

by **Bob Lo**, BHL Earth Sciences  
**Petr Kuzmin**, Geotech Ltd.

## AFMAG: Geotech's New Airborne Audio Frequency Electromagnetic (EM) System



Figure 1. AFMAG unit interior showing the three orthogonal coils, damping mechanism and suspension.

An airborne AFMAG (Audio Frequency electroMAGnetic) system has been developed and successfully tested by Geotech Ltd. The system uses proprietary and patent-pending technology to damp vibrations and de-rotate the electromagnetic (EM) fields respectively. Three orthogonal coils are used to measure the horizontal and vertical components of these fields (Figure 1).

The EM source energy is the Earth's natural time-varying magnetic field, in the audio frequency range of 30 to 6,000 Hz. This method is quite similar to MT or magnetotelluric methods; however, electric fields are not measured by AFMAG. Natural EM sources are nearly homogeneous, which allows deep penetration. Typical penetration depths, observed from the system tests, range from zero to hundreds of meters for small test bodies that were hundreds of meters in size. Theoretically, the AFMAG system is capable of detecting large conductive features such as salt water

trapped in anticlines as deep as 10 km. Like all airborne systems, this data can be rapidly acquired over large areas, over rugged terrain and over areas where access is difficult.

The development of AFMAG was partially funded by the Ontario Minerals Exploration Technologies (OMET) program and two mining companies. Therefore initial tests, completed in August of 2004, have focused on minerals exploration applications. Airborne field tests are very encouraging and in addition to mineral targets, some large conductive features due to conductive sedimentary units have been mapped (Figure 2).

Geotech is now completing its OMET project report and is seeking suitable petroleum plays for airborne tests to define airborne

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Figure 2 - Geotech's airborne AFMAG system in field trials in Sudbury, Ontario with the principal designer, Dr. Petr Kuzmin.

AFMAG's performance in petroleum exploration. In addition, current development is now focusing on using the field data collected by the base station to monitor the natural EM fields and perhaps to provide a remote reference for signal processing of the EM fields. The base station data will also be assessed to determine if the number of airborne coils can be reduced to just the vertical dipole receiver coil, providing the possibility of installation onto a fixed-wing platform.

An introduction to the AFMAG method, the system, and its deployment will be presented. Results from the Sudbury test area, characterized by deep conductive targets including conductive sedimentary rocks, as well as several numerical models of typical petroleum target geometries, will also be presented. ■

### Biographical Sketch

Bob Lo graduated from the University of Toronto with a Bachelors of Applied Science (geophysics) in 1981 and with

a Masters of Science degree in physics in 1986. Bob also obtained an MBA from Laurentian University in 1994. Bob has held positions of Senior Geophysicist for Inco Ltd., Chief Geophysicist for Aerodat Ltd. and Vice President of Scintrex Ltd. Bob



currently works as an industry consultant, specializing in advanced geophysical interpretations of electromagnetic data for clients around the world. Bob is active in the geophysical community, having served as KEGS President, reviewing expanded abstracts and chairing sessions at various SEG Annual Meetings. Bob is a Professional Engineer and holder of a Certificate of Authorization from the Professional Engineers, Ontario.

## Sailing Up the Nile River continued from page 15

As he travels further up the river, Herodotus describes the effects of the Nile rapids on his travel itinerary:

“From the City of Elephantine as one goes up the river there is a country which slopes steeply; so that here one must attach ropes to the vessel on both sides, as one fastens an ox, and so make one's way onward; and if the rope breaks, the vessel is gone at once, carried away by the violence of the stream. Through this country it is a voyage of about four days in length, and in this part the Nile is winding like the River Maiander. Then you will come to a level plain, in which the Nile flows round an island named Tachompso. Adjoining this island there is a great lake, round which dwell Ethiopian nomad tribes; and when you have sailed through this you will come to the Nile Stream again, which flows into the lake. After this you will disembark and make a journey by land for forty days; for in the Nile sharp rocks stand forth out of the water, and there are many reefs..

Among the many wild animals Herodotus cites, he gives a particularly lovely description of the Nile Crocodile:

“Of the crocodile the nature is as follows: During the four most wintry month this creature eats nothing; she has four feet and is an animal belonging to the land and the water both; for she produces and hatches eggs on the land, and the most part of the

day she remains upon dry land, but the whole of the night in the river, for the water in truth is warmer than the unclouded open air and the dew. Of all the mortal creatures of which we have knowledge this grows to the greatest bulk from the smallest beginning; for the eggs which she produces are not much larger than those of geese and the newly-hatched young one is in proportion to the egg, but as he grows he becomes as much as seventeen cubits long and sometimes yet larger. He has eyes like those of a pig and teeth large and tusky, in proportion to the size of his body; but unlike all other beasts he grows no tongue, neither does he move his lower jaw, but brings the upper toward the lower, being in this too unlikely of all other beasts...”

Here ends my summary of Herodotus' observations on the Nile River. His book is full of other interesting notes and stories. He writes, among other topics, about the measuring of time, astrology, sacred animals and the way the Egyptians lived. ■

Source: “An Account of Egypt” by Herodotus. Translated by G.C Macaulay. Published as E-book by Roberts Publishing, 197 Woodlands Pkwy. # 104-529, San Marcos, Ca. 92069

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Franz L Kessler has a PhD in sedimentology, and has worked 20 years in the oil industry as exploration geologist.