Geophysical Aspects of the Kudz Ze Kayah Massive Sulphide Discovery Southeast Yukon, Canada

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INTRODUCTION

The Kudz Ze Kayah (KZK) property is the site of a new polymetallic volcanogenic massive sulphide (VMS) discovery, the ABM deposit, by Cominco in the Yukon-Tanana terrain of southeastern Yukon, Canada, about 250 km northwest of Watson Lake. Anomalous regional geochemistry and subsequent follow-up led to the discovery of a massive sulphide boulder about 1 km down-ice from the deposit. Initial UTEM and reconnaissance horizontal loop electromagnetic (HLEM) and magnetics surveys in 1993 identified a conductive (40 S) and highly magnetic (700–1000 nT) target which was drilled in March 1994, and found to represent a significant economic massive sulphide body. The area was subsequently flown with helicopter-borne EM and magnetics, clearly identifying the ABM deposit. Ground grids were established over this target and exploration programs involving a variety of geophysical methods were carried out, including, HLEM, magnetics, UTEM, and gravity, successfully outlining the deposit in detail. This presentation provides a geophysical case history of the discovery of this massive sulphide deposit.

GEOLOGY

The KZK deposit is located in the Yukon–Tanana Terrain of southeastern Yukon. A favourable package of Devonian-Mississippian aged felsic and mafic metavolcanics and metasediments lies in close proximity to a deformed granitoid intrusive complex of similar age, possibly representing a subvolcanic intrusive complex. Mineralization is associated with felsic metavolcanics, which have been identified throughout the belt, with those close to the intrusive complex considered to be the most favourable. Over much of the area the target felsic volcanics are overlain by metasediments, generally mudstones and shales which typically have pyrrhotite disseminations, and are variably carbonaceous, making these metasediments locally both magnetic and conductive. The target metavolcanics are more easily evaluated in areas absent of the conductive capping metasediments, areas which generally tend to be in low-lying valleys, typically overburden covered, and minimizing the exposure of favourable lithologies in the belt. As a result, geophysics plays a critical role in the exploration of this highly prospective belt, and in particular, in the discovery of the ABM deposit.

GEOPHYSICS

A variety of geophysical methods were employed in the discovery and definition of the ABM deposit. With the discovery of a small massive sulphide boulder grading 9% Zn, 0.8% Pb, 17, 540 gm/t Ag, and 5 gm/t Au, in the regional geochem follow-up, and no local source evident in outcrop, geophysical methods were employed as the next stage of exploration. Despite complicated glacial ice directions locally, the most probable source was correctly determined to be to the south. A one-day

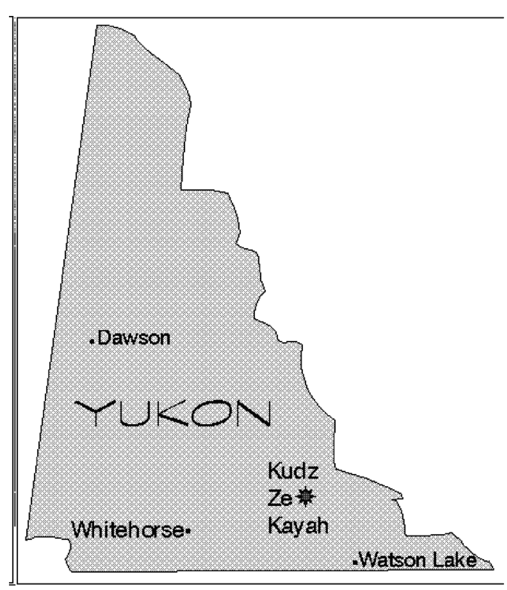

Figure 1: *Location of the Kudz Ze Kayh deposit.*

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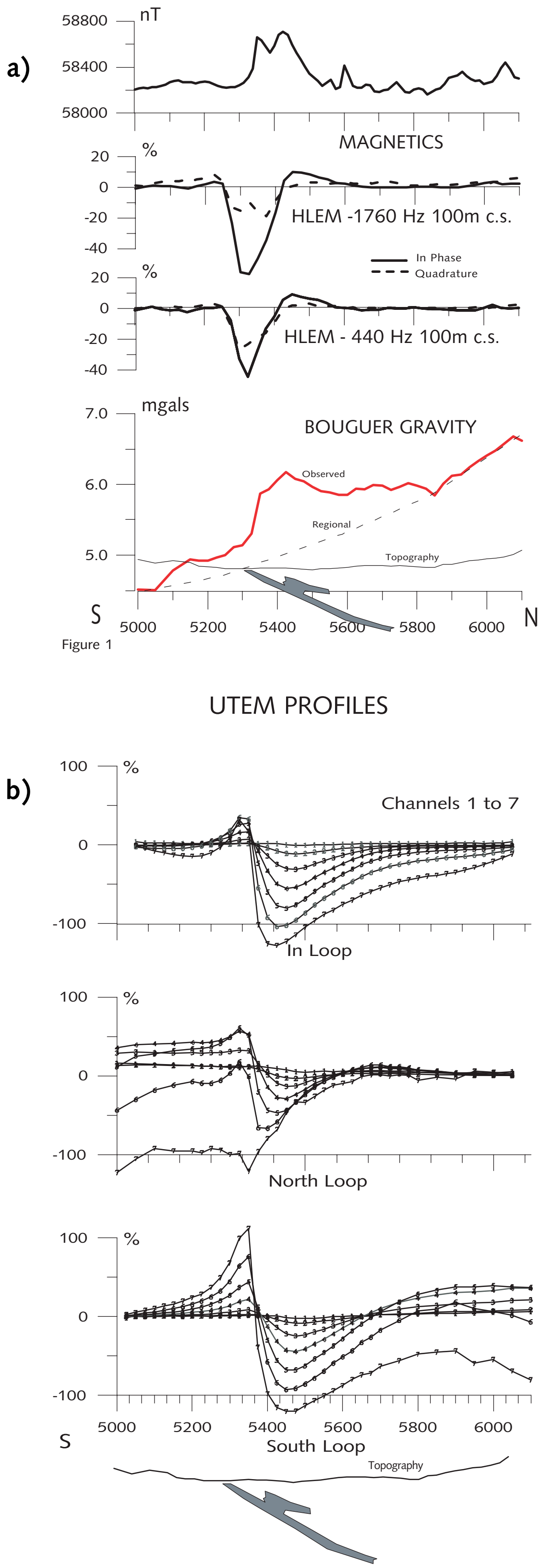


reconnaissance UTEM survey was carried out with a transmitter loop positioned one km south of the sulphide boulder location, which indicated the presence of a conductor within the transmitter loop. Subsequently HLEM and magnetics surveys, again in a reconnaissance mode, were carried out, and located a strong conductor with high magnetic signature. Interpretations from these HLEM and magnetic traverses provided the basis for the spotting of the initial diamond drill holes. Success was immediate, with the first hole drilled in April 1994, intersecting, as interpreted, two massive sulphide intervals, an upper zone 7.5 m thick, followed by 10.8 m of waste, and a lower zone 15 m thick, and average grades over the two intervals of 0.53% Cu, 2.8% Pb, 10% Zn, 278 gm/t Ag, and 2.9 gm/t Au, and dipping 30° to the north. Three additional holes were drilled on the reconnaissance HLEM/magnetic results, all intersecting significant intervals and base metal grades. A proper grid was established in the summer of 1994, and a combination of geophysical techniques were applied to delineate the sulphide mineralization. HLEM, magnetics, UTEM, and gravity surveys were carried out, with selected samples of each included in this review.

The southern margin of the deposit was well defined by the HLEM, which is interpreted as a shallow body (<10 m), 10–50 m wide, and having a conductivity thickness of 22–40 S with coincident magnetics of 700–1000 nT, traceable over 500 m. The deposit produces a Bouguer gravity response of 1.1–1.5 mGal. The UTEM program was particularly successful, outlining not only the shallow up-dip edge, but also the down-dip limit of the deposit. Shown here are profiles of gravity, HLEM, magnetics (Figure 2a), and UTEM from three loop configurations (Figure 2b) along Line 4750E, near the centre of the deposit. Figure 3 shows the HLEM profiles plotted over contoured magnetics. An in-loop UTEM survey was of particular interest, clearly showing the deposit limits, and the migration of the secondary field with time. Figure 4 shows the in-loop contours of time channel 4 (Ch4), and the induced current distribution at that time compared with the ore outline. The strongest Ch4 responses coincide with the thickest portion of the sulphide body.

The deposit has been drilled in detail (139 drill holes), outlining 11.3 million tonnes grading 0.9% Cu, 1.5% Pb, 5.9% Zn, 133 g/t Ag, and 1.3 g/t Au. An open pit mine plan has been developed and an access road to the deposit completed. Exploration is on-going in the Kudz Ze Kayah area, and throughout the belt, with geophysics playing an important role along side geological mapping and geochemistry.

Figure 2: *(**a**) Gravity, HLEM and magnetic profile, (**b**) and UTEM from three configurations along L4750E near the centre of the deposit.*

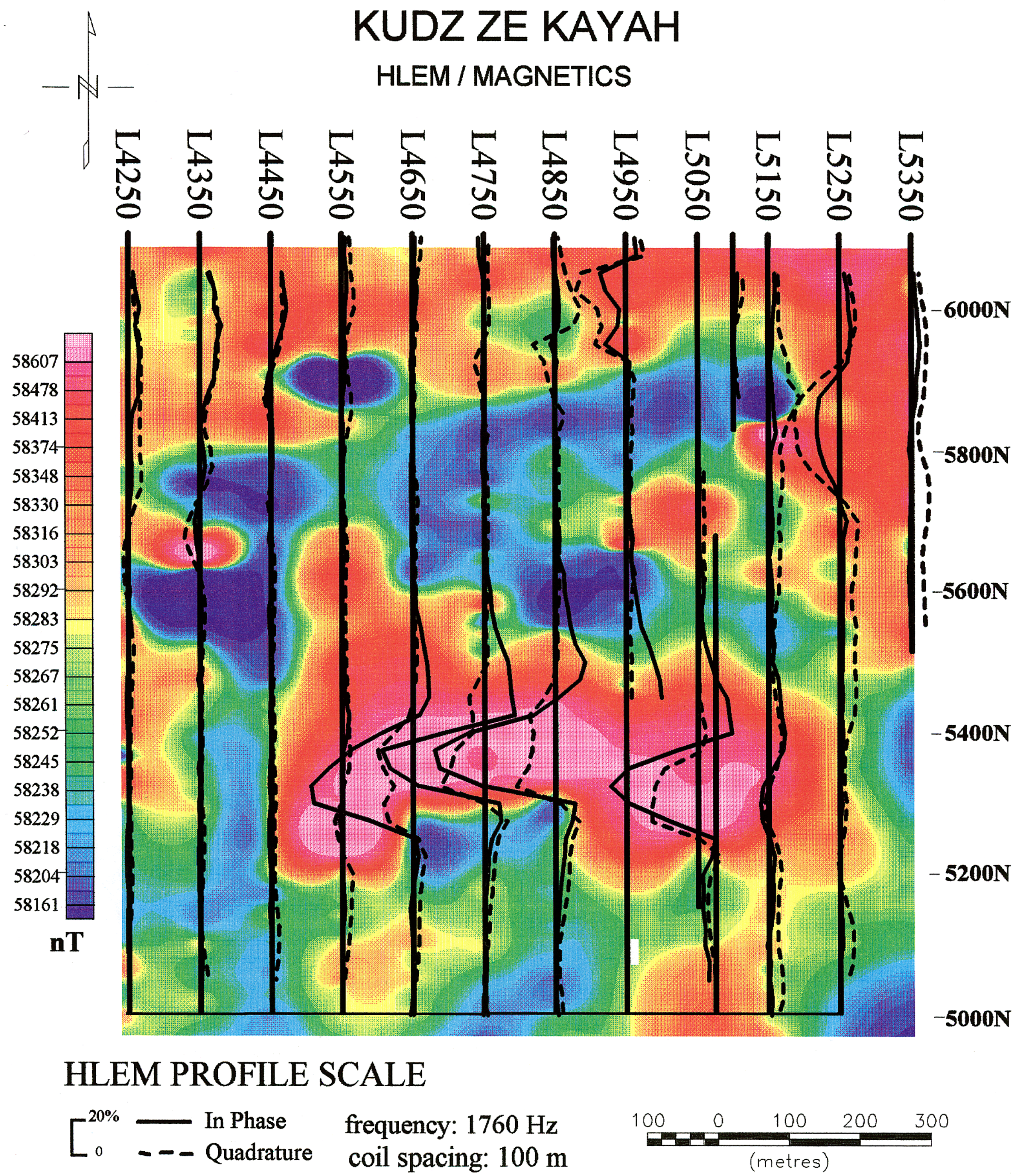
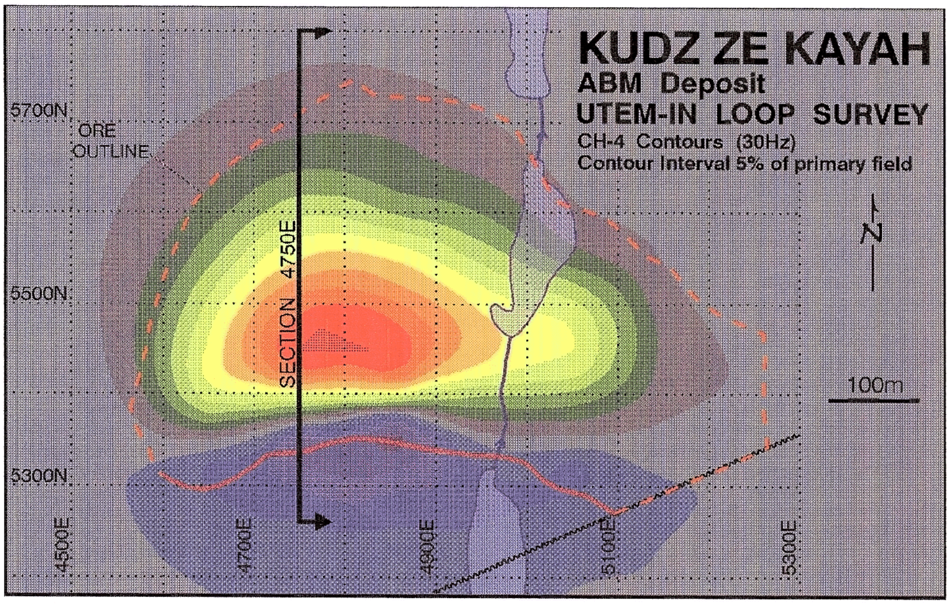


Figure 3: *Horizontal-loop EM (HLEM) profiles plotted over the contoured magnetics.*

a)



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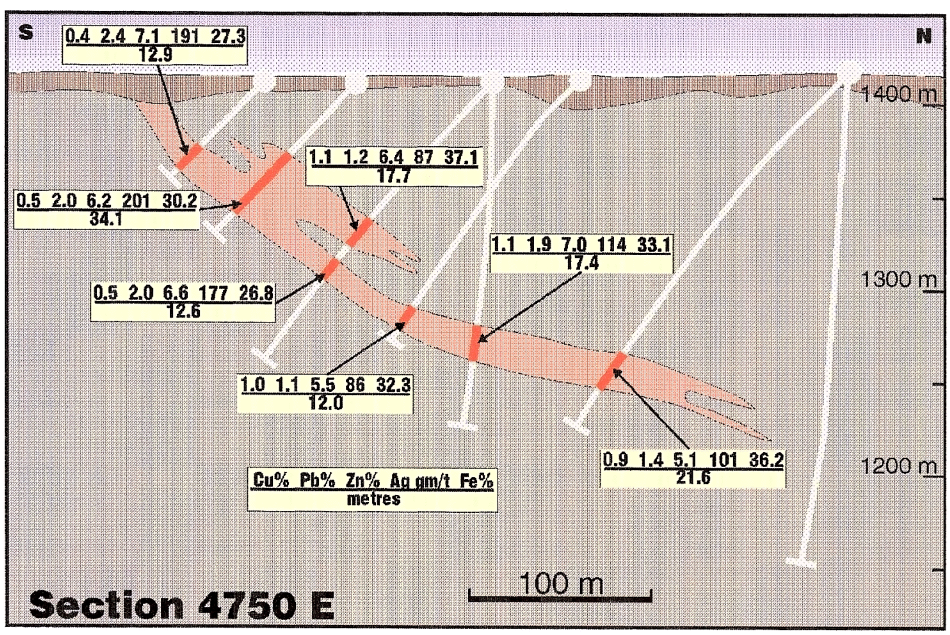

Figure 4: *(**a**) The in-loop UTEM survey Ch. 4 contours and (**b**) the induced current distribution at that time compared with the ore outline.*