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Performance of the Spectrem^{PLUS} system in Australian geological conditions

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SUMMARY

SPECTREM AIR has been successfully acquiring data in Australian terrain since 2017 and has shown substantially better depth of penetration as well as increased sensitivity in shallow sounding with the SPECTREM^{PLUS} as compared to earlier systems. The higher-powered transmitter (amongst other improvements) has shown significant improvements in signal to noise ratio of the system.

The combination of higher transmitted power, wide system bandwidth and advanced data processing gives SPECTREM^{PLUS} the unique advantage of being able to map at depths of up to 600m (dependent on overburden conductivity), without compromising the simultaneous resolution of shallow features, thus making the system an ideal tool for exploring under cover in Australian terrain where difficult geological settings are present.

Key **words:** SPECTREM, EM, Australia, high power.

INTRODUCTION

SPECTREM is a fixed wing, towed bird, airborne time domain electromagnetic (TDEM) system developed by Anglo American just over 30 years ago. Continual upgrades and significant modifications have since been undertaken on the system with the latest upgrade resulting in SPECTREM^{PLUS}.

Exploration is continuing to target deeper deposits, either under thicker conductive regolith, or at greater depths within the geological succession whilst requiring higher resolution near surface. The development of the SPECTREM^{PLUS} system (**Error! Reference source not found.**) has been undertaken to facilitate this challenge.

Many high priority targets and geological formations have been successfully mapped using SPECTREM^{PLUS} which has been operating continuously in Australia since 2017.

AEM APPLICATION IN AUSTRALIA

The advantages of the SPECTREM^{PLUS} system are presented in this poster, as will be several examples, including data collected in Australia in the current campaign which commenced in September 2017.

Figure 1. SPECTREM AEM system

The Basler Turbo DC-3 aircraft's endurance is well suited for surveys in remote areas, making safe data acquisition possible in many parts of Australia. The large transmitter moment, currently the largest of any fixed wing AEM system in production, allows for increased depth of investigation and better geological mapping.

Due to the wide bandwidth of SPECTREM^{PLUS}, high resolution mapping of the regolith thickness cover has been achieved as well as substantially better depth of penetration through the thick and conductive overburden that generally pervades Australian terrain. Such an AEM system is a powerful tool in areas such as the Yilgarn Craton margin and Albany Fraser Orogen (Gonzalez-Alvarez et al, 2015).

Recent processing improvements have been developed such as the Sum of Exponentials algorithm which further extends out the exponential decay so a more accurate estimation of the primary field amplitude can be obtained (Leggatt, 2014).

The ShC processing has also been developed specifically for the applications of ocean floor topography which can also be applied to highly conductive environments. A numerical method is applied in which a thin conductive sheet response is used for the model function to fit to the data, from which the primary field is estimated. (du Plooy, 2015).

Both of these latest processing developments are used in highly conductive areas to calculate the most accurate secondary field amplitudes which have direct bearing in better defining the response of a target.

The SPECTREM^{PLUS} system has collected over 60,000 lkm in Australia since September 2017 (Figure 2).

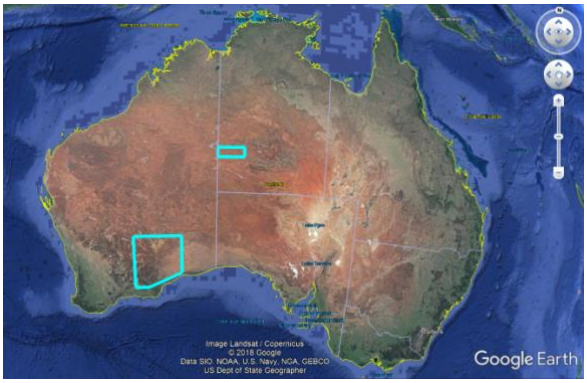

Figure 2. The recent Australian survey area coverage

Examples will be shown which highlight the improved depth of investigation by the SPECTREM^{PLUS} system, with particular relevance to improved resolution as seen in CDIs and inversions (Figure 3 and 4).

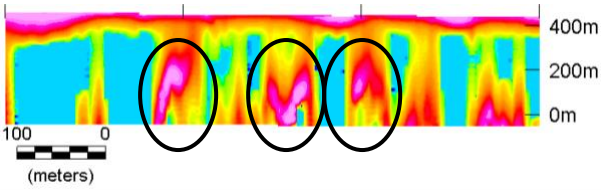

Figure 3. CDI indicating highly resolved deep conductive features in the Australian terrain, seen amongst system noise and ground proofed by client.

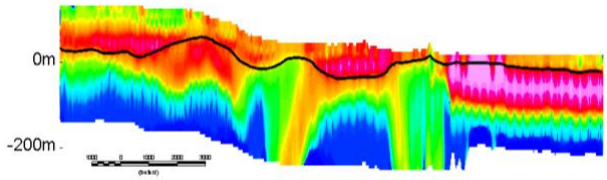

Figure 4. CDI providing high resolution regolith cover mapping, which has been ground proofed with drill information provided by the client.

CONCLUSIONS

As shown throughout its current deployment in Australia, the technical design of the SPECTREM^{PLUS}, its advanced processing algorithms and value-added interpretation has shown to be an effective solution for geological mapping and mineral targeting in complex geological environments, especially under cover. This allows for a system like SPECTREM^{PLUS} to be a highly relevant to the Australian conditions.

ACKNOWLEDGMENTS

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