to perform the survey, compared to an equivalent area surveyed with the 1D VES technique. With this method, smaller bodies and structures have a greater possibility for detection and definition.

3D studies have the greater resolution of all IP/Resistivity methods, as well as greater comparative cost. To do a true 3D study, a previously staked gris with equally spaced stations is required, so that measurements may be performed between all posible transmitter-receiver combinations between stakes. A more realistic way to do a 3D inversion is to use two-dimensional profiles, but taking into account that to obtain a reasonable inversion line-separation should preferably not exceed twice the minimum electrode separation. The block diagram shown is the resulting Resistivity from a 3D inversion over an epithermal deposit, with line separation of about 200 meters and minimum electrode spacing of 50 meters. Field electrode array used was Pole-Pole with 3 penetrations, for some 180m of maximum penetration. The bodies shown in clear (or red) are the pursued silicified masses.



Until next time...

Av. Petit Thouars 4380, Miraflores, Lima 18, Perú. Telephone:4227205, Fax:4426946.
perfiles@geofisicos.com.pe http://www.geofisicos.com.pe