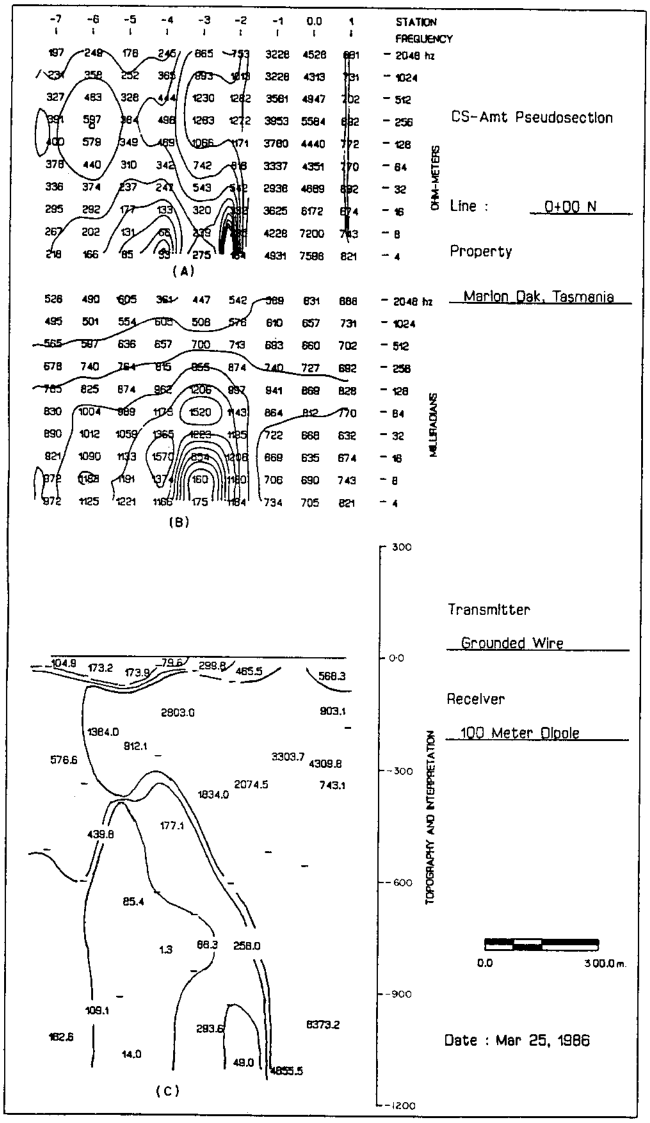

FIGURE 2
A one dimensional inversion of the CSAMT data suggests that there is a very deep conductive zone from 300 to 500W. However this type of treatment of CSAMT data is not accurate for two dimensional cases.
(a) Cagniard resistivity.
(b) Phase.
(c) One dimensional inversion.

conductor at about 400W (station −4). This may not in fact be the case as shown by Strangway *et al.* (1973) who show that a contact between very resistive and conductive units (as between 100W and 200W) always has an effect on the Cagniard resistivity that can be misinterpreted as a deep conductor. However as pointed out by Zonge (1986) this would not cause the conductive feature extending between 200 and 450W. Proper two dimensional inversion of the CSAMT data is now in progress. However it is proving to be very difficult to match the phases.

Conclusions

Both UTEM and CSAMT detect a very deep conductor in the vicinity of 150 to 500W on Line 0. In addition, one SIROTEM sounding centred at 300W on this line has detected a conductive body at about 600 metres. There are problems with the interpretation of all of the data, and to date the exact location and shape of the body has not been determined. This continuing case history clearly illustrates the problems involved with even the most modern geophysical equipment when a conductive body is very deep.

References

Strangway, D. W., Swift, C. M. & Holmer, R. C. (1973)—'The application of AMT to mineral exploration', *Geophysics* **38**, 1159–1175.
Zonge Engineering and Research Organisation (1986)—'CSAMT Survey, Final Report Marionoak project, Tasmania', Unpublished report for Aberfoyle Resources Ltd.

THE DISCOVERY AND DEFINITION OF A SULPHIDE DEPOSIT USING GEOPHYSICAL METHODS

Graham J. Elliott and David Richards

Introduction

A drill-hole, targetted at the source of a magnetic response, has led to the discovery of a significant sulphide deposit, 15 km north of the Telfer gold deposit, in the north eastern Pilbara region of Western Australia. The use of other geophysical methods has been unsuccessful in defining this deposit and highlights the potential for finding economic mineral deposits in this largely unexplored region.

Geology and Style of Mineralization

A significant sequence of sulphides, with zones of rich copper mineralization, has been intersected within strongly altered, shallow dipping sediments on the flanks of a large domal structure. The structure is similar in form to the Telfer Dome, although the mineralization occurs in the older Isdell Formation.

The mineralization has been interpreted to be within an alteration halo associated with the intrusion of a granite into the Isdell Formation.

Sequence of Geophysical Exploration Over the Dome Structure

An aeromagnetic survey, by Carr Boyd Minerals in the 1970s defined a broad magnetic response. The line spacing used during this survey was 700 metres and there was no indication from the magnetic profiles that there was a near surface source.

RAB geochemical drilling traverses by Western Mining Corporation over the dome did not locate significant mineralization.

Duval Mining flew an extensive detailed aeromagnetic survey (300 m line spacing) over this area. The aeromagnetic signature over the dome was that of a broad sub-circular source with one profile suggesting a relatively shallow magnetic source.

Subsequent ground magnetic traverses (although severely affected by surface noise) defined a horseshoe shaped magnetic anomaly with a similar trend to the domal structure as defined by geological mapping.

The definition of the magnetic field was greatly improved by the use of the Scintrex digital storage field magnetometer (and base station), with a four metre sensor height. Digital filtering of the data allowed useful machine contours to be drawn even in this relatively noisy area.

Interpretation of the ground magnetics led to the targetting of a drill hole to intersect the magnetic source at a depth of 100 m. Although the magnetic profiles were extremely noisy, smoothing of the data and the constraints placed on the model by known geology produced a reasonable fit between field and theoretical profiles (Fig. 1).

In 1984 the only hole drilled to test the magnetic source intersected sulphides and significant copper mineralization between depths of 80 m and 170 m. The location of the mineralization correlated well with the position of the modelled magnetic source. Unfortunately the drill hole was not continued to a sufficient depth to test the foot wall.

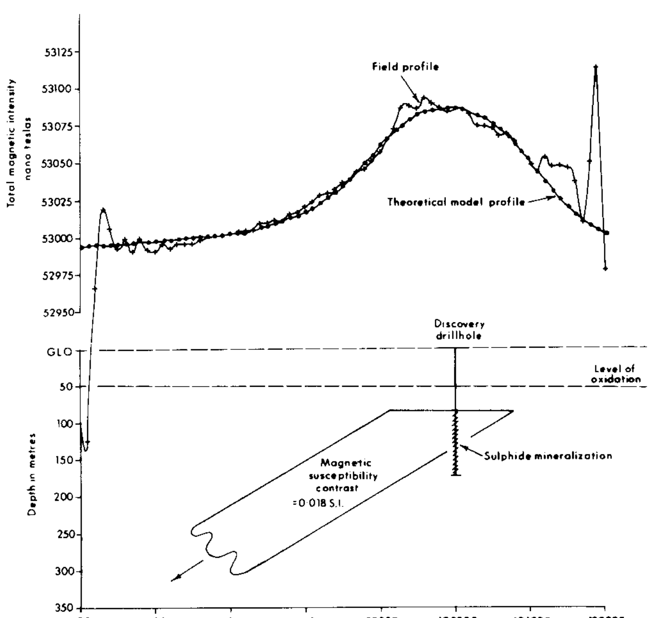

FIGURE 1
A 2.5D computer model for the ground magnetic profile along line 20200N.

Magnetic susceptibility logs on the chip samples and drill core confirmed that the mineralization was sufficiently magnetic to explain the source of the magnetic response.

Electrical logs using a downhole three array to measure the induced polarization response and the resistivity suggested that the lateral extent of the mineralization could be mapped using electrical techniques.

The Rapid Reconnaissance Magnetic Induced Polarization technique (RRMIP) was initially used because of the possibility of a highly conductive overburden. (This could not be measured with the electric log, because of PVC casing in the upper part of the hole.) Unfortunately, the three kilowatt transmitter used for this survey gave a poor signal to noise ratio, with an input frequency of one cycle per second. An input frequency of three cycles per second increased the signal to noise ratio; however electromagnetic coupling appeared to dominate the polarization response. The measurement of the primary magnetic field did define a conductive zone co-incident with the magnetic response.

In an effort to gain chargeability information, a conventional gradient array electrical induced polarization/resistivity survey was employed. This defined a chargeable zone co-incident with the magnetic response. The resistivity response was not well defined.

Several long traverses of SIROTEM single wire, co-incident loop, were carried out to locate fault and shear zones within the area. The one SIROTEM traverse that did pass over the mineralization defined a broad strong conductive zone, co-incident with the magnetic response. Lateral migration of the peak response for later channels measured over the conductive zone, confirmed that the conductor had a similar dip to the magnetic source predicted by modelling.

Gravity data was collected in the area in an attempt to define the mineralized zone and to better understand the geological structures. A density high was defined at the central core of the dome. The mineralization could not be confidently located by computer modelling of the gravity field, in the presence of the large response associated with the core of the dome.

NEGATIVE SIROTEM ANOMALIES — CASE STUDIES

P. J. Elliott

Introduction

In theory, the transient electro-magnetic (TEM) response measured with coincident coaxial transmitter and receiver loops should be positive over ground which is frequency independent with respect to conductivity and permeability (Weidelt, 1982). Therefore, negative TEM responses should