The PetRos EiKon News

News from PetRos EiKon Incorporated

New EMIGMA Development:

In keeping with our main goal of providing useful, easy-to-use and flexible software for the practising geophysicist, we are well on our way to making another large step towards providing software capable of simulating real geological structures. The cover page is meant to graphically illustrate these developments.

We are currently testing new basic structures which will be included in **EMIGMA** to make our software considerably easier to use for representing real geological problems. The conventional and simplistic cubic block structure, adopted mainly for mathematical convenience, was improved in our initial **EMIGMA** by a generalized rectangular prisms of arbitrary size and aspect which were fundamental numerical building blocks for the software . These still limiting structures are now to be replaced by the capability to represent anomalous structures with generalized polyhedra defined simply by a set of vertices. For the modeller, this will mean both increased ease of use and more representative models for calculation. In addition and possibly most importantly, these more general basic structures will offer the ability to, firstly, examine the limitiations of representing structures through simplistic rectangular prisms and, secondly, to enable the use of electromagnetic data to resolve geological questions that cannot be answered by representing the earth by simple series of blocks.

The cover illustration is typical of a situation where polyhedra may make an important difference to understanding the electromagnetic data. An ore body has been encountered, with several interesting intersections. However, it is not clear how the drill results should be interpreted. Is the body tightly folded? does it have two separate structures? Should DDH-7 be extended, or should a new hole be placed between it and DDH-3. Modelling should help define the extensions of the body past DDH-7, and contribute to spotting the next drill hole.

This is the type of problem that we anticipate the polyhedral structures will help you to answer more easily. Certainly, it would be possible to model this situation with blocks, but the resulting model would be difficult to specify accurately and for conventional techniques would require many cells or grid points and probably would still lack accuracy because it is a poor representation of the geology. This is particularly true when receivers and transmitter are in close proximity to the structures of interest. On the otherhand, if the inferred structure on the bottom of the cover page could simply be represented as a few arbitrary 3D polyhedra each with its own conductivity then representing the geometry of the section would be significantly made simpler and the accuracy could well be improved. The polyhedral model is scheduled for release in **EMIGMA** prior to July 1, 1995.

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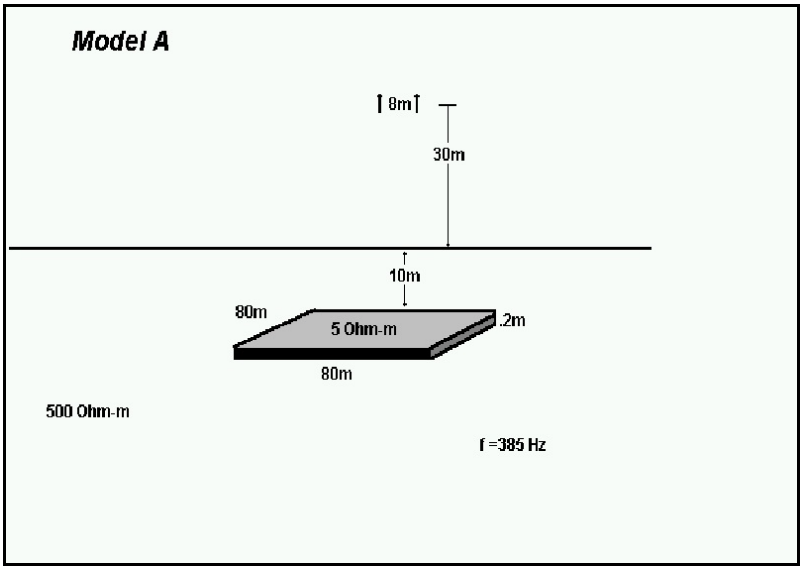
VHPLATE, EMIGMA Comparison Tests:

We, like many of you, are very concerned about accuracy and the differences between modelling algorithms and techniques and the relationship of these accuracies to the physics of the problems we are trying to simulate. In this newsletter, we begin what is intended to be an on-going monthly section devoted to comparison tests. If our readers would like to participate in this section, we would welcome their contributions.

With the recent shipping of the first release of VHPLATE and our second release of EMIGMA, we thought it would be a good idea to compare the simulation results of these two programs.

In the model below, there is a flat lying plate-like structure 20cm in thickness with lateral extent 80m by 80m having a conductance of 5 Ohm-metres. It is buried 10m below ground



in a 500 Ohm-m halfspace. A coplanar system is being towed 30m above the ground with a 8m separation and is operating at 385Hz. We show the response from the center of the plate out to 160 metres from its center.

In Figures 1 and 2, we examine 6 different simulations of both in-phase (real) and quadrature (imaginary) response. Two conventional integral equation solutions are given. One solution (open box) consisting of 400 cubic cells of 2m size having the equivalent integrated conductivity (.04S) and another (crossed box) consisting of 100 cells of 4m size also having the equivalent integrated conductivity are shown. With this conventional technique, it is impossible to reduce the thickness of the plate-like structure as the number of required cells to cover the required horizontal extent becomes prohibitive computationally. Notice that the amplitude of both the real and imaginary parts of these conventional solutions over the plate increases as the thickness of the plate decreases.

The next two solutions (open diamond and solid triangle) are for **EMIGMA** with a 2m thick

plate of equivalent integrated conductivity with 100 and 800 points used for the solution. These are shown primarily to indicate the convergence characteristics and the relationship to the thinner models. Finally, we show the response of **VHPLATE** (solid square) with the same integrated conductivity and a plate of 20cm thickness using **EMIGMA** (circles). The thin **EMIGMA** solutions and **VHPLATE** are extremely close on the flanks and are quite comparable over the plate. With 6 polynomials used for **VHPLATE** it is possible the solution is not large enough. On the otherhand, **VHPLATE** is more capable of generating an accurate inductive response than both **EMIGMA** and the conventional IE techniques. The inductive response of the plate would be expected to increase as the dipole-dipole system moves over the plate center. Nevertheless, we feel the closeness of **EMIGMA** and **VHPLATE** particularly on the flanks of the profile is a excellent benchmark result considering that the numerical techniques for solution of the integral equation are almost completely different.

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Case Studies:
Cominco has generously released a data set to us for study and to report upon. We begin this interpretation study in the month of November and hope to show some preliminary results in the December News.

Product Releases
EMIGMA V.2 is being shipped to licensed buyers. Both WINDOWS (16bit) and DOS (32 bit) executables are now available. A Beta release of **FSEMTRS** is also being shipped with both WINDOWS and DOS executables available. The first release of **VHPLATE** is also being shipped as a 32 bit DOS executable. All the above products are available for UNIX.

TOPICS NEXT MONTH:
Large Loop and Extended Dipole Sources for EMIGMA and VH Plate
Magnetotelluric Modelling
More Comparison Studies
IP Results
OS/2 Executables

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