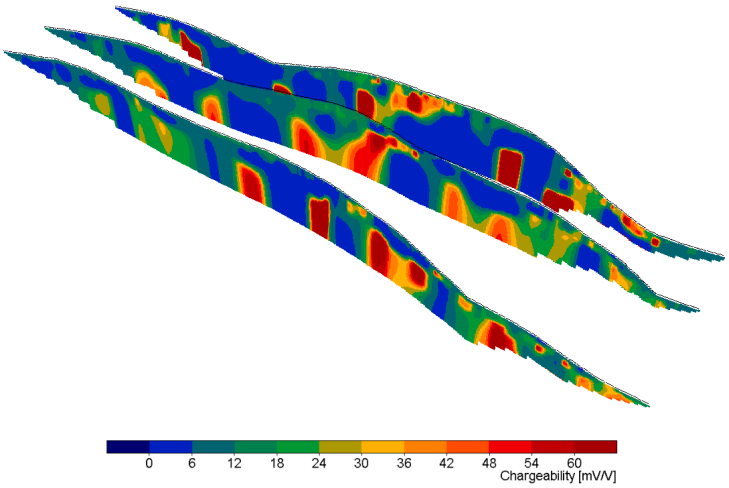
Terrameter LS

MINERAL PROSPECTING



Automatic System for Resistivity and IP Imaging

Terrameter LS is a world leading resistivity-IP instrument that offers high quality data. The instrument can be used for several applications and mineral prospecting is one of its many strong competences where its wide dynamic range provides superior results.

Why measure IP?

Variations in lithology do not always lead to significant contrasts in resistivity, for example in the case of disseminated ore minerals. In such cases the ground may contain many small conducting zones that are isolated from each other, thus imitating the characteristics of a capacitor. The presence of the conductors does not affect the resistivity measured by direct current, whereas the chargeability measured as Induced Polarization (IP) will reveal them. This chargeability varies for different materials and they can therefore be differentiated from each other by using IP measuring (e.g. Bertin and Loeb 1976; Sumner 1976).

An IP-measurement is conducted by transmitting current into the ground and carefully monitoring the voltage discharge after the current transmission has been switched off. The chargeability of different zones in the ground is thus recorded. Zones of mineralization can be detected in this way even if they do not stand out in terms of different resistivity, since for example sulphide ore minerals give rise to high chargeability.

World leading Resistivity/IP system - optional configuration tailored to fit your needs

Highest bandwidth on the market - providing highest resolution data

State-of-the-art constant current transmitter

No need for Non-polarizable electrodes - less maintenance and cost, higher productivity

Automatically stores full waveform data - opens for future analysis

No analog input filters - leaves signal uncompromised

High level of integration - less equipment to transport

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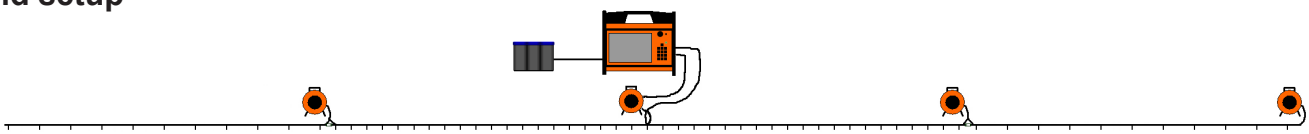
ABEM Terrameter LS system

Terrameter LS system incorporates both a powerful transmitter, high resolution receiver as well as a integrated electrode switching matrix. Together with an integrated computer and full colour screen it's a one single item solution configuration tailored to meet each individual clients requirements.

Terrameter LS utilizes a constant current transmitter that sends an almost perfect square current wave. This means that the instrument is less sensitive to noise disturbances. The instrument also incorporates galvanically isolated input channels where every input can measure totally independent of the others. Together with 24 bit input resolution the Terrameter LS has the highest bandwidth on the market.

IP-surveying is traditionally carried out using non-polarizable electrodes, but thanks to the large dynamic range, the Terrameter LS system performs excellent IP-measurements with common stainless steel electrodes (Dahlin, Leroux and Nissen 2002), thus increasing field effectiveness as well as eliminating the need of electrode maintenance.

Field setup



The Terrameter LS system standard setup is carried out by connecting the instrument to 4 interconnected cables with 21 electrode takeouts each. Stainless steel electrodes are connected to each takeout and the internal relay switch automatically addresses every electrode during data collecting.

Field effectiveness is kept at its maximum by using the Multiple Gradient protocol were all input channels can be used simultaneously for data sampling, with optimal resolution and depth penetration compared to traditional arrays such as Wenner, Schlumberger or Dipole-Dipole.

Using roll-along, the measuring profile is extended as far as desired and field measurement is interpreted using 2D or 3D inversion software such as Res2Dinv or Res3Dinv.

High resolution data sampling

During the IP-measurement, the Terrameter samples the voltage discharge with a sampling rate of 1kHz through a 24-bit A/D-converter, thus recording the discharge with a very high resolution. Also, the Terrameter LS optionally stores complete full waveform data during the whole measuring cycle, making sure that no data is lost during the data collecting. Another benefit using the Terrameter LS is that the instrument has no analog low-pass input filters since this would greatly compromise the measured result.

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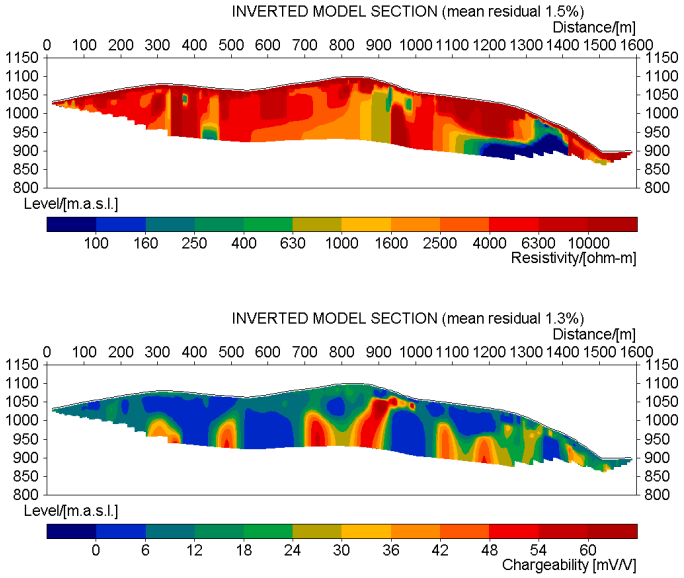
Example of Resistivity-IP Survey for Gold Prospecting

The following example shows data from a combined resistivity-IP (induced polarisation) survey that was carried out using an ABEM Terrameter LS with the purpose to find gold. Gold bearing formations are often associated with metallic sulfide mineralization, which creates IP effects (chargeability) in the gold bearing zone. The gold itself will not contribute significantly to the IP effect, but by finding the sulfide mineralization the chances of finding gold is greatly enhanced (Hallof and Yamashita 1990).

The field survey was done using an 800 m long cable spread with 81 electrodes at a spacing of 10 m. Measurements were carried out along three more or less parallel lines.

The data were inverted using Res2dinv, resulting in model sections with maximum depth of the models around 150 metres. The good data quality resulted in mean residuals as low as 1-2 % for both resistivity and IP model. Figure 1 shows the inverted resistivity and IP sections for one of the lines. A number of high chargeability zones are evident, and one of the zones reaches shallow depths (around length co-ordinate 950 m) and would thus be an easy target for exploration drilling.

The inverted sections are in good agreement with each other as can be seen in Figure 2. This shows that the geological structural direction is essentially perpendicular to the line direction, making the 2D approach valid. It also confirms that the data quality is good enough to produce consistent models from the IP data.



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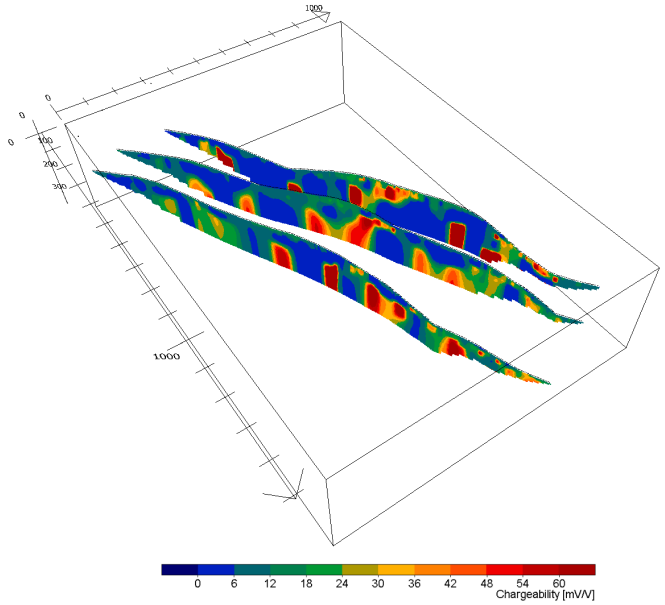


Figure 2 shows an IP fence diagram of the three survey lines

Conclusion

With a result like this it is simple to target the first ground follow up and exploration drilling in spots where the expected mineralization is shallow.

Optimizing the initial test drilling to the most promising and shallowest spots makes it possible to save large costs on equipment, logistics and manpower requirements, especially in remote areas. This is of particular interest before verification of the precious metal find is at hand.

Furthermore, adding more investigations lines would make it possible to create 3D models of the expected geometry of the mineralization which would be a very valuable asset when planning a core drilling program to delineate the 3D extension of the mineralization.

Full Waveform recording

Terrameter LS optionally records Full Waveform data, ensuring that the received measured signal is stored totally uncompromised. This means that it can be thoroughly analysed and supply the user with vital information.
Since Terrameter LS utilises constant current transmission, the measured voltage is a direct result of the ground response. It also reveals any form of disturbance, such as power-net noise, which can easily be averaged out.

Full waveform data also opens possibilities for developing advanced signal processing algorithms, which in real time or post processing might extract meaningful data from data sets that are otherwise too noise contaminated to be used in a meaningful way.

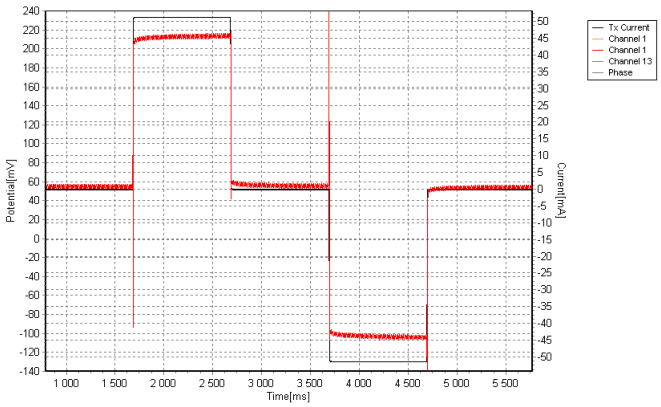
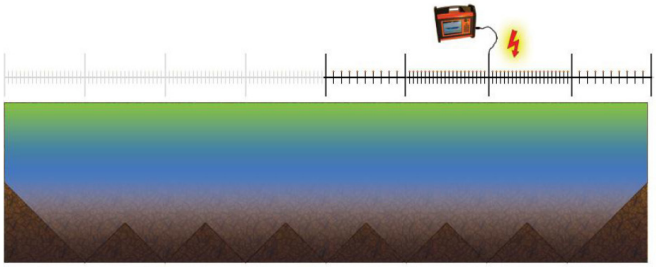


Figure 3 shows an example of a raw data sweep (Full Waveform) where black is transmitted current and red is received voltage.



Did you know?

With an ABEM 4x21 cable set, the cables are interconnected with an overlap, thus sharing an electrode position.
This enables easy maintaining of electrode spacing since no control with measuring tape is required.

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ABEM has been in the geophysics business since 1923 which means valuable experience second to none. Through a network of distributors we offer local support in order to give our customers the best possible advantage.

For more information regarding our various system packages, please contact your local distributor or our sales department at sales@abem.se.

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