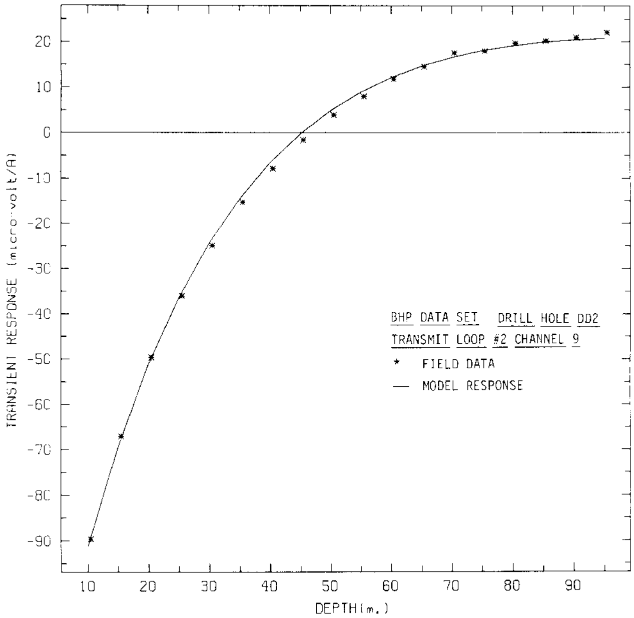

FIGURE 4
The fit between 200 m x 200 m filament model response and down-hole data for drill hole DD2, transmitter loop #2, channel 9.

the resolution obtainable with down-hole surveys will be greatly increased. Meanwhile non-uniqueness problems can be alleviated considerably by careful planning of large loop down-hole and multi-component surface surveys.

References

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MARIONOAK—A VERY DEEP CONDUCTIVE TARGET

E. T. Eadie, J. Silic and N. Hungerford

Introduction

At the Marionoak property in Tasmania, a large deep conductor has served as a good site for testing and comparing deep penetration EM systems such as UTEM, Controlled Source Audio Magnetotellurics (CSAMT) and Sirotem. All of the systems detect the conductor, different problems being encountered when attempting an accurate interpretation of any of them. Up to the time of writing this abstract, a final interpretation had not been tested by drilling.

Early Work

The Marionoak Licence was acquired by the Aberfoyle group in 1974 to explore for sedimentary exhalative lead-zinc ore bodies in the Rosebery Group rocks to the west of the Mount Read Volcanics in north-west Tasmania. Early geophysical work included two generations of helicopter-borne EM/magnetics which failed to discover any moderately to highly conductive discrete bodies. Attention was drawn to an area in the southern portion of the licence when a road cutting exposed sphalerite-galena veining in a siltstone unit. A grid was cut by Shell, the operators at this point, for mapping and geophysics, and was covered by magnetics, gravity and I.P. The results from Line 0, where the lead-zinc veining occurs are shown in Figs 1 (c) and (d). DDH SBD-1 was drilled to test the Pb-Zn show and an interpreted combined gravity and I.P. anomaly. The hole intersected minor sphalerite and galena but was not thought to have adequately explained the geophysical anomalies.

Deep Penetration Work

In order to search for deeper mineralisation, a UTEM survey covered the prospect area with two loops, both extending from 400S to 400N along strike, loop 1 having a front edge at 400W and loop 2 at 400E. A deep conductor could be seen on all lines (600N to 400S), indicating that the conductor is at least 1 km long. The point-normalized results from Line 0 are shown in Figs 1 (a) and (b).

Interpretation of this data is not straightforward. One problem is that the shallow zone of low resistivity that is visible in the I.P. data, can also be seen by inflections in the UTEM data particularly at early times, but also to an unknown extent at later times. Two interpretations appear to fit the data equally well. First the data can be explained by a vertical body midway between the two apparent crossovers, at around 150W. The hypothesized reason that these crossovers are offset away from the loop is that there is a background response from the halfspace and therefore the zero crossings are not the true crossovers. The true crossovers would then be further back towards the loop, closer in each instance to 150W. Another way to see this more clearly is to determine the position of maximum slope, which is close to 150W in both cases. A second interpretation suggests that there is a folded structure beneath loop 1 with a steep limb at about 300W and a second limb dipping at a shallow angle to the west. In this case, loop 1 would energise the shallow dipping limb, which would cause the crossover to occur at about a 45 deg. angle from its actual edge, away from the loop, as observed. Loop 2 would energise the vertical limb, causing a crossover right over the body at about 300W, as observed. Depth determinations are very difficult in both cases; however depth interpretations based on either shape or amplitude of the response (inductive limit about 30%) suggest that the body is at least 500 m below surface.

To help with the interpretation of the anomaly and to determine its strike length (1.5 km), a CSAMT survey was conducted. The results for Line 0 are shown in Fig. 2, along with an interpretational diagram based on a one dimensional inversion. At first glance, the CSAMT appears to define a deep

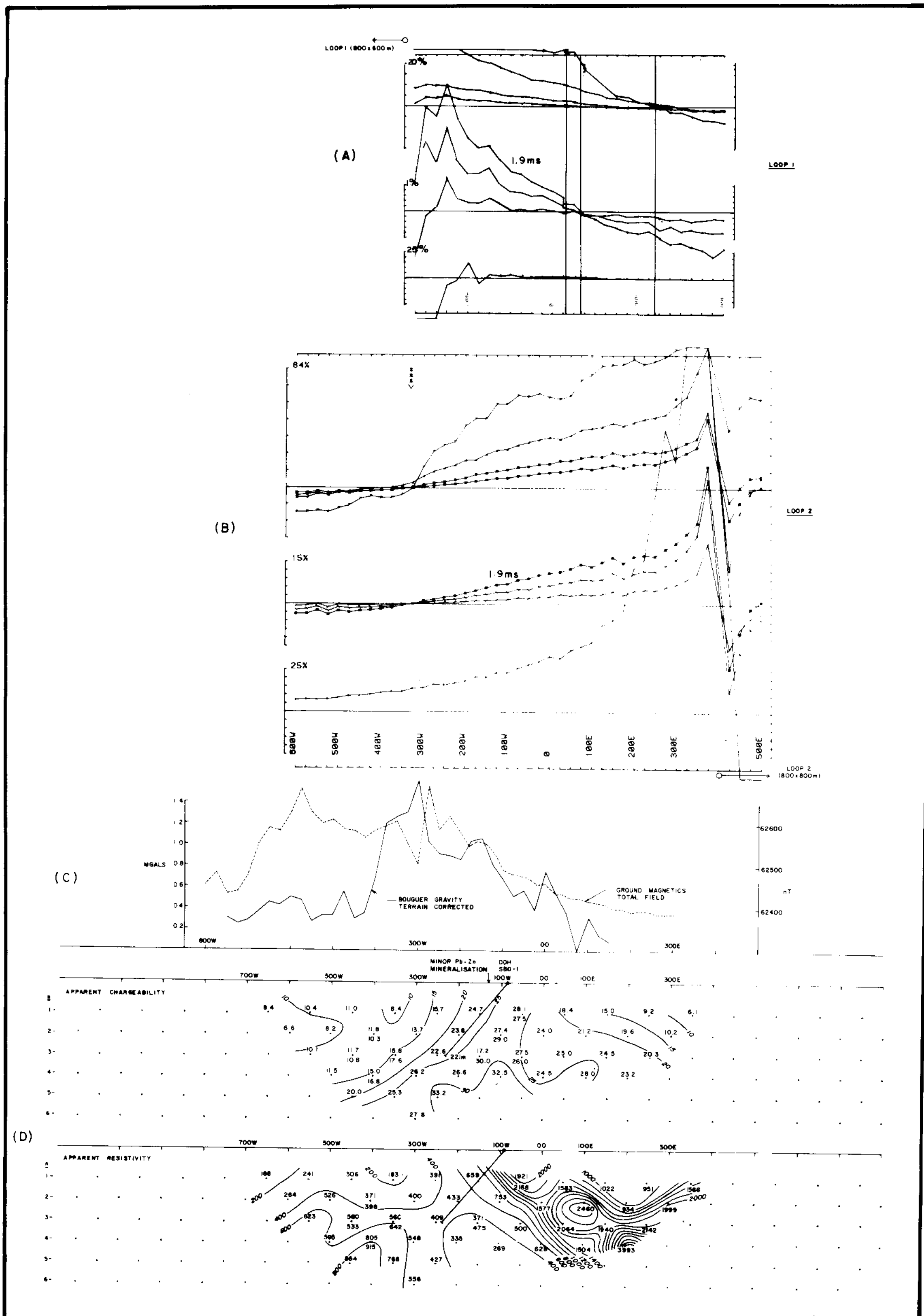

FIGURE 1
Geophysical data from Line 0.

(a) UTEM Hz component from loop 1 (frequency 30 hertz). There is a crossover from positive to negative at about 50E on the important late time channels.

(b) UTEM Hz component from loop 2 (frequency 30 hertz). The crossover is at approximately 325W.

(c) Gravity and magnetic data showing a dense body from about 100 to 300W.

(d) Chargeability and resistivity data show a very resistive chargeable body to the east with a moderately conductive chargeable body from about 100 to 200W.

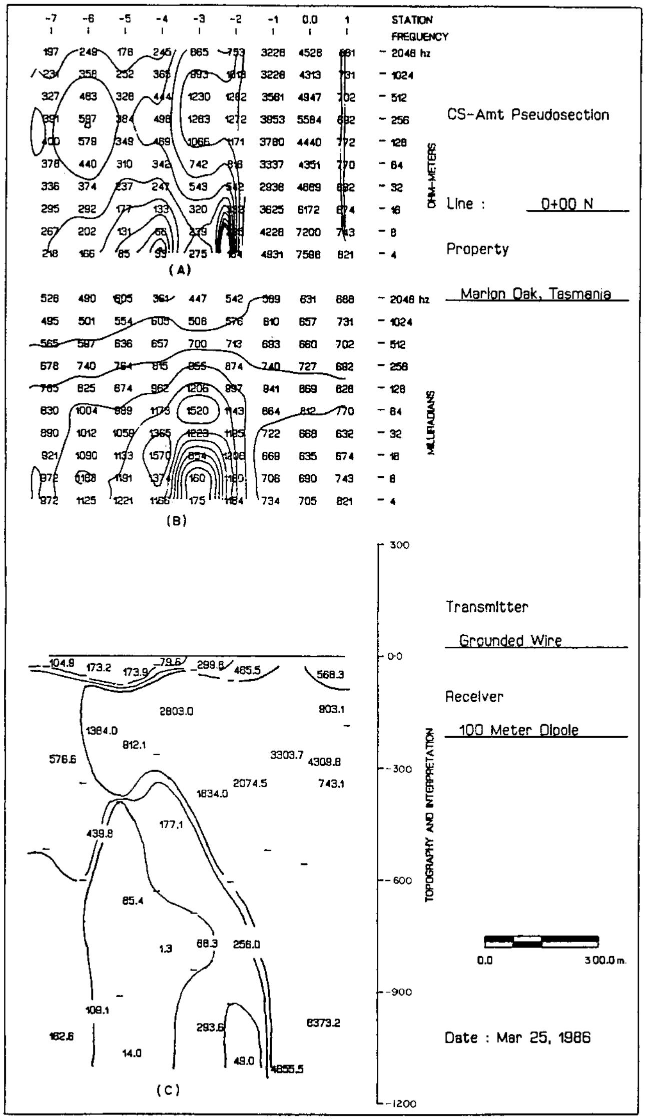

FIGURE 2

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.

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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.