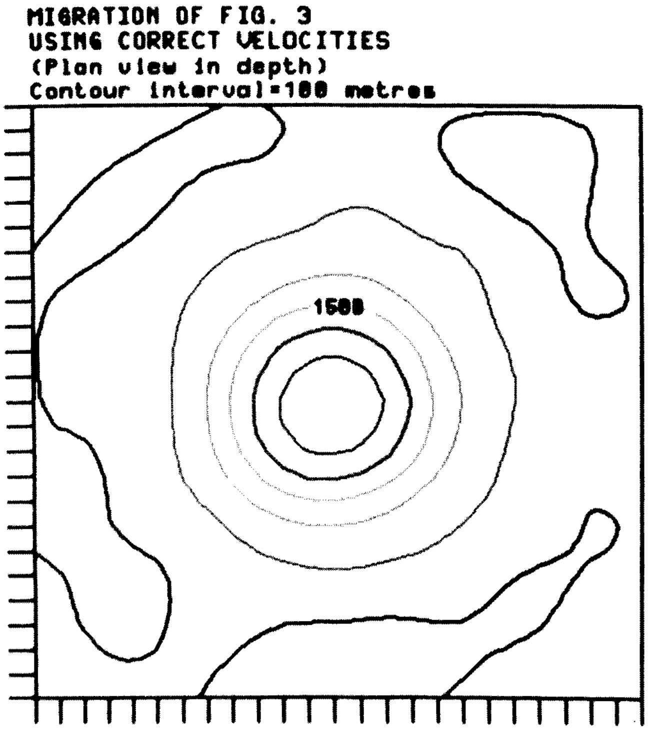

FIGURE 5
Contour map of Fig. 3 after migration with correct velocities (in depth).

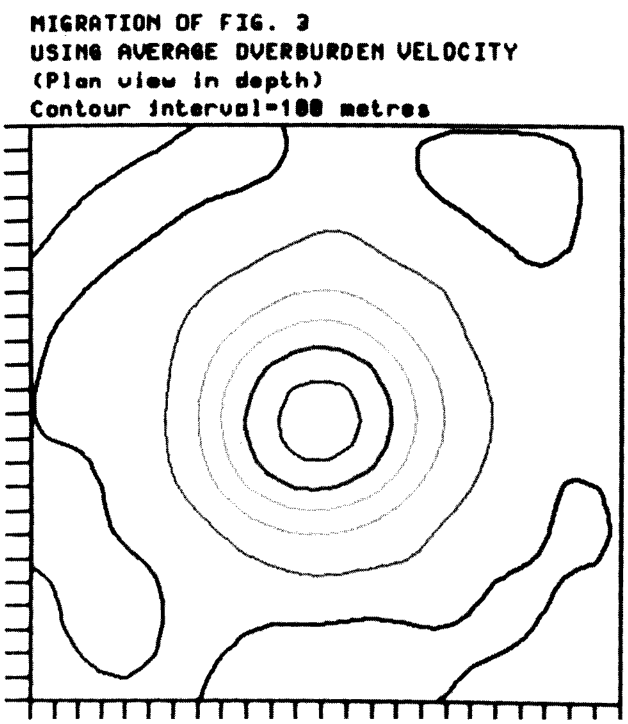

FIGURE 6
Contour map of Fig. 3 after migration with average overburden velocity (in depth).

used, with the biggest difference occurring at the crest. In this case, the error had been increased to 50 metres, or 4.2 percent, apparently because of a slight overmigration.

Further tests involving simplification to a single velocity layer, and a study of the effect of systematic velocity errors are discussed in the paper.

The Effects of Omitting Coincident Multiple Surfaces

While there is no doubt that the separation of multi-valued points into coincident surfaces can prove extremely useful in model studies, with the ability to identify energy from out of the plane of a seismic section, the question still remains as to the importance of including such energy when migrating. The 'Mexican Hat' structure was migrated with only the top surface from Figs 3 and 4 retained. This could approximate the situation in practice, where the bow-tie may be obscured by interference effects. The results of this simplification are demonstrated.

DRILLHOLE TIME-DOMAIN ELECTROMAGNETIC RESULTS

R. Kneebone, R. Parums, A. Smelic & L. Thomas

Physical model results are useful both as typical examples to aid in interpretation and also as controls on numerical or analytical model predictions. We present here some results of simple physical modelling of the SIROTEM downhole time-domain electromagnetic (DHEM) system which have been obtained over the last few years. More examples, and more discussion, are included in unpublished Reports of University of Melbourne Honours Projects by Parums, Kneebone, and Smelic.

The following main lines of modelling have been pursued, as examples show. To date, all modelling has been carried out with an axial sensor in a borehole dipping at 45 or 60 degrees and simple metal targets, at a spatial scale of 1:1000. A SIROTEM field system has been used for data acquisition, so that there is no time scaling, and results shown have been corrected for power scaling.

We have produced a suite of responses for a simple conductive slab in free space (air). Fig. 1 is an example; the target is a copper slab, representing a target 300 m square with a conductance of approximately 120 S, symmetrically placed with respect to the borehole. The cartoon at the top of the figure is a scaled section in the plane of the borehole. The responses plotted show the variation with depth of selected SIROTEM channels.

The responses found confirm the numerical results of programs such as PLATE, and also verify predictions on the behaviour of the anomalous field with time. For instance, Fig. 2 shows how the field crossover positions in the borehole migrate with time as the induced currents diffuse within the target plate. Our studies with this model verify that the downhole profiles might be used to predict the relative attitude of the plate, because the currents induced in the plate are confined in the plane of the plate (compare Fig. 2 with Fig. 1).

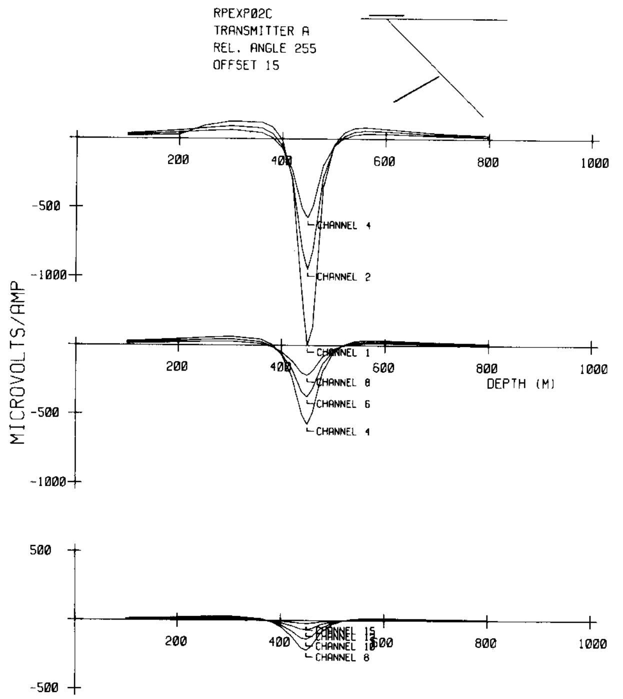

FIGURE 1

Model SIROTEM response to a conductive plate in air. The cartoon at the top depicts the cross section through the model. Responses for SIROTEM channels 1, 2, 4, 6, 8, 10, 12 and 15 are shown.

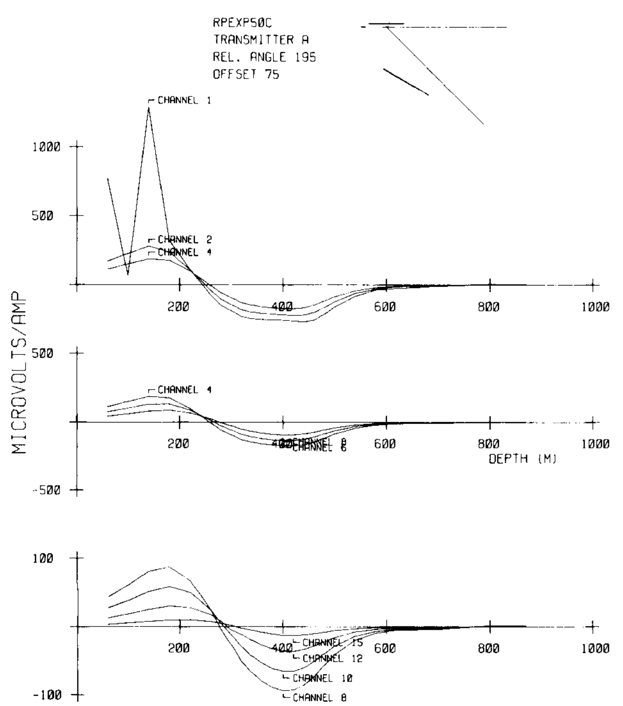

FIGURE 2

As for Fig. 1. The relative angle between the plate and the borehole has been changed. Note the regular shift in crossover depths.

Similar model responses have also been used to verify some interpretation and inversion methods.

A copper/lead sphere was used to model a spherical target, at various locations relative to the borehole, and for different transmitter positions. The sphere represented a target approximately 150 m in diameter, with a conductivity of 4.5 $S.m^{-1}$. The responses shown here are obtained with the target and transmitter centres in the same vertical plane as the borehole, but more general positions have also been used.

Responses in this case are more difficult to summarize concisely, but can be seen to be dissimilar in style to those for the plate case. Fig. 3 shows the response for a spherical target in approximately the same position as the plate target of Fig. 2. The response shape is rather different, and the field crossover position is relatively fixed in time.

When the target is spherical, the shape does not constrain the diffusing induced currents, so that the shape of the response in the borehole is more dependent on the position of the transmitter coil than in the plate case.

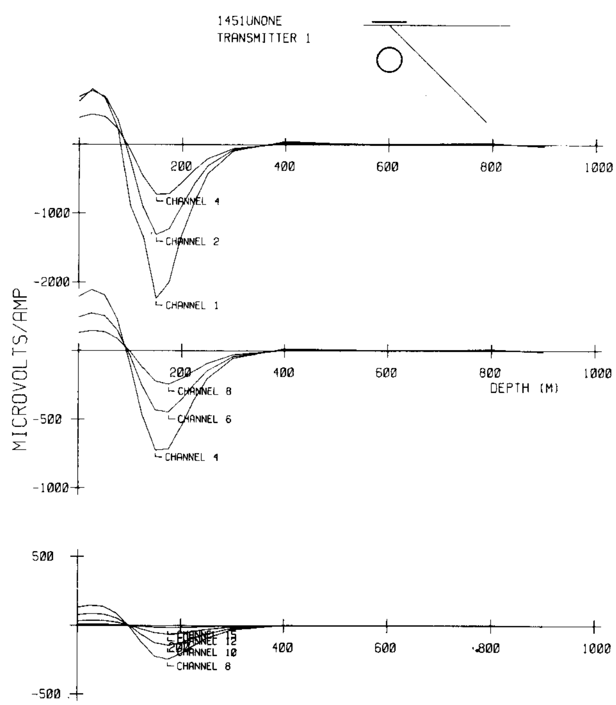

FIGURE 3

Model SIROTEM response to a conductive sphere in air.

We have used a sheet of aluminium to simulate an overburden with conductance of 16 S, with results shown in Fig. 4. The response again depends on the position of the transmitter even for the overburden-only case, and in addition may be influenced by the finite size of the model (scaled to 900 m square).

Fig. 5 shows the response for a model which includes the sphere and overburden, and comparison with the no-overburden case shows that, if the effects of the overburden could be predicted, the target signature could still be

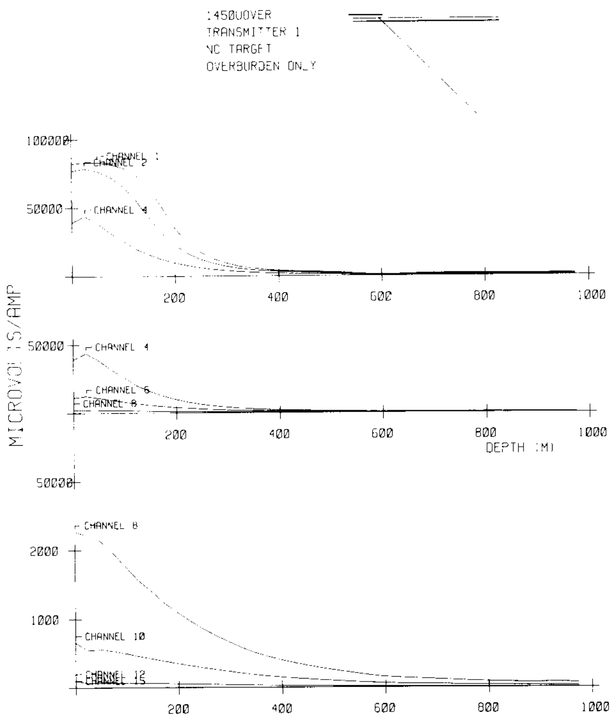

FIGURE 4
Model SIROTEM response to a conductive overburden alone (no 'host rock').

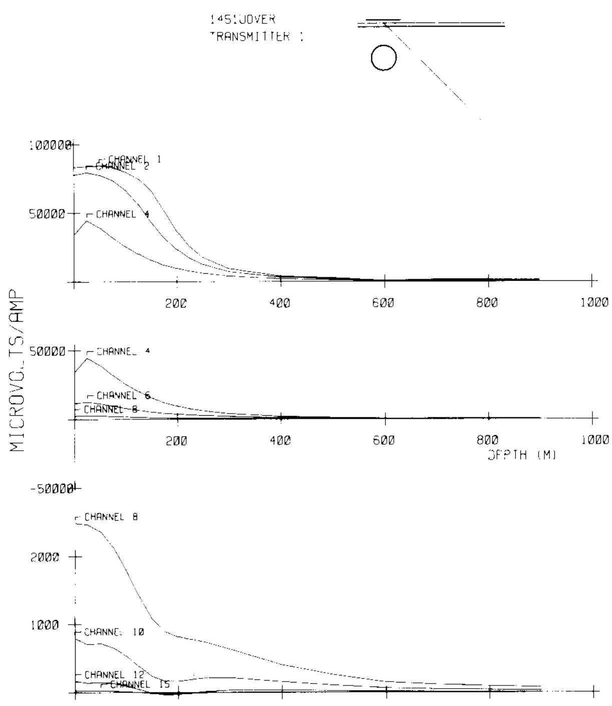

FIGURE 5
Model SIROTEM response to a conductive sphere beneath a conductive overburden.

discerned by differencing at least within a range of decay times, as has been suggested by others. Fig. 6 shows the result of subtracting the overburden-only response of Fig. 4 from that in Fig. 5. We notice that, at late times, the difference results are similar to the no-overburden results (with a time

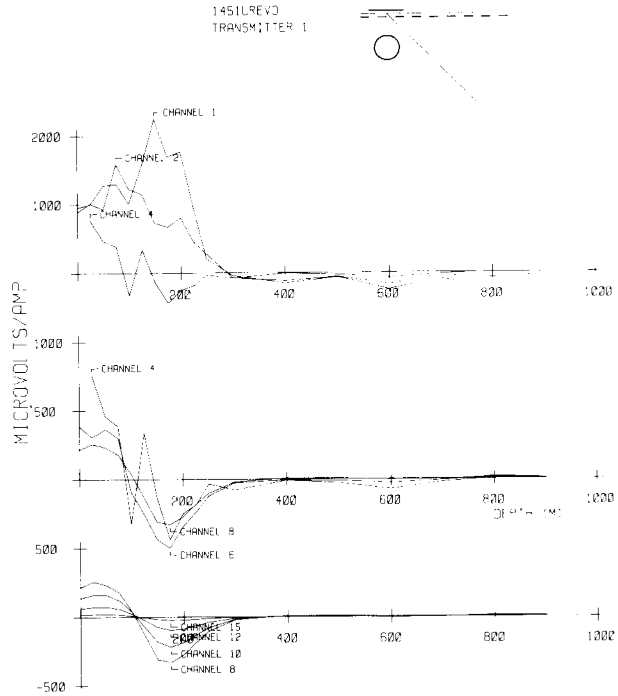

FIGURE 6:
Resultant after subtracting the overburden-alone response (Fig. 4) from the sphere-and-overburden (Fig. 5). Compare with Fig. 3 and Fig. 5.

shift) when the target is spherical, but this is not so evident with the plate-like target.

These observations may be seen as further support for joint inversion arguments, where other data concerning the near-surface electrical properties might be used to forecast the overburden response. Our data are available for controlled testing of such schemes.

At the time of writing we are working on a method for investigating the host-rock interaction effects in our model environment. (We are trying to avoid the need for a dedicated model tank for host-rock simulation.)

THE PERTH BASIN: A POSSIBLE FRAMEWORK FOR ITS FORMATION AND EVOLUTION

Kurt Lambeck

Introduction

The Perth Basin of Western Australia is a linear structure of sedimentary rock extending north-south for some 1000 km (Fig. 1). Phanerozoic sedimentary material may exceed 15 km in thickness. The basin is bound on the east by the north-