

The transient electromagnetic (TEM) sounding method is a powerful surface EM technique for obtaining accurate subsurface geological information. With the Geonics Ltd. PROTEM system geoelectric section information that details vertical and lateral variations may be obtained with a minimum of field time and cost.

The system is comprised of a PROTEM receiver and is used with a family of transmitters, each suited for a range of depth of exploration. The TEM47 is optimised for sounding work to a depth of approximately 70 metres. The higher powered TEM57 transmitter is used to provide the intermediate and lower frequency repetition rate required to obtain deeper information. For very deep soundings the high powered TEM37 or TEM67 is used.

In operation, a transmit loop appropriate for the depth of exploration is laid on the ground surface. A common loop size for very shallow work is 5 by 5 metres. Deeper investigations, using the TEM57 transmitter, utilise larger loops. The transmitter produces a current in the loop which is rapidly terminated. The rapid change of current in the loop results in the induction of a current circulation in the ground beneath the loop, often described as a 'current filament'. This current filament moves down into the earth at velocities proportional to the resistivities of the materials.

A multiturn coil connected to the receiver samples the variations in the secondary magnetic field resulting from this current filament, as it sweeps through the earth materials. These variations in the secondary magnetic field contain diagnostic information on the resistivities and thicknesses of the layers encountered.

The maximum contribution to the response results from material in close proximity to, and directly below the transmitter loop. This is in contrast to ground contact electrical sounding surveys that may be affected by lateral changes in subsurface layering due to the large array expansions required to achieve the depth of interest.

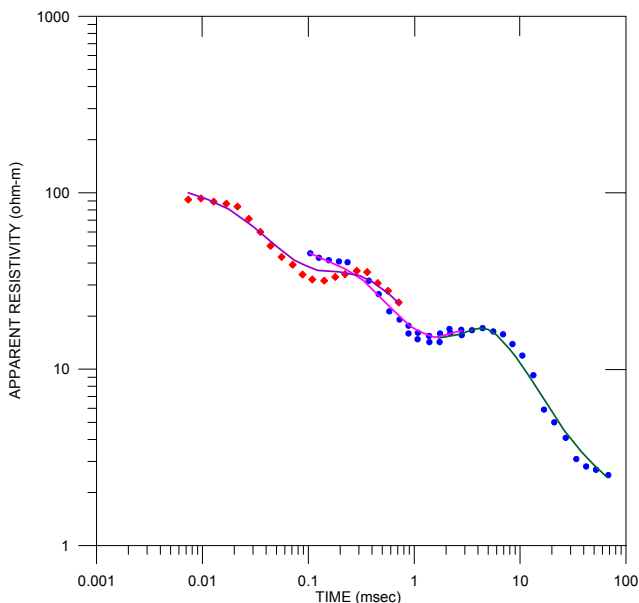
The data are recorded digitally and plotted as apparent resistivity versus time in log-log format. The twenty channels of recorded data result in approximately two decades of coverage, at ten points per decade, providing good layer resolution. This would be the rough equivalent of a current electrode expanding from a few metres to hundreds of metres for a conventional Schlumberger vertical electrical sounding. The data are modelled as depth-conductivity format using a ridge regression inversion technique.

Field loop layout and sampling of the transient takes very little time so very high sounding densities are economical. Either as individual soundings for widely distributed geological information or for rapid continuous profiling, the transient electromagnetic sounding method is an effective and reliable technique.

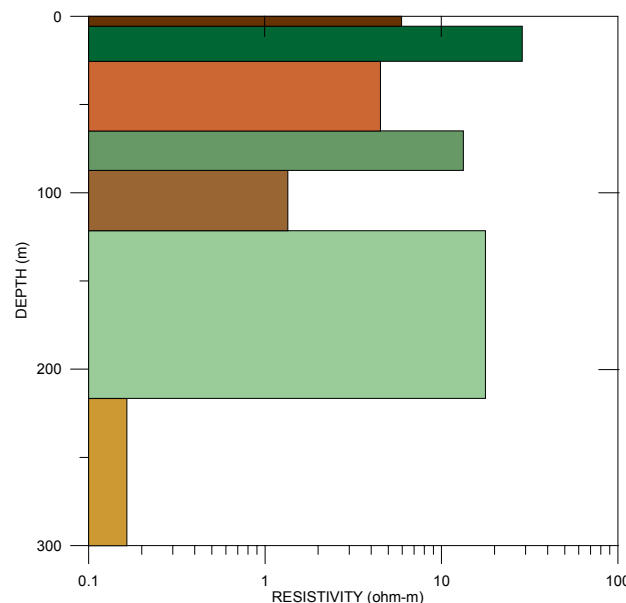
Applications

- Groundwater exploration investigations
- Groundwater contamination and saline intrusion
- Depth to bedrock, overburden layering
- Gravel, clay deposits
- Mineral exploration
- Geothermal investigations
- Permafrost investigations

TEM SOUNDING CURVE
(Raw Data Plot)



INTERPRETED LAYER MODEL
(Ridge Regression Result)



DRILLHOLE

