

Stratagem EH4 Geometrics, Inc.



Stratagem EH4

Hybrid-Source Magnetotellurics

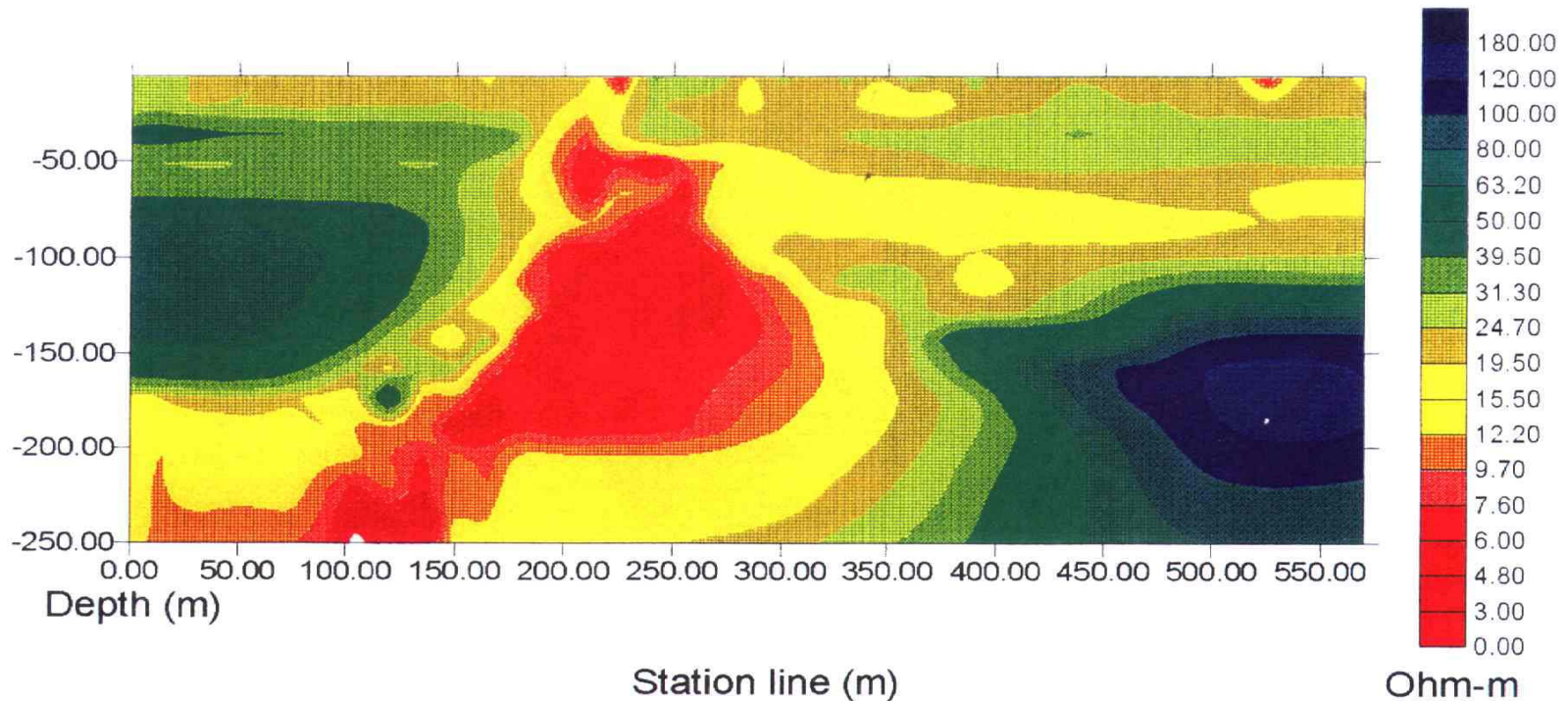
- Frequency range of 10 Hz to 90k Hz
- Approx. depth of investigation from 5m to 1km
- Portable with rapid setup and teardown
- Full tensor MT and CSAMT measurements
- In-field display and printout of 1D inversion and 2D depth section
- In-field display and print out of sounding curves
- In-field display and print out of signal amplitudes, phase, and coherency curves

Applications

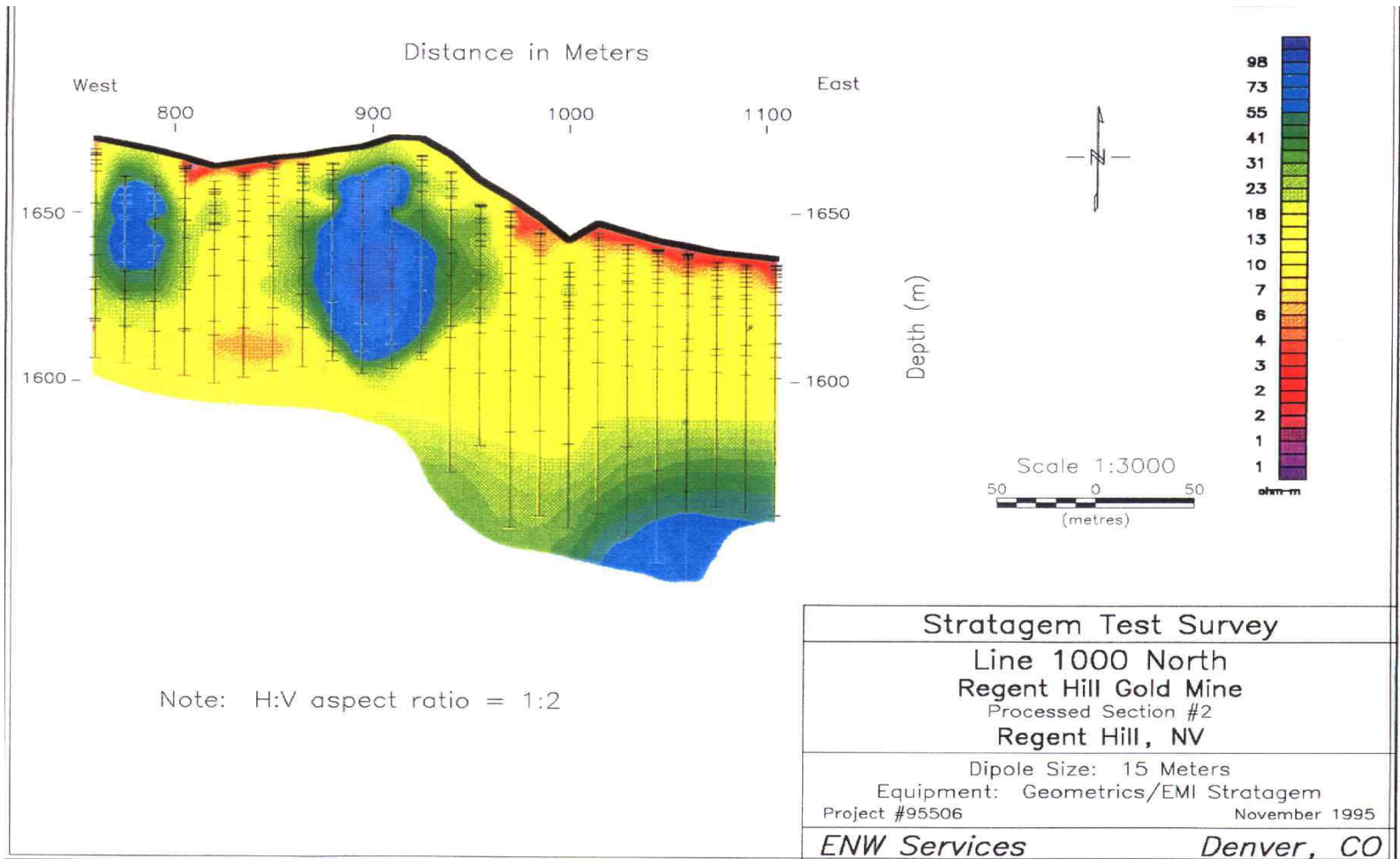
- Minerals Exploration
- Groundwater Exploration
- Engineering Studies
- Academic and Scientific Research

Test Survey for geothermal exploration in China. Red (conductive) area is location of a know fault with geothermal activity. Note high resolution of fault dip. Depth of 250 meters.

STRATAGEM (EH-4) Survey Profile in Xiao Tang Shan Hot Spring Area in North Beijing



Minerals Exploration: Resistive (blue) areas correspond to silicification zones with high concentration of hard-rock gold.



Groundwater Exploration: Resistive (darker) areas correspond to paleochannel acting as a confining aquifer in high clay content sediments. A well drilled over the resistive body was highly productive.

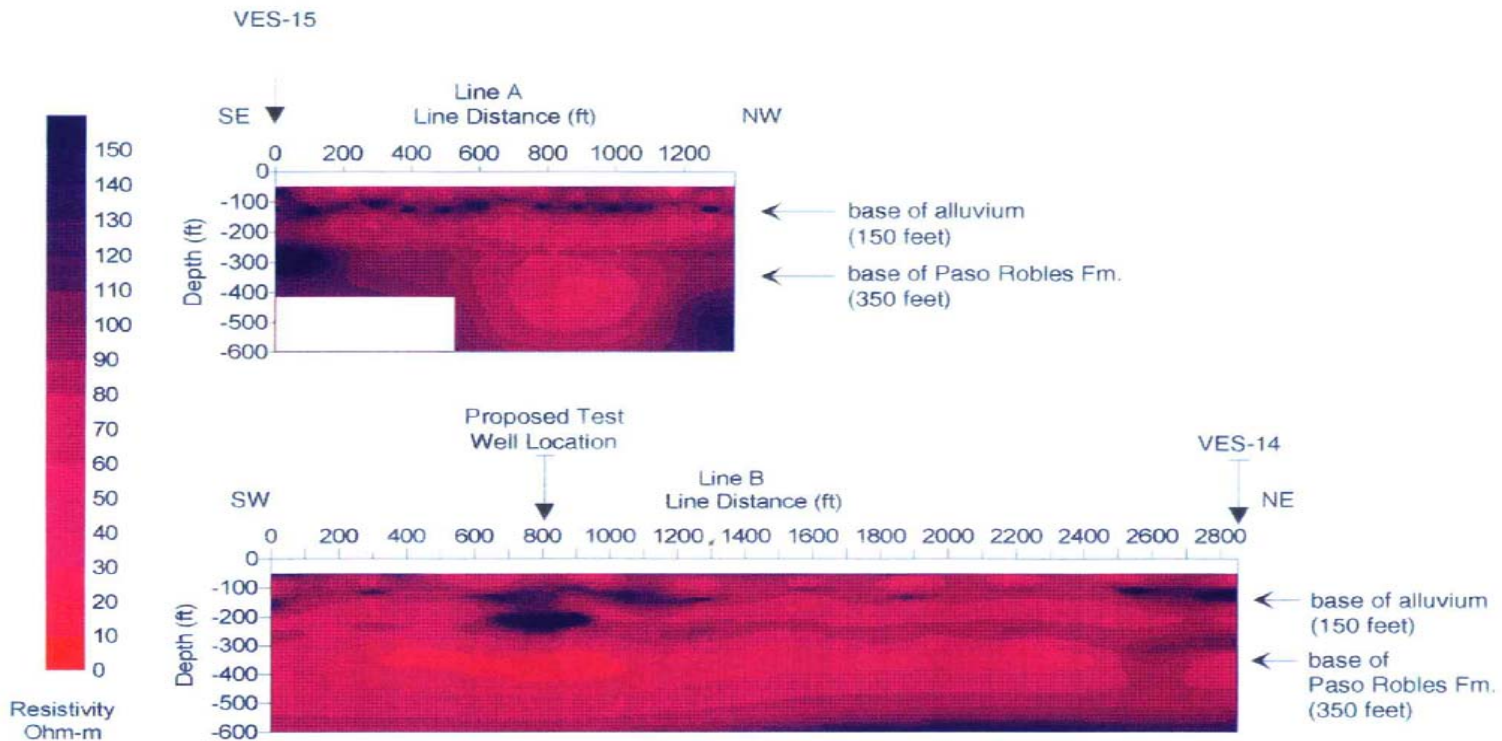


Figure 2

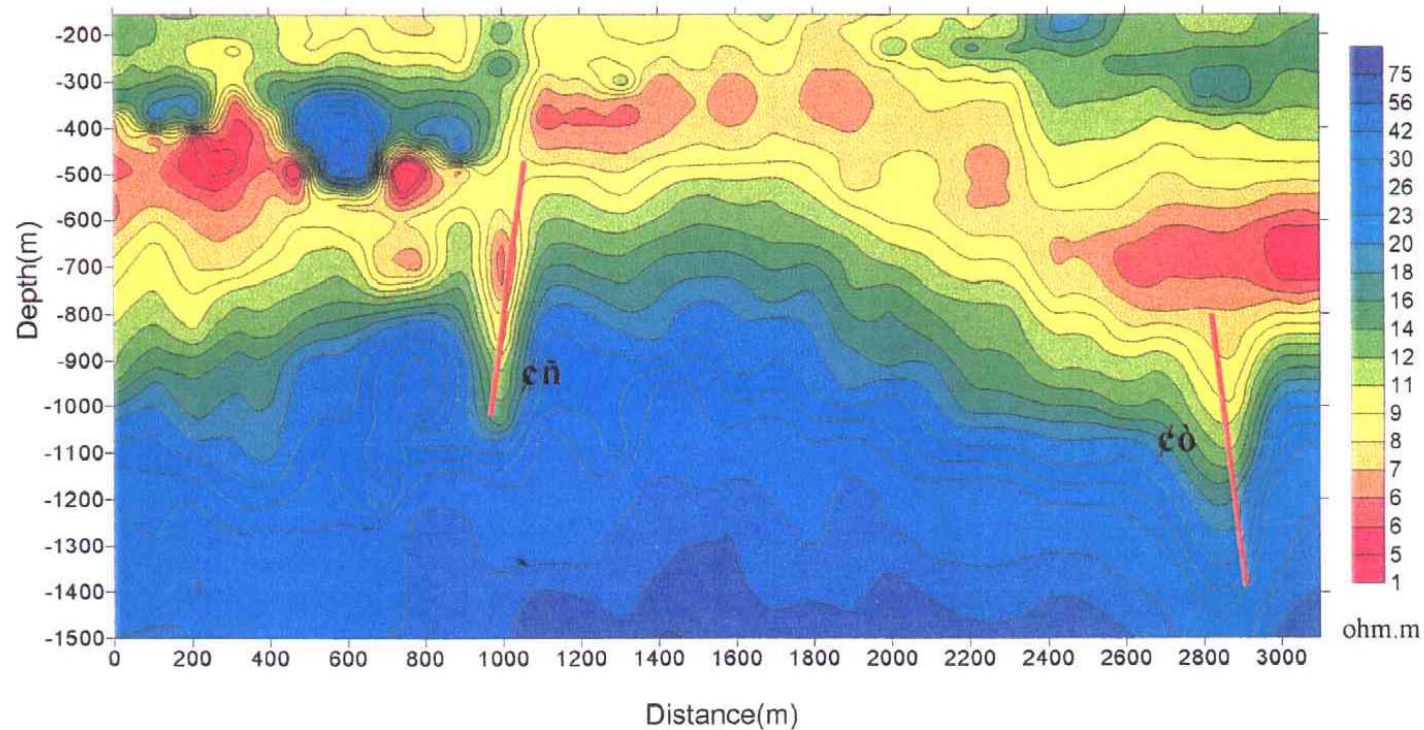
Resistivity Profile, Lines A and B
Santa Barbara County, California



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Proj No.:

Ground water exploration in China: The two red lines indicate suspected faults/fracture zones. A well was drilled in the second (deeper) fracture and provided the most productive fresh water well in the region.

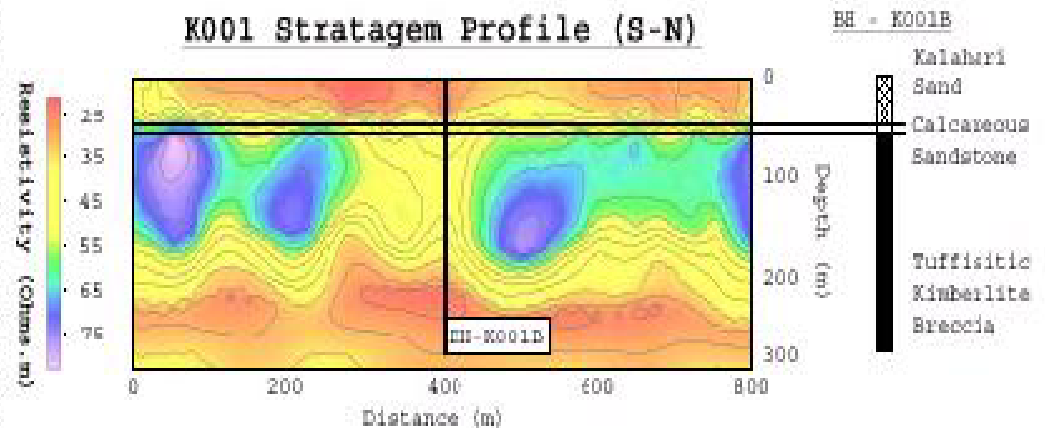
Stratagem Profile for Shielded Karst Caves & Fractures in Fu Ping in Northwest China



Mining Applications -Diamonds

Diamond Exploration - Stratagem kimberlite survey

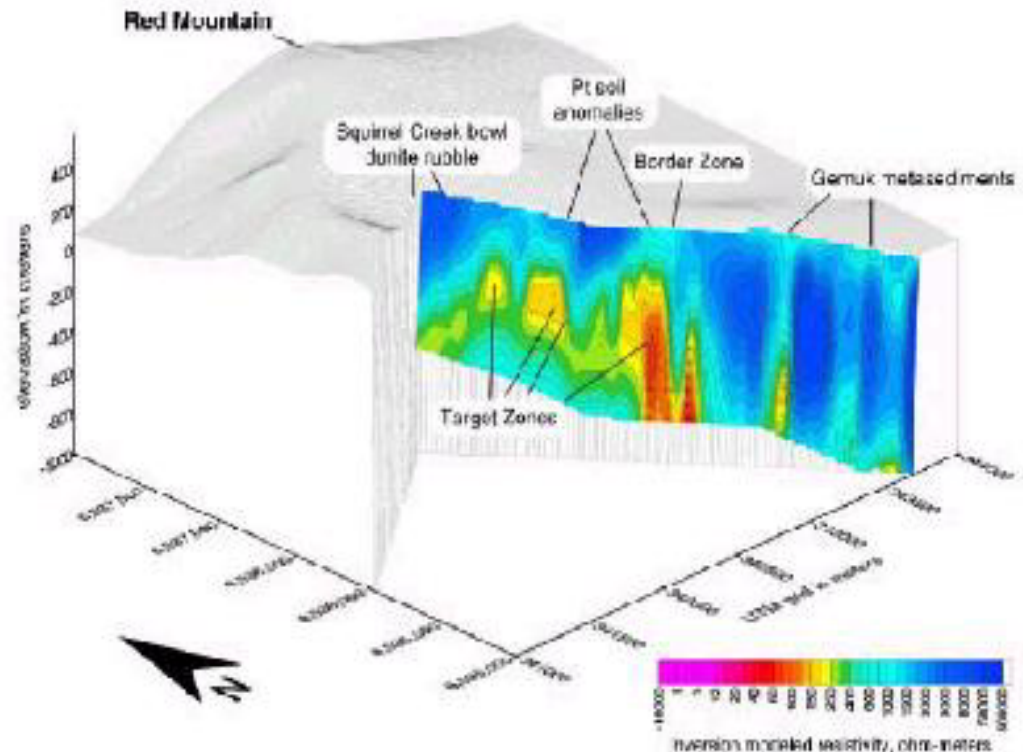
On the accompanying pseudo-depth section the vertical break in resistivity, at approximately station 400m, corresponds to the position of a kimberlite intrusion. This intrusion forms part of the Okwa Kimberlite Cluster in western Botswana. It is also evident on the borehole log how the depth of the Kalahari cover can be determined using this technique. This 800 metre long section comprises 33 individual soundings spaced at 25 metre intervals.



Mining - Platinum

Platinum Exploration - Stratagem platinum survey

At Red Mountain, CSAMT data show resistivity lows with the Border Zone and in a gently-inclined and undulating interface of relatively low electrical resistivity which may lie within the complex or at its base. Resistivity lows in these contexts could be caused by shearing, alteration, serpentinisation, or accumulations of sulphide or oxide minerals (most likely to contain PGM's). Agreement between the geophysical and geochemical data sets is achieved by modeling the Red Mountain complex as a wedge like body, which is gently inclined and thickest at the south end, and may include a magnetite-rich layer along the floor. Corral Creek's interpretation is that multiple injections of magma ascended from deep feeder structures along the southern end of Red Mountain and moved northward, allowing the later intrusions to dome and fracture earlier dunite and peridotite and to remobilise PGM's locally.

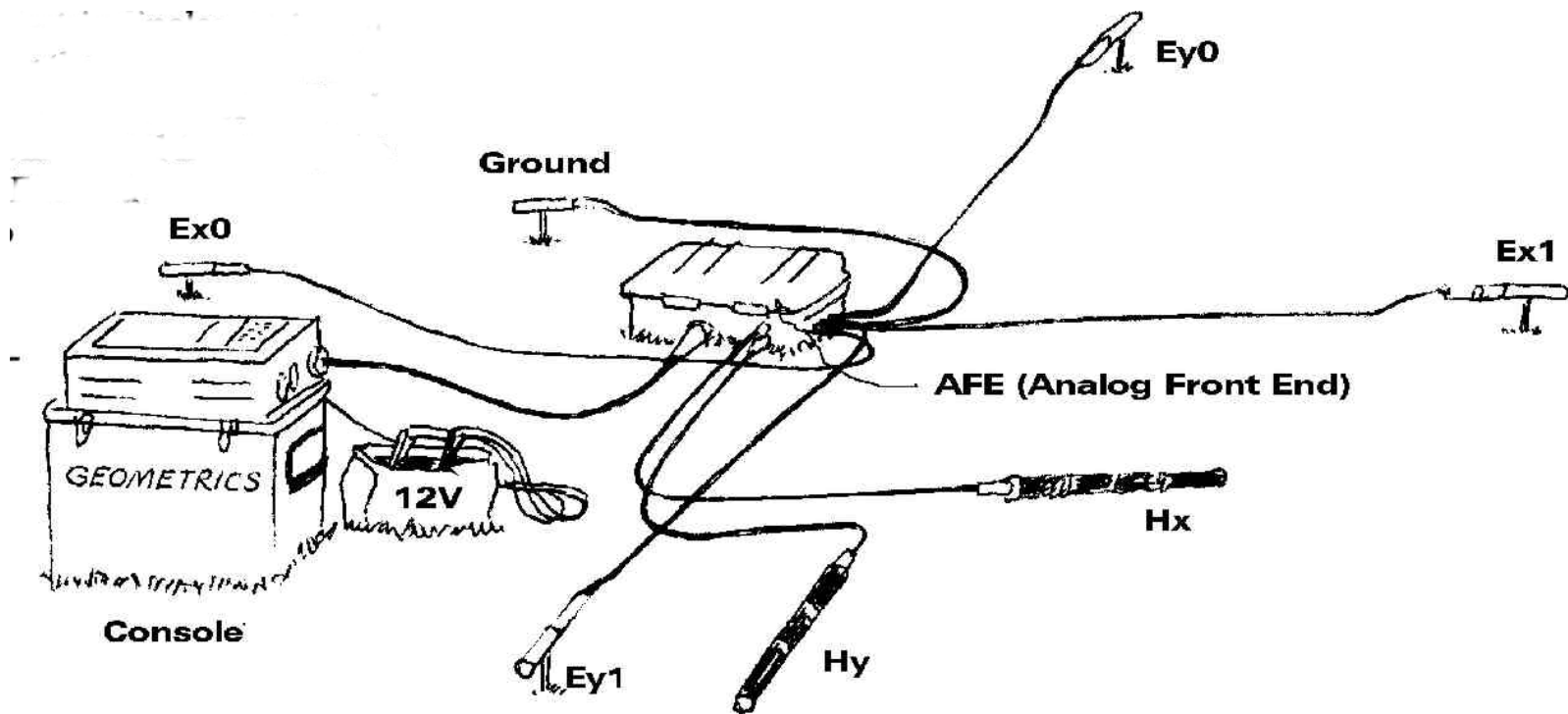


Block diagram of the Red Mountain area with CSAMT profile 8N

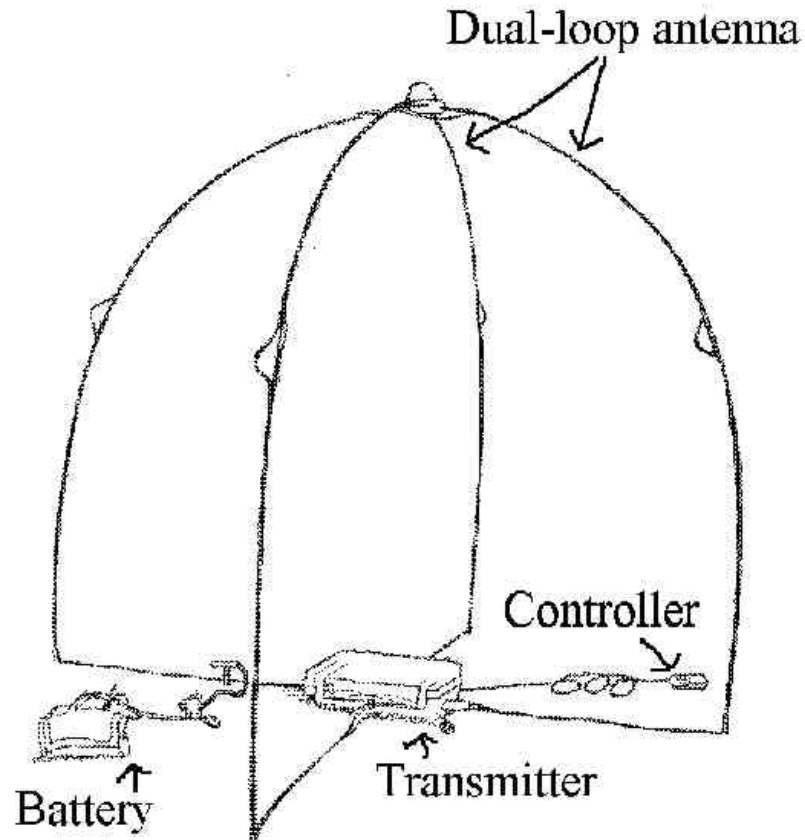
Equipment Setup

- Electric fields measured with galvanic stakes (can use porous pot for low-freq. measurements below 10 Hz)
- Magnetic fields measured with induction coils
- Natural field measurements from 10 Hz to 90k Hz
- Transmitter intended to fill in the natural field gaps in the range from 1k Hz to 70 k Hz.

Four channel operation (two electric and two magnetic) allows for rapid deployment and data collection.



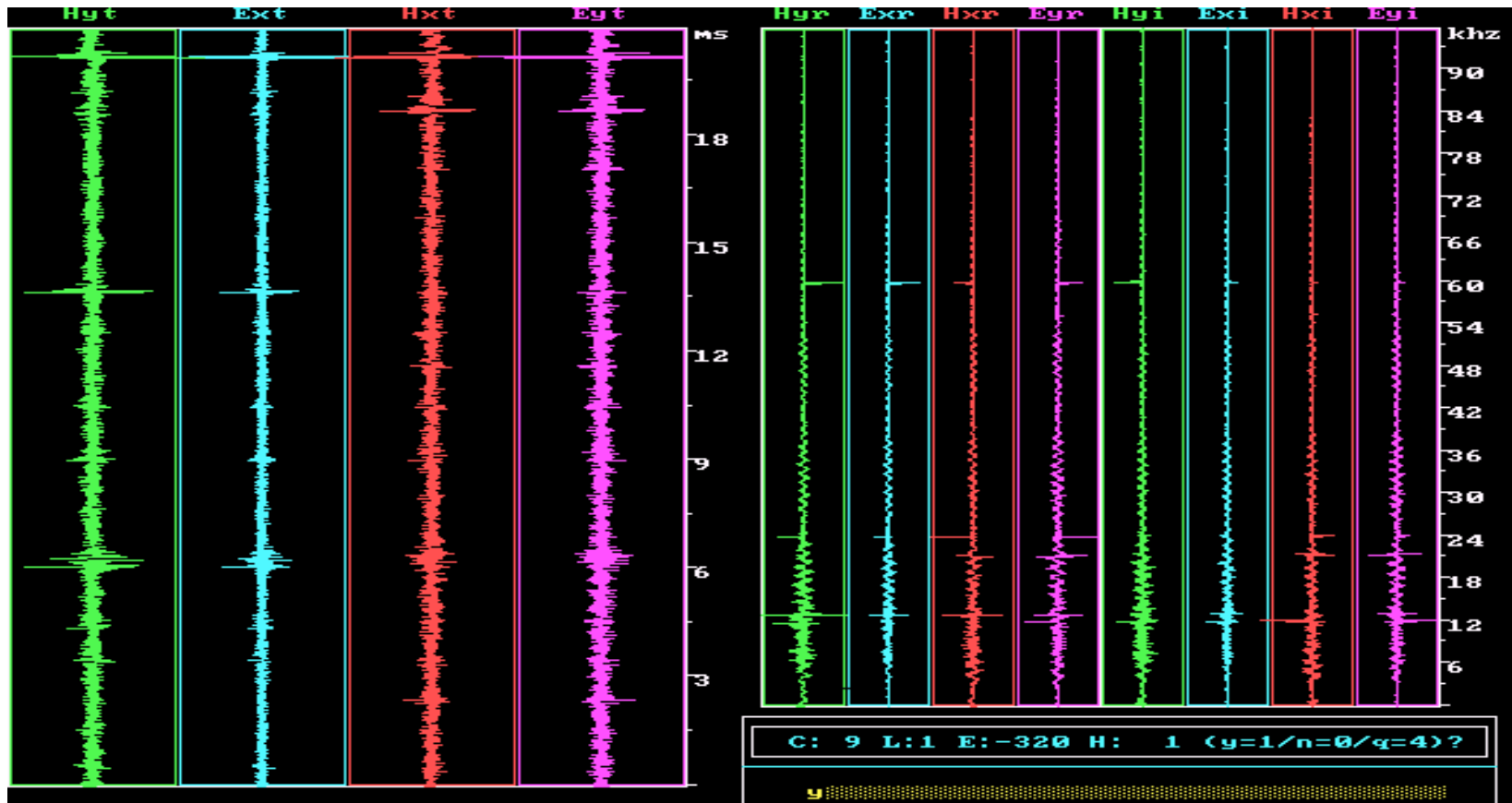
Induction-Loop Antenna for high-frequency, controlled-source operation. Dual-loops allow full tensor CSAMT measurements.



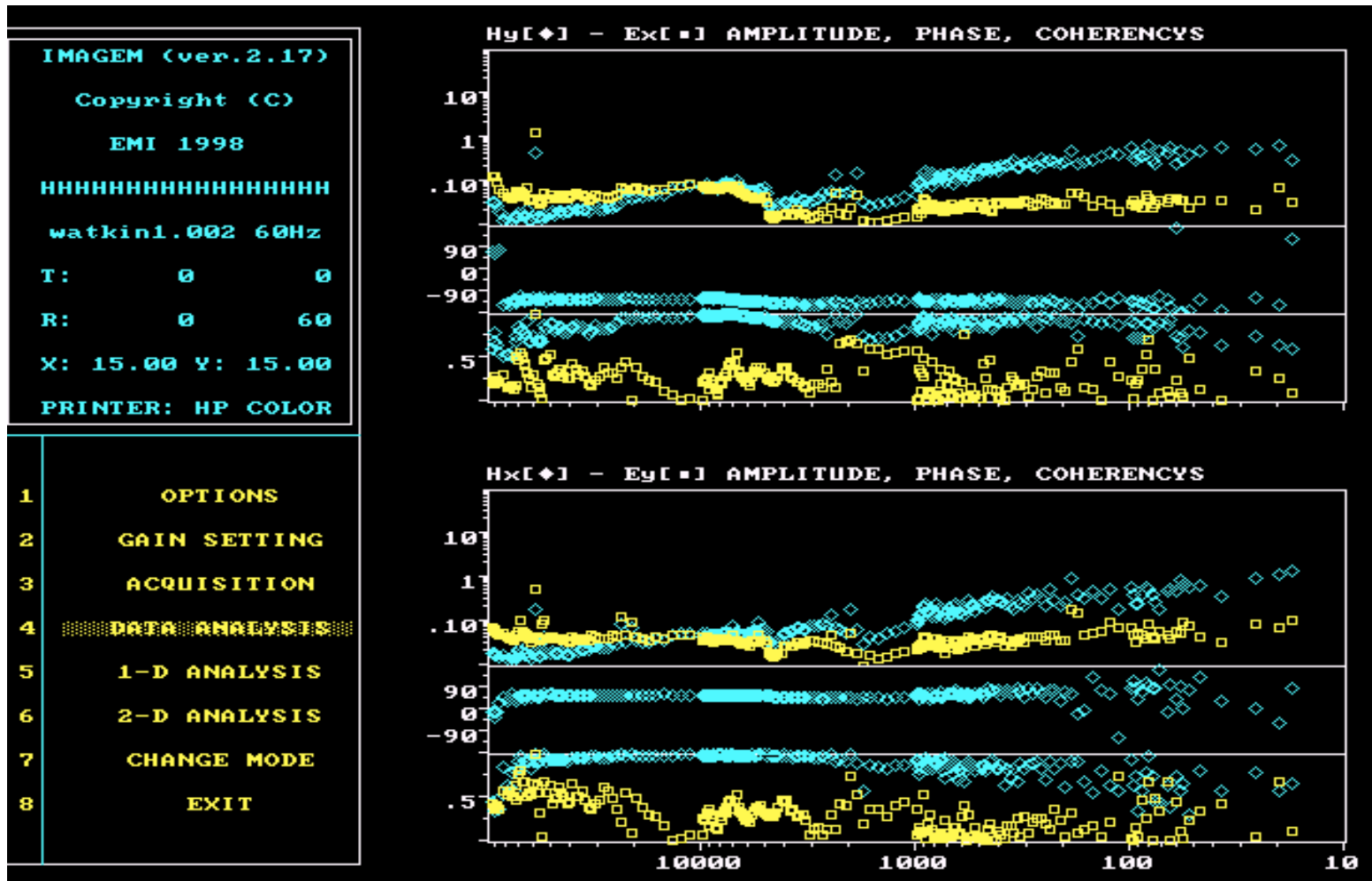
In-Field Display and Printout

- Sounding curves of full tensor measurements
- Signal amplitude
- Phase
- Coherence and error bars
- 1D Bostick transform
- 2D depth sections (EMAP)
- X and Y location map of all measurement stations.

Real-time Display of Time Series and Fourier Transformation



Automatic calculation and display of signal spectral amplitudes of magnetic and electric fields

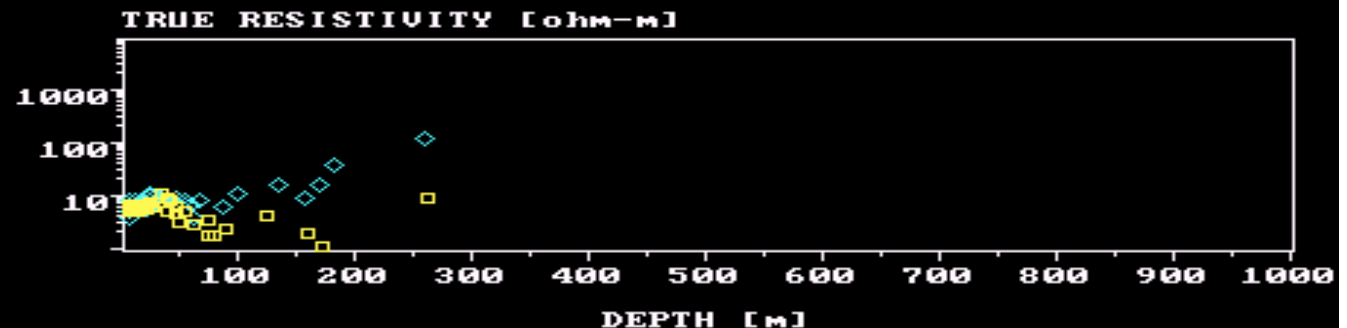
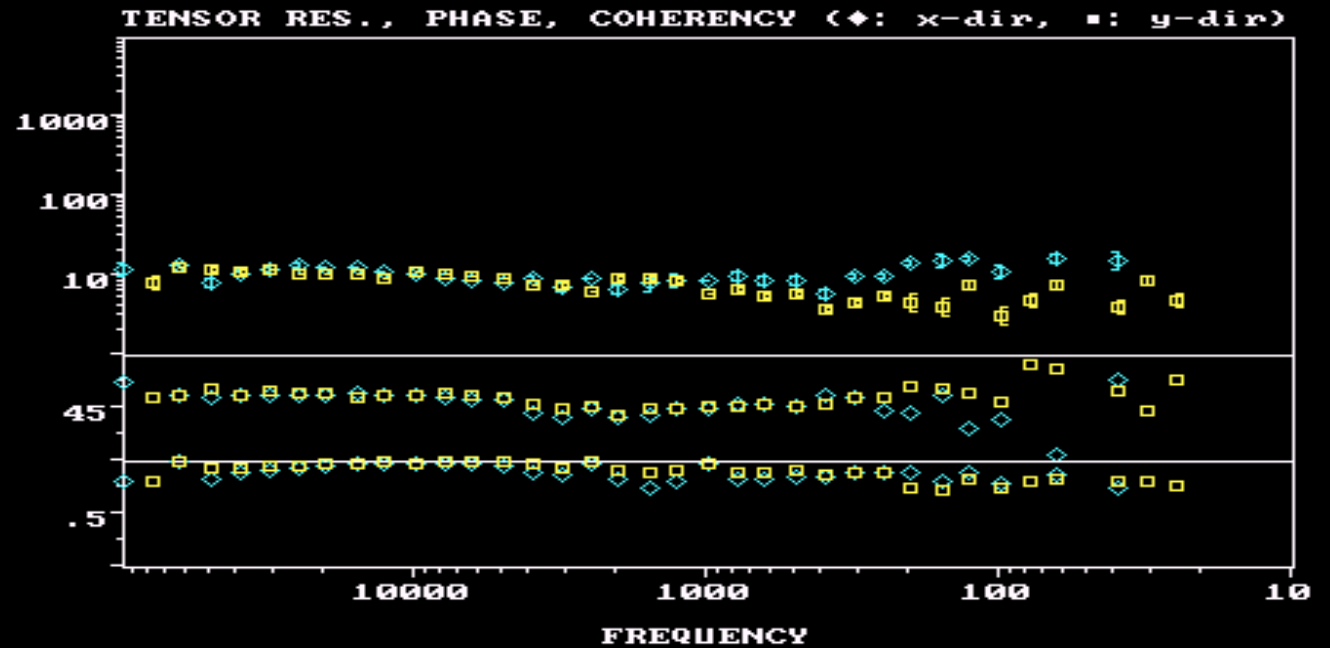


Real-time In-Field Display of Sounding Curves for app. res. Vs. freq. and Bostick resistivity vs. depth

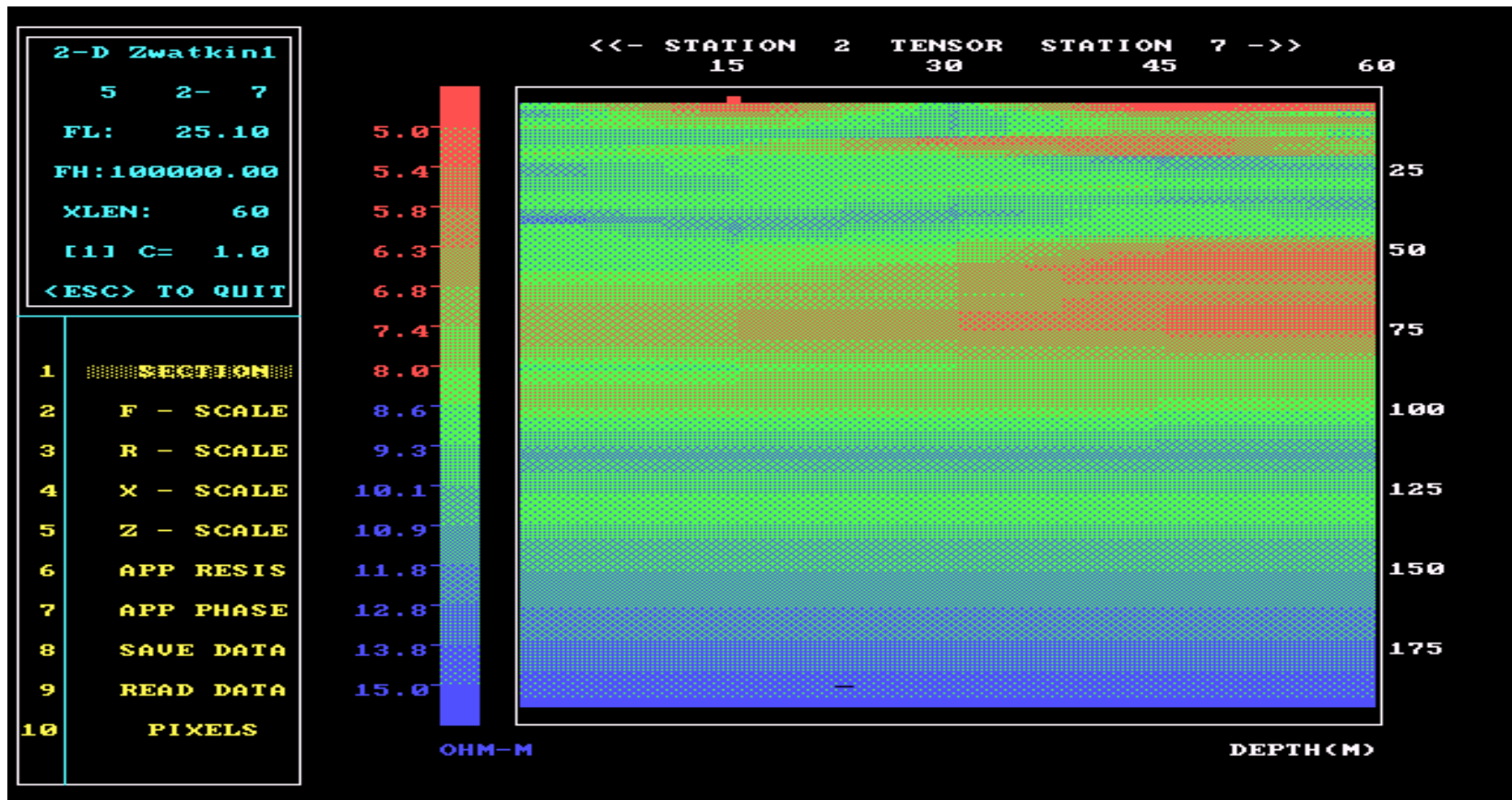
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IMAGEM (ver.2.17)
Copyright (C)
EMI 1998
HHHHHHHHHHHHHHHHHHHH
watkin1.006 60Hz
T:      0      0
R:      45     60
X: 15.00 Y: 15.00
PRINTER: HP COLOR

1  OPTIONS
2  GAIN SETTING
3  ACQUISITION
4  DATA ANALYSIS
5  1-D ANALYSIS
6  2-D ANALYSIS
7  CHANGE MODE
8  EXIT
    
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In-Field 2D Depth Sections (built-in field printer in black and white)



Coordinate Map of All Stations



Stratagem EH4 from Geometrics

- High-resolution natural-field and controlled-source data
- Reliable, proven technology
- Fastest, most cost effective way for exploration to depths of greater than 100 meters and less than 1,000 meters
- Backed by Geometrics 30 years of experience in geophysical instruments

Stratagem Theory of Operation

- Stratagem EH4 is a magnetotellurics instrument used to measure ground resistivity. Frequency domain EM instrument.
- Ground resistivity can be calculated from the ratio of the amplitudes of the magnetic and electric fields generated by currents in the ground (telluric currents). Resistivity in Ohm-meters is $\rho = (0.2/f) \cdot (E/H)^2$ where ρ is apparent resistivity, E is amplitude of the electric field, and H is amplitude of the orthogonal magnetic field.
- Currents generated by natural fields (lightning strikes) and artificial source (transmitter antenna).
- Electrode stakes used to measure electric fields and highly sensitive magnetic coils used to measure magnetic fields.

Stratagem Theory 2

- Time series from electric and magnetic fields are converted to frequency domain measurements by Fourier transformation.
- Calculating apparent resistivities at multiple frequencies provides sounding curve of apparent resistivity vs frequency.
- Inverting frequency sounding curves gives true resistivity and depth.
- 2-D depth sections derived from inversion data and filtering.