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Discovery of the UTEM Zone, Heninga Lake, Nunavut, Canada

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Introduction

Heninga Lake, District of Keewatin, Nunavut, Canada is located 400km due north of Churchill, Manitoba, or 110 km west-northwest of Eskimo Point, Nunavut. In 1979, Sulpetro Minerals (now Novamin) and formerly St. Joseph Explorations Ltd. Had outlined two areas of potential economic interest.

The main zone is located at the south end of Heninga Lake and consists of six separate concentrations of mineralization within a total strike length of 120m. About 2km south is the AB-II zone, consisting of three separate zones of mineralization within a strike length of 700m.

The host rocks are a Precambrian volcanogenic sequence similar to those occurring in the Noranda or Flin Flon areas. The mineralization occurs within layered intermediate to felsic volcanics, mainly pyroclastic lapillae tuffs, grading upwards into finer grained volcanoclastic sediments and a low-grade magnetite iron formation.

Figure 1: Heninga Lake location map.

Previous (and New) Work

Drilling up to 1979 was not of sufficient detail to assign firm tonnage estimates; however, a tentative estimate based on drill indications totalled 5 to 6 million tons grading 1.3% Cu, 9%Zn, 0.03oz/t Au and 2oz/t Ag.

Conventional geophysics had aided in delineating the near-surface mineralization, and as the potential of finding other zones at greater depth was recognized, a UTEM2 survey was carried out in 1979 with deep penetration in mind

Two new zones were detected by the UTEM survey. The first (AB-II Deep Zone) lies at an interpreted depth of 100 to 150m and had not previously been recognized due to to overlying poorly conductive material associated with the AB-II Zone. It has been confirmed by drilling to be massive sulphides, but will not be discussed in this paper. The second conductor (UTEM Zone) was interpreted to be very deep and is located within the area of the main zone.

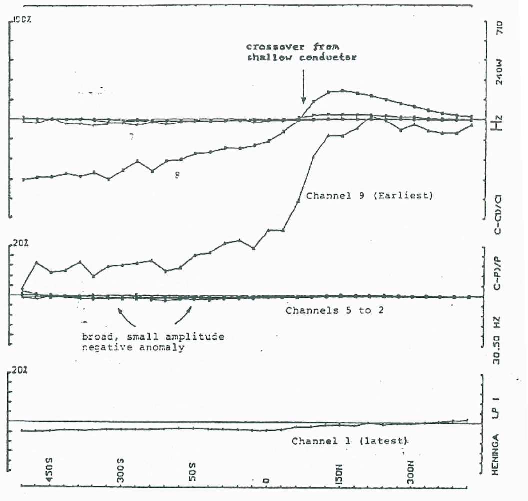

Figure 2: Routine field plot of Hz (vertical magne4tic) data from line 2400W. The short time constant anomaly seen on the early channels (Ch. 9 to7) is unrelated to the deep conductor seen as a broad negative at late times (Ch. 5 to 2).

Note: The 10 UTEM time windows are numbered from latest to earliest as channels 1 to 10.

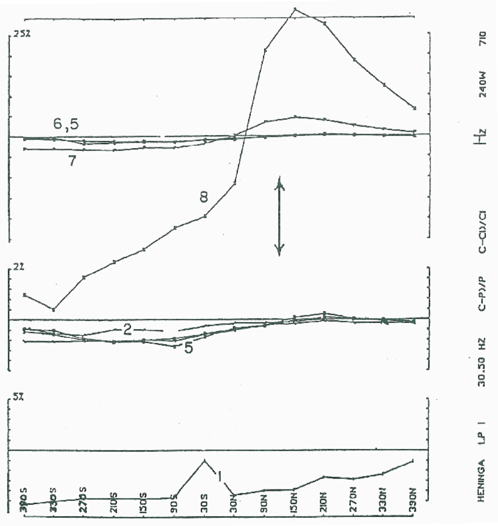

Figure 3: Detail profile (every second station) of line 240W. Longer averaging times (2 to 4 minutes rather than 30 seconds) have reduced the noise in the readings from that in the data of the previous figure. Note the expanded plotting scale of 2% (instead of the usual 20%) on the middle axis. The vertical arrow marks the interpreted location of the deep (UTEM Zone) conductor.

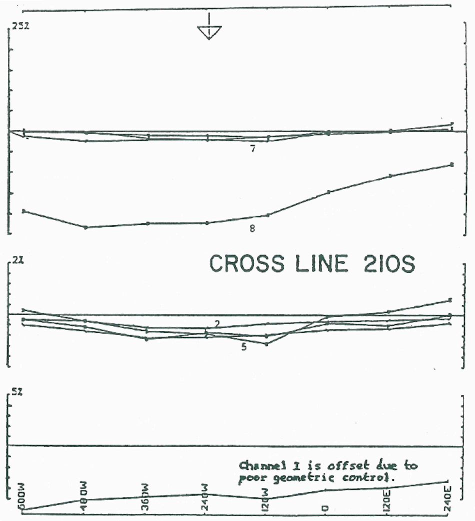

Figure 4: UTEM data (Hz) collected on a cross line (210S to line 240W through the negative peak of the anomaly shows the limited strike extent of the conductor. Note how the amplitudes begin to approach 0 at each end of the line. Amplitudes at each station are normalized to the primary field recorded at the station indicated by the arrow.

Field Data

The routine plot of the UTEM data on line 240W is shown in Figure 1. Most evident at first glance is a crossover centred at about station 60N that shows up on the early time data (Ch. 9, 8, 7) which are plotted on the upper set of axes. This corresponds to poorly conducting mineralization in the near surface. The later time channels (Ch. 5 to 2) are plotted at an expanded scale in the middle set of axes. Towards the south end of the profile, there is a broad, slowly-decaying, negative anomaly of very small amplitude (less than 2%) that attracted attention when the data were plotted in the field.

Because of the small amplitude of the anomaly compared to the scatter in the data due to noise, an additional half day of surveying was performed with longer averaging times (2 to 4 minutes per station compared with the routine 30 seconds) and a plot of these data (see Figure 2) shows the detected anomaly clearly with a peak-to-peak amplitude of about 1%. The broadness of the original anomaly indicated that the second pass profile did not need to be as densely sampled, so only every second station was read. A cross-line was also surveyed, located so as to pass through the maximum of the negative part6 of the anomaly. The data from the cross-line (see Figure 3) confirmed the presence of the anomaly, and indicated that the causative conductor was strike limited.

Due to the severe time constraints on the survey, no further detailing was performed on this small anomaly.

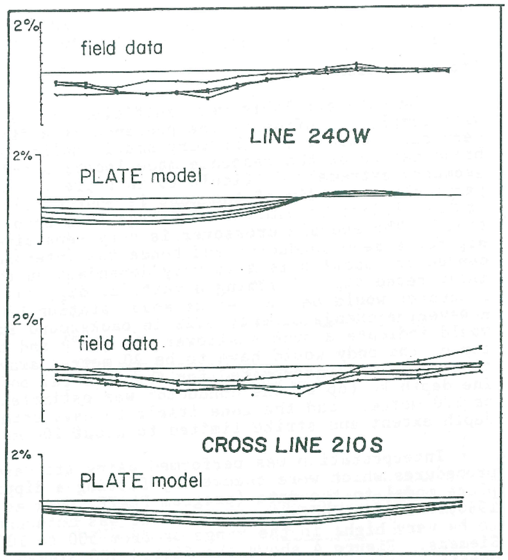

Figure 5: UTEM field data and calculated PLATE model response for line 240W and cross line 210S. Only late time channels (Ch. 5 to 2) are plotted.

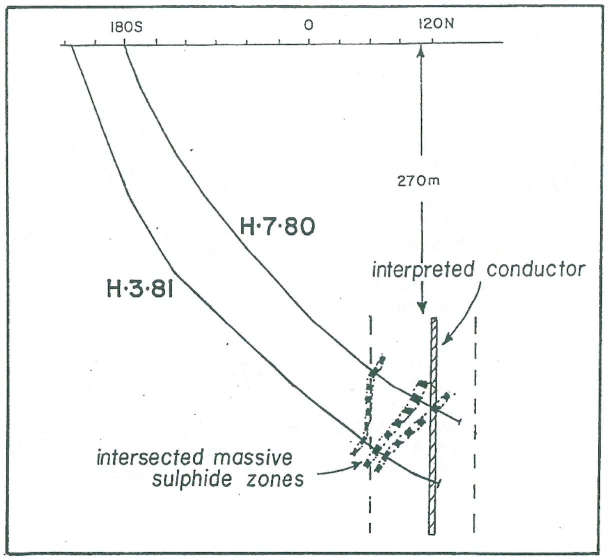

Figure 6: Cross section of the UTEM Zone based on drill information from H-3-81 and H-7-80. The large margin of error in the interpreted model (indicated by the dashed lines) is due to the conductor's small depth to size ratio.

Interpretation

The data available were sufficient to detect with complete confidence the presence of a finite, very deep conductor. The very small amplitude and broad nature of the response made location and geometry extremely difficult to interpret. In particular, the dip of the zone is most difficult to assess without transmitter coverage from both sides.

Interpretation (continued)

The anomaly crossover is very sensitive to dip for a deep conductor and hence the interpreted conductor location is also very dependent on the interpreted dip. Assuming a vertical dip, the conductor would be located at about station 120N. However, a change of only 0.2% in background level would indicate a much shallower dip (45º) and the top of the body would have to be 90m away from that which was interpreted for the vertical body. The depth to top of the conductor was estimated to be 270m, and the zone itself to have both depth extent and strike limited to about 200m.

Interpretation was performed using standard procedures which were checked by fitting a dipping plate model to the data (program PLATE, Dyck et al., 1980). The conductance of the zone was interpreted to be very high; in the range of 500 to 1000S. Figure 4 shows the fitted 500S, vertical plate model and the late time UTEM data on lines 240W and 210S.

Drill Results

Based on the interpretation, a drill hole was recommended to test the source of the anomaly as shown in Figure 5. The hole was drilled by Sulpetro Minerals and at 483m (300m vertical depth) massive sulphides consisting mainly of pyrite with significant sphalerite were intersected.

The sulphides occurred in three closely-spaced zones which are summarized below:

Intersection (m)	Assay	
	Zn (%)	Ag (oz/ton)
6.0	15.6	3.6
5.0	12.0	1.3
2.9	16.0	1.2

Three subsequent holes drilled based on the original UTEM interpretation all intersected massive sulphides and indicated that the true dip was about 70º to the South.

References

Dyck, A.V., Bloore, M., and Vallee, M.A. (1980); User manual for programs PLATE and SPHERE; Research in Applied Geophysics No. 14, Geophysics Laboratory, University of Toronto.

Macnae, J.C., Lamontagne, Y., and West, G.F. (1980). Noise processing atechniques for time-domain EM systems; GEOPHYSICS Vol. 49, No. 7, pp. 934-948.