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SkyTEM312HP – Case study from Areachap Belt, South Africa

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SUMMARY

The objective of the AEM survey in in the Areachap Belt, Northern Cape, South Africa was to investigate the mineral potential of the area. Previously known mineral occurrences in the area include the Kantienpan and Boksputs VMS deposit and the Jacomynspan magmatic Ni-CU deposits that are located at depth.

As a result of the knowledge of existing deep targets the AEM survey was conducted with the SkyTEM312HP system that has been developed for optimized depth penetration. The SkyTEM312HP system is based on both new high power transmitters and optimized receiver coils. The SkyTEM312HP has a magnetic dipole moment of 1,000,000 NIA and is operated at a base frequency of 12.5 Hz.

The SkyTEM312HP survey successfully verified the presence of the known mineral occurrences and identified several other EM anomalies that could be potential new discoveries. The survey fulfilled the scope of mapping the mineral potential of the survey area and showed the potential depth penetration capabilities of the SkyTEM312HP system.

Key words: SkyTEM312HP, Areachap Belt, Zn-CU VMS, Ni-CU intrusive deposit, Deep targets

INTRODUCTION

The SkyTEM312HP system was introduced as the optimal choice for the deep target imaging required for the Areachap Belt survey in the Northern Cape province of South Africa.

The survey area has a number of known VMS deposits as well as magmatic Ni-CU deposits (Orion Minerals Ltd, 2018). The AEM survey with the SkyTEM312HP system did successfully verify these deposits and identified a number of other geophysical anomalies that could lead to potential new discoveries.

The Jacomynspan magmatic NI-CU deposit is verified down to depth of more than 500 meters and an AEM system with the capabilities of a large depth of exploration was prioritised. The use of the SkyTEM312 HP with a transmitter moment of 1,000,000 NIA and the low base frequency of 12.5 Hz did prove successful in recording the EM signal to the latest gate times.

METHOD AND RESULTS

The SkyTEM312HP survey covered an area of 962 km^2 in the Areachap belt, Northern Cape, South Africa as outlined in Figure 1. Previously identified deposits are known to exist along the contact of the Jannelsepan Formation and the mapping of this contact is therefore vital to a successful survey. The survey design consisted of 6,000 linekilometers with a line spacing of 200 meters.

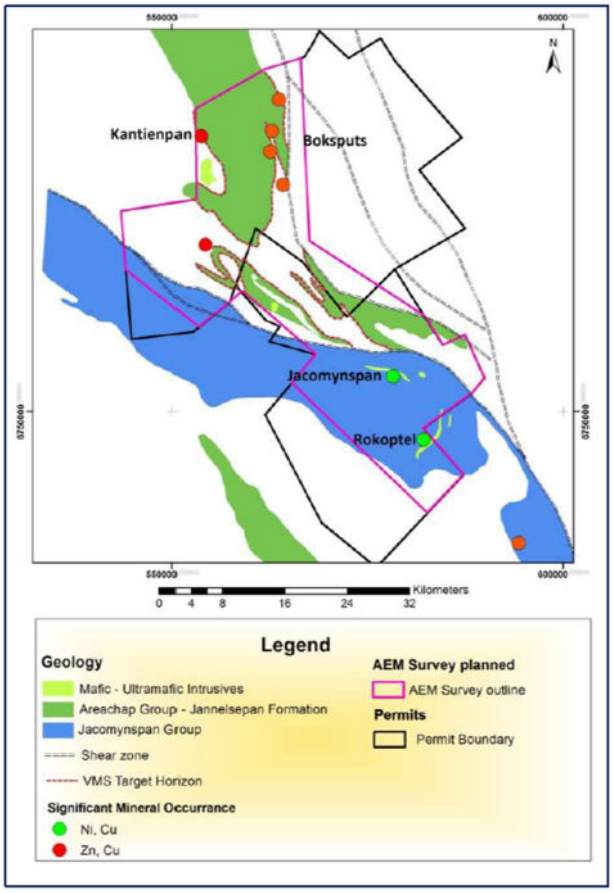

Figure 1. Locality plan for the SkyTEM312HP survey area. The contact with the geological unit indicated in green represents the priority target area.

System description

To meet the requirements for the deep penetration required for the mapping of the deep-seated exploration targets the AEM system deployed was the SkyTEM312HP.

The SkyTEM312 HP system is based on the new high power TEM transmitter that delivers a maximum current of 250 Ampere in each transmitter turn. The 12 turns mounted on the SkyTEM300 series compact frames with an area of 342 m^2 delivers a magnetic dipole moment of approximately 1,000,000 Am2.

The receiver induction coil is optimised to minimum noise at late times to enhance the depth of investigation. It has an area of 100 m^2 and a cut-off frequency of 31.5 kHz.

To further optimize depth of investigation the SkyTEM312HP system is operated at the lowest possible repetition frequency of 12.5 Hz. This has an on-time of 8 ms and an off-time of 32 ms with the last gate centre time around 29 ms. The waveform of the SkyTEM312HP system is shown in Figure 2.

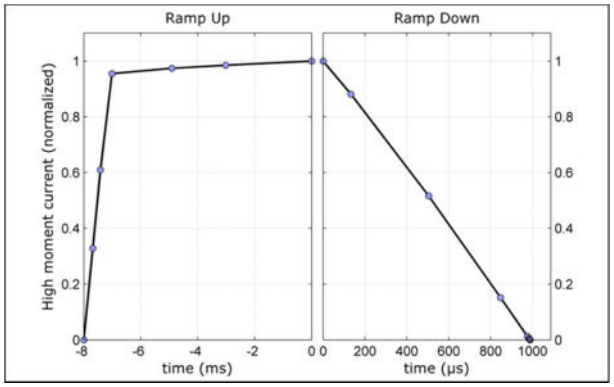

Figure 2. Normalised current waveform for the SkyTEM312HP transmitter operated at a 12.5 Hz repetition frequency. Left panel show the ramp up normalised current versus time in ms and right panel show the ramp down normalised current versus time in µs.

Survey results

The preliminary evaluation of the SkyTEM312HP data shows the values of applying the airborne EM method in the highly prospective Areachap Belt. Figure 3 show the identification of several identified anomalies based on the AEM data for future follow-up. Where the survey covered the known VMS deposits Kantienpan and Boksputs and the Jacomynspan Magmatic NI-CU deposit, conductors were detected, proving the SkyTEM312HP data to be effective for these deposits.

To elaborate on the outcome of the AEM data a series of four raw data plots are presented in figure 4. The EM data has been corrected for the effects of varying ground clearance according to the method described by Green (1998). Panel a through d show the gridded data for successively later gates. The early gates show several marked conductors running NW-SE in the survey area. Some of these conductors can be followed all the way to latest gate indicating that the conductors at these locations continue to large depth.

The ability of the SkyTEM312HP system to map the EM anomalies to the latest gates is important for extending the depth of exploration of the AEM systems. The Jacomynspan deposit that is known to extend to 500 meters is mapped to the latest gate. The stronger anomalies seen on the latest gate located elsewhere in the area is very promising for the depth of exploration for the SkyTEM312HP system.

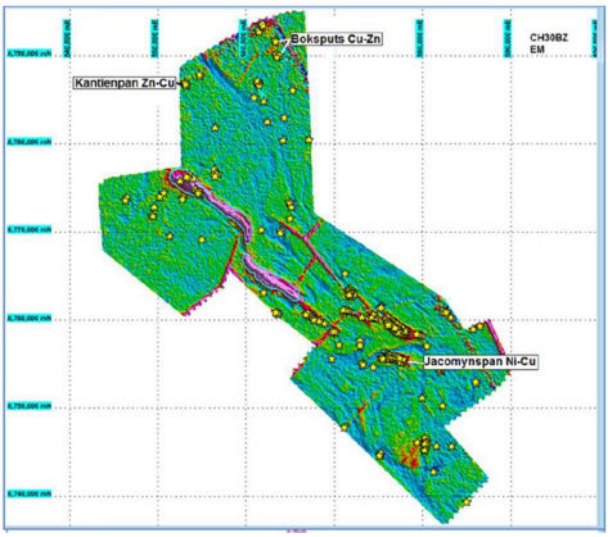

Figure 3. Preliminary identified EM anomalies marked with yellow stars on the AEM map. Previously known deposits are marked with names.

CONCLUSIONS

The SkyTEM312HP survey over the Areachap Belt, Northern Cape, South Africa succeeded in acquiring high quality data verifying known deposits and providing positive indications for a number of unknown follow-up targets.

The large depth of exploration of the SkyTEM312HP system was verified by the detection of the known deposits.

ACKNOWLEDGMENTS

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A special thanks to all people involved in the field campaign for the Areachap SkyTEM312HP survey.

REFERENCES

Green, A., 1998, Altitude correction of time domain AEM data for image display and geological mapping using the Apparent Dipole Depth (ADD) method. Exploration Geophysics 29:1/2, 87-91.

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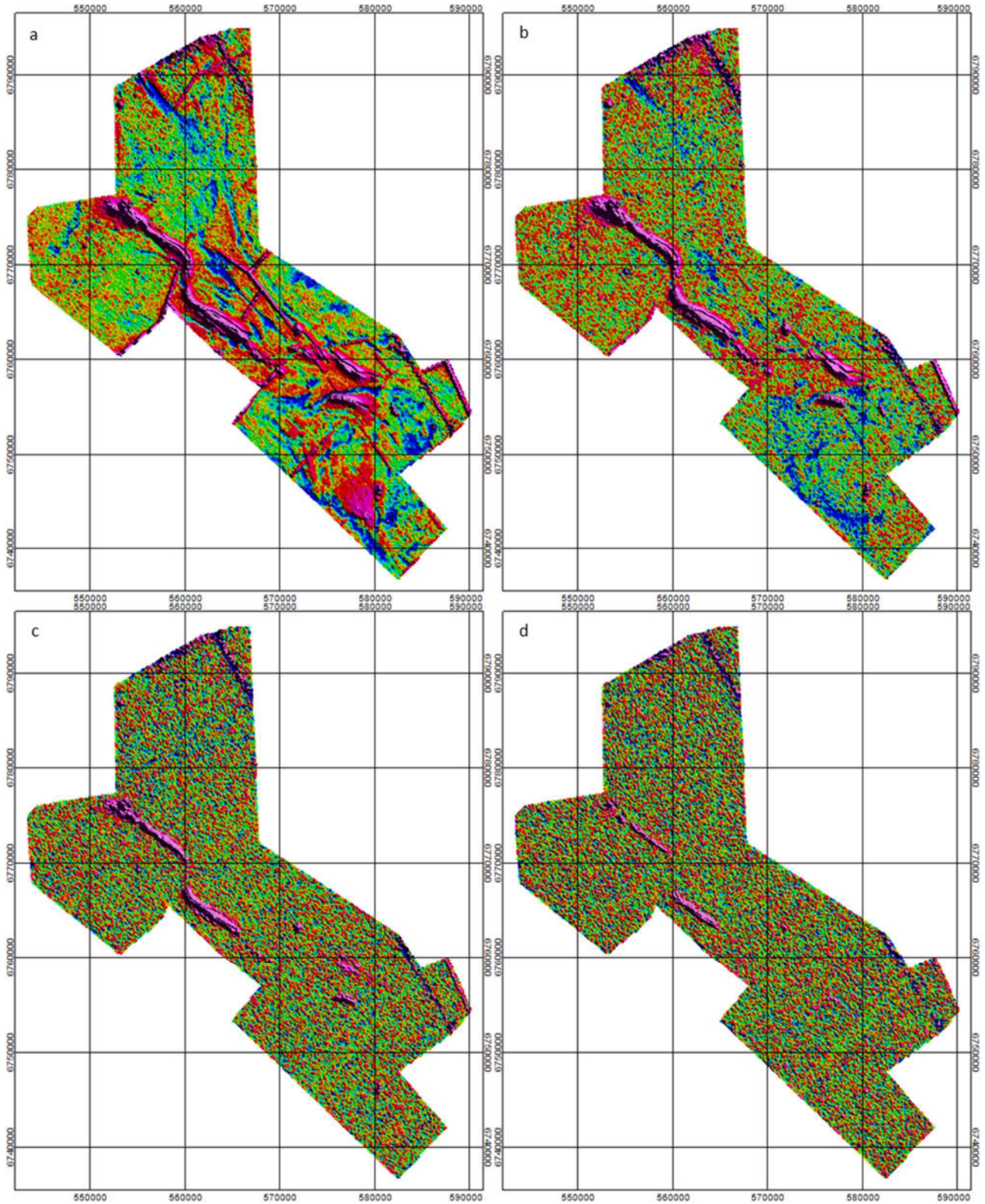

Figure 4. Raw high moment EM data for four selected gate centre times. Warm colours represent high signal. The EM data has been corrected for variations in flying height to a standard ground clearance of 40 m. Panel a: Gate centre time 3,216 µs. Panel b: Gate centre time 6,470 µs. Panel c: Gate centre time 13,805 µs. Panel d: Gate centre time 29,509 µs.