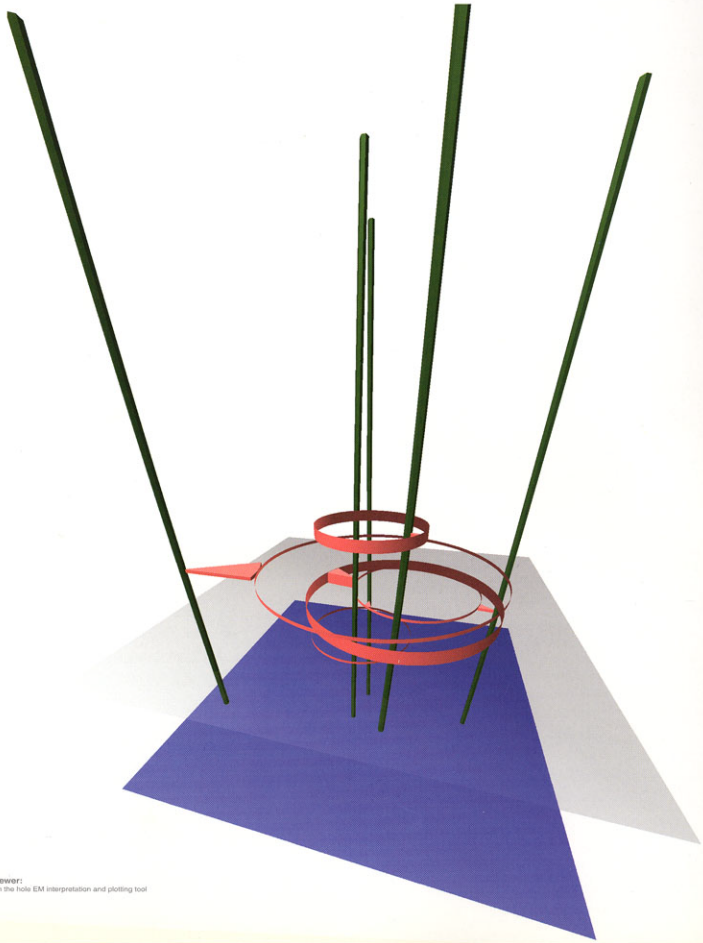
LAMONTAGNE GEOPHYSICS LTD GEOPHYSIQUE LTEE

Deep Electromagnetic Exploration Since 1979



Holeviewer:
3D down the hole EM interpretation and plotting tool

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UTEM: The World's Most Advanced TEM System.

Lamontagne designs the most sophisticated TEM systems for surface and down-the-hole EM surveying. Our UTEM systems provide maximum depth of investigation, efficient field deployment, superior resolution of conductive bodies and easier interpretation. The unique waveform and design of our UTEM systems helps us achieve these results. Where other transient EM systems become less sensitive in conductive environments or as the conductivity of your target rises, the Lamontagne UTEM maintains a much more uniform target sensitivity.

The UTEM system consists of a transmitter, receiver and either a coil for surface exploration, or a borehole probe for down the hole applications.

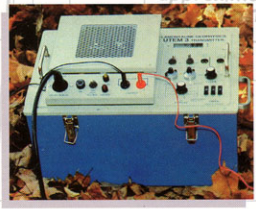
UTEM Transmitter: A high voltage (+/- 200V) current-regulating EM transmitter specifically designed for large transmitter loops, providing excellent depth of exploration. The Lamontagne transmitter is designed to use light-weight 17 gauge (1mm) wire. For higher current output, a 14 gauge (1.5mm) wire can be used. Even with the heavier gauge wire it is possible for a one or two person crew to lay out a large loop in one day, even in difficult terrain, keeping survey costs low while allowing application in demanding environments.

UTEM Receivers: Designed to be rugged and light-weight for applications in demanding situations. The UTEM 4 receiver is an asynchronous mode, DSP controlled, high resolution digital receiver, making it the best choice for conductive environments, deep exploration and remote and difficult terrain.
The UTEM 3 receiver is a versatile, high sensitivity, low noise EM receiver for surface H field, surface electric field and axial component down the hole surveying.
Both receivers use innovative noise-reduction techniques for a better signal to noise ratio, enabling them to detect and differentiate your targets more uniformly.

UTEM 3 Surface Coil: A ferrite core sensor designed for use with the UTEM 3 Rx. It can read the three components of the H field, and unique features like active guarding, shielding and field feedback techniques give it exceptional gain and response stability.

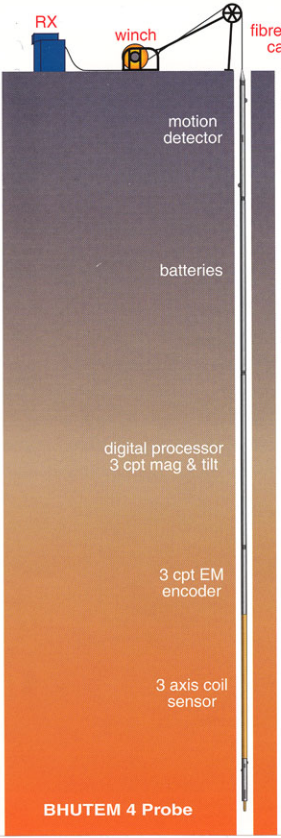
UTEM Borehole Probes: The UTEM 3 borehole probe was the first UTEM sensor probe for axial component down the hole surveys. It was instrumental in discovering the Victor deposit at a depth of 2.5 km. The UTEM 4 borehole probe measures the three components of the EM field (axial and the two transverse) simultaneously and independently at the same location. The magnetometers and accelerometers contained in the probe are used to accurately calculate the probe's orientation. In addition, the temperature reading (taken to correct the accelerometer's reading) can be used to locate temperature anomalies due to sulphide bodies.
The use of fibre optic cable link and digital signal output from both these probes greatly reduce the down hole noise allowing the UTEM probes to explore to greater depths than other systems.

UTEM 4 receiver



UTEM transmitter

UTEM 3 receiver and coil



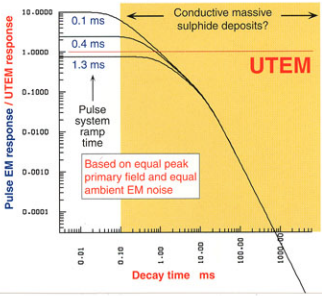
UTEM Waveform

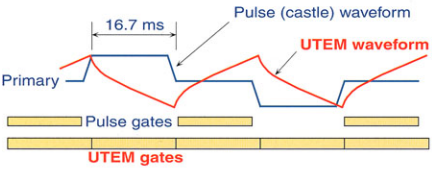
The UTEM transmitter waveform, which is dynamic over its entire range, is unique in EM exploration. The UTEM system measures the EM response while the transmitter field is changing. This is the only way to detect and characterize extremely conductive deposits. Such structures generate a secondary field that tracks the primary field variations so as to exclude any time varying field from their interiors. By measuring while the transmitter field is changing, UTEM sees both the freely decaying and the directly driven part of the secondary field. Other time domain systems measure mainly while the transmitter waveform is off and depend primarily on the freely decaying part of the field, therefore they are insensitive to very high conductivity structures. An additional benefit of the UTEM's waveform is that measurements are taken over the entire waveform so no response signal is wasted, leading to improved surveying productivity and better signal to noise per unit survey time.

Uniform Response Sensitivity

The unique features of the UTEM waveform and sampling scheme combine to produce UTEM's uniform response sensitivity. The amplitude of the UTEM response varies little over a wide range of target conductivities and thicknesses, parameters which affect the decay time of the response, therefore, the response amplitude expected for a given target size is predictable.

Pulse/UTEM Sensitivity Ratio
Ratio of Peak Responses
for Varying Decay Times





The modified triangular UTEM waveform is tailored to perform well with the normal ambient EM noise spectrum using pre-emphasis deconvolution techniques. This is made possible by using wide band transmitter current regulation and receiver deconvolution techniques.

Software: Tools for Interpretation and Modelling.

To complement the high quality data from our UTEM systems, Lamontagne has developed a suite of software to aid in the reduction, presentation and interpretation of UTEM data.

UTEM Reduction Tool BARD: Bard is a batch automated reduction and deconvolution program for UTEM data. It keeps track of any changes in data that affect final reduced data, and will automatically update the appropriate files as well as keep a record of what data files were used to reduce the data.

UTEM Plot Tool UTPLOT: Software that displays the reduced data in an easily manipulated manner. The UTPLOT provides templates which are customizable and reusable to quickly produce formatted data plots.

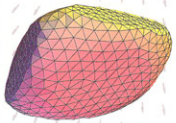
EM Field Rendering VECTOR PLOT: Draws a two dimensional vector diagram of the primary EM field given the Tx parameters and the section. VECTOR PLOT allows the user to see how the primary field is interacting with the target conductor.

Conductivity vs Depth Imaging CDI: Used to reduce and process the data collected from multi-fold depth sounding. It generates a conductivity vs. depth section from the UTEM data.

EM Modelling MultiLoop: A versatile multi-conductor modelling tool for controlled source EM systems. MultiLoop can simulate the EM response of multiple interacting plates, giving an excellent approximation of a true physical response. MultiLoop is a powerful tool for interpretation, planning EM surveys and testing hypotheses.

Holeviewer: Works with UTPLOT to display in 3D interpretation and induction vectors for three component borehole data.

Current R&D in EM Modelling MBEM: The latest R&D project at Lamontagne is a multiscalar boundary element method for EM modelling. MBEM promises to revolutionize EM modelling. It will be capable of displaying current gathering effects and eddy current induction, and modelling realistic 3D conductor geometries, conductors in weakly conductive half-space and composite conductors with differing conductivities.



Survey Services: Exploiting the UTEM's Advantages.

The unique system response of Lamontagne's UTEM equipment lends itself to a wider range of applications than traditional TEM systems. It was designed to provide uniform wideband coverage for both large loop surface and down the hole surveys for deep exploration. Lamontagne provides survey services with our UTEM system for base metal, precious metal, uranium and hydrocarbon exploration as well as ground water and crustal studies. Lamontagne provides experience and expertise in the design, execution and interpretation of EM surveys.

Surface Surveys

The surface system has the capability of measuring five components, the time-varying electromagnetic field (Hx, Hy, Hz) and surface electric field (Ex , Ey) for various loop configurations.

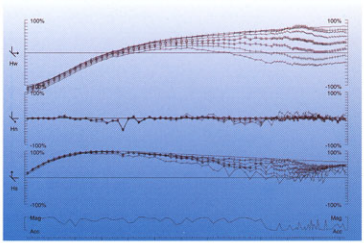
The large loop/H mode is ideally suited for massive sulphide and deep-basement conductor mapping. In this mode, the survey can be designed for reconnaissance or detailed mapping of conductors at depth. A wide range of transmitter loop sizes (from 100m x 100m to 4 km x 4 km) and the ability to search inside or outside the loop enables the detection of conductors of any orientation.

The sounding mode produces a conductivity vs depth (CDI) colour section by using multiple fold coverage. This mode is ideal for hydrocarbon exploration (porosity mapping), ground water investigations, fluid/heat source mapping in geothermal exploration and crustal sounding.

The E field or Inductive Source Resistivity (ISR) mode is a technique suitable for detecting and mapping silicified zones in gold exploration. The ISR technique can detect and map resistive zones under overburden.

Down the Hole Surveys

Down the hole systems use similar large loop configurations. The UTEM 4 system, which measures the three components of the H field (axial and two transverse), and the UTEM 3, which measures only the axial component, can survey holes to a depth of 3400 m. The BHUTEM systems are ideal for deep drilling follow-up, increasing the search radius of the drill hole from just the hole diameter to several hundred meters.



3 component total field d ata

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Lamontagne Geophysics Limited was founded in 1979 by Dr. Yves Lamontagne to pursue a new direction in electromagnetic geophysical exploration. The commercial expression of our technical development is the UTEM system. The UTEM system differs from conventional TEM systems since it was designed to measure the step response of the earth (other TEM systems measure the pulse response) by transmitting a unique UTEM waveform.

Instruments: Lamontagne has developed the UTEM system for deep exploration beyond the capabilities of other TEM systems. The unique UTEM waveform allows for continuous measurement during the entire waveform. This and other design features allows the UTEM system to detect and characterise conductors that other systems may miss.

The UTEM 4 is our newest generation EM system. Its new digital input, multi-channel design and noise reduction techniques provide increased sensitivity and resolution so you can look deeper and further for your next exploration target.

Software: Lamontagne has a full suite of reduction, plotting, 3D viewing and modelling software to complement our UTEM equipment. MultiLoop II is a powerful modelling tool for controlled source electromagnetic systems, aiding the interpretation of a variety of EM data.

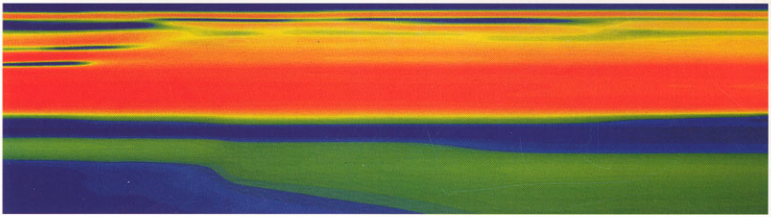
R&D: Our R&D team is working on a new way of modelling EM responses. MBEM will allow modelling of much more realistic 3D conductor geometries, allowing for enhanced interpretation.

Services: Lamontagne provides field surveying services for base metal, precious metal, uranium and hydrocarbon exploration as well as geothermal and ground water mapping and crustal studies. We also provide UTEM survey design, field crews, and interpeting and modelling by experienced geophysicists.

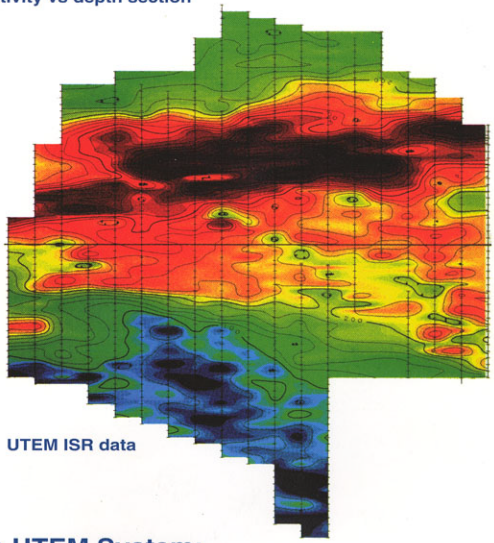
Our innovations in design give our UTEM system the sensitivity and search depth to achieve exploration results:

Victor Deep in Sudbury - Inco.
Heringa in the NWT - St. Joe Minerals.
McCreedy East Footwall in Sudbury - Inco.
Kudz Ze Kayah in the Yukon - Cominco.
Hellyer in Tasmania - Aberfoyle-Cominco.
Pipe Deep in Thompson - Inco.
And other as yet undeveloped deposits throughout the world.

All discovered with the help of Lamontagne's UTEM system.



UTEM CDI conductivity vs depth section



UTEM ISR data

Lamontagne UTEM System:

surface or down the hole EM surveys for deep exploration.

The UTEM Advantage

-depth of exploration
-reconnaissance or detailed mapping
-uniform response sensitivity
-suitable for remote locations and over conductive, rugged terrain
-detects a large variety of target conductances and geometries
-interpretation software support

UTEM Exploration Applications

-Massive sulphide
-Uranium
-Silicified zones in gold exploration
-Hydrocarbon
-Ground water and crustal studies

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