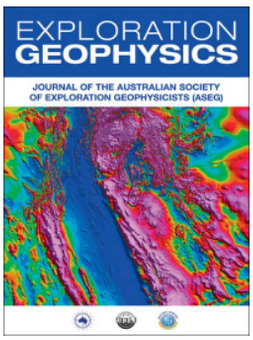

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Mike Whitford & Doug Winzar

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The Discovery of the Bumblebee and Grapple Mineralisation and Impacts on Exploration at the Lake Mackay Project

Mike Whitford
Independence Group
South Perth
Mike.Whitford@igo.com.au

Doug Winzar
Independence Group
South Perth
Doug.Winzar@igo.com.au

SUMMARY

The Grapple and Bumblebee mineralisation at the Lake Mackay Project have been discovered using a combination of routine fine fraction soil sampling, drilling and focused ground electromagnetic methods. Soil sampling initially provided the target areas with subsequent EM surveys delineating basement conductors. Bumblebee returned sub economic intersections when drill testing, while the third drill hole at Grapple returned a significant Cu-Au intersection.

The methodology has been expanded to use airborne electromagnetic methods to rapidly screen the large tenement holding, assist in the understanding of the soil geochemistry results and plan ground EM surveys going forward. The airborne EM method also allows us to test areas deeper under cover than soil sampling.

Key words: Electromagnetics, Grapple, copper, gold

INTRODUCTION

The Lake Mackay Project is located approximately 400 km WNW of Alice Springs in the South-Western Aileron Province. The project is a joint venture between Independence Group NL (IGO), Prodigy Gold NL and Castile Resources Pty Ltd and at the time of writing consists of ~8,058km^2 of granted tenure. To-date basement mineralisation (Cu-Au) has been identified at the Bumblebee and Grapple prospects.

The Bumblebee prospect was first identified in 2014, as a multi-element geochemical anomaly through routine regional soil sampling over the project tenements, with an anomalous Au response, 2.0 ppb Au in one sample and an adjoining sample with an anomalous Zn response of 62.9 ppm Zn on an 800 m x 800 m soil sampling grid. Infill soil sampling in 2015 on 20 0m x 400 m grid and then 50 m x 200 m sampling generated a coincident Au-Ag-As-Bi-Cu-Pb-Zn anomaly, with a peak of 15.2 ppb Au. Drilling the peak of the soil anomaly returned a number of significant intercepts, amongst the best being 7m @ 3.29 g/t Au, 12.4 g/t Ag, 3.25% Cu, and 1.34% Zn (Winzar, 2016). The moving loop electromagnetic method (MLEM) was then used to target associated basement conductors, and downhole electromagnetics (DHEM) applied to further vector towards mineralisation and confirm the source of the anomalism.

Results and learnings from the Bumblebee discovery rapidly drove the discovery of the Grapple deposit, located ~2 km southwest of Bumblebee. An infill soil sample grid was expanded to cover lower order coincident Au-Cu anomalism in the vicinity of the Grapple Prospect and at this time ironstones were also discovered during mapping. The Grapple prospect was reviewed and a coincident poorly-tested EM conductor was identified in available historical geophysical information. A larger MLEM survey was completed over the geochemical anomaly which identified a conductor that was underlying the spatially associated outcropping ironstone. Drill testing under the ironstone lead to the discovery of the Grapple mineralisation. DHEM was completed on all drill holes to provide vectors to additional mineralisation and confirm the source of the geophysical anomalism.

The results from these two discoveries have been used to develop a methodology for exploring the project utilising geological, geochemical and geophysical techniques. This paper outlines the surveys conducted at the Bumblebee and Grapple deposits and how these results have been used to develop the exploration plan.

Geology

The Lake Mackay project is located at the southern margin of the Palaeoproterozoic North Australian Craton, straddling the Aileron Province to the north, and the Warumpi Province to the south. These provinces are separated by the Central Australian Suture (CAS), a major deep crustal-scale structure comprising a series of east–west trending major faults and shear zones (Shaw *et al* 1992, Scrimgeour *et al* 2005a, Selway *et al* 2009). Sulphide mineralisation at Grapple and Bumblebee is hosted within poorly exposed ca 1.84–1.81 Ga metasedimentary rocks of the Lander Rock Formation, with the ca 1.80 Ga mafic Du Faur Suite present proximal to mineralisation at both prospects. The prospects are several kilometres north of the ca 1.64–1.63 Ga Andrew Young Igneous Complex that emplaced felsic and mafic magmatism contemporaneous with the Liebig Orogeny (Wyborn *et al* 1998, Cross *et al* 2005b, Scrimgeour *et al* 2005a, Hollis *et al* 2013).

The Mineralization at Bumblebee and Grapple consists of stockwork- to stringer-breccia style pyrrhotite-dominant sulphides with common chalcopyrite, sphalerite and arsenopyrite, minor traces of galena and native bismuth. The host rocks have undergone extensive metasomatism and alteration that has obliterated the protolith textures (Crawford 2017).

METHODS

The project area largely consists of thin aeolian sands juxtaposed against deeply weathered paleochannel features known to consist of conductive clays. These are two very different regolith types, and not two that an exploration program can easily accommodate without prior knowledge and planning. Lessons learnt from the discovery process has driven

a two-pronged approach for exploration. Soil sampling in areas of shallow cover coupled with electromagnetic (EM) methods to delineate targets under cover.

Prior to the discovery of the Bumblebee and Grapple prospects soil sampling was conducted routinely on an 800m x 800m grid, using a -50um BLEG sampling technique, analysing for Ag, As, Au, Bi, Ca, Cu, Fe, Ni, Pb and Zn over the entire tenement package. Since the discovery this method has been continued with an expanded suite of elements, however regolith thickness products generated from airborne EM (AEM) and radiometrics has now significantly refined the areas where it is believed soil sampling will be effective.

The soil sampling led to the siting of MLEM surveys over anomalies. MLEM surveys were conducted using 200 m square loops, in a slingram configuration, with the fluxgate sensor offset to the north. A current of ~60 A was transmitted into the loop at a frequency of 1Hz. Lines where spaced at nominally 200 m with a 100 m station spacing.

DHEM surveys were conducted using a 400 m x 400 m loop transmitting ~60 A at between 0.125 and 1 Hz frequency. An EMIT Digi-Atlantis receiver tool was used for all surveys.

RESULTS

Eleven lines of MLEM were completed over the Bumblebee geochemical anomalism, with a strong basement conductor identified in the survey across ~500 m of strike (Figure 1). Modelling of the target prior to drilling indicated a moderately conductive (~550S) source, dipping to the south at ~55° and a depth to the top of the conductor of ~100 m.

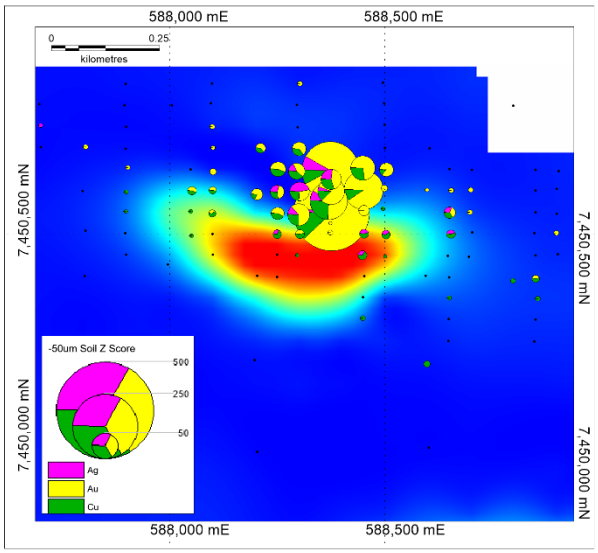

Figure 1. Slingram MLEM X component channel 17 (~4 ms) over Bumblebee with multi-element pie chart Z scores from soil sampling.

On the basis of this result a small programme of drilling was completed with the first drill hole intersecting a 5 m interval from ~152 m consisting of low-level Au, Ag, Cu, Pb, Zn, anomalism. The dominant sulphide assemblage associated with the mineralisation includes pyrite>pyrrhotite>chalcopyrite >sphalerite>galena within a package of metasediment gneiss, muscovite quartz schist, meta-gabbro and Amphibolite (Figure 2)

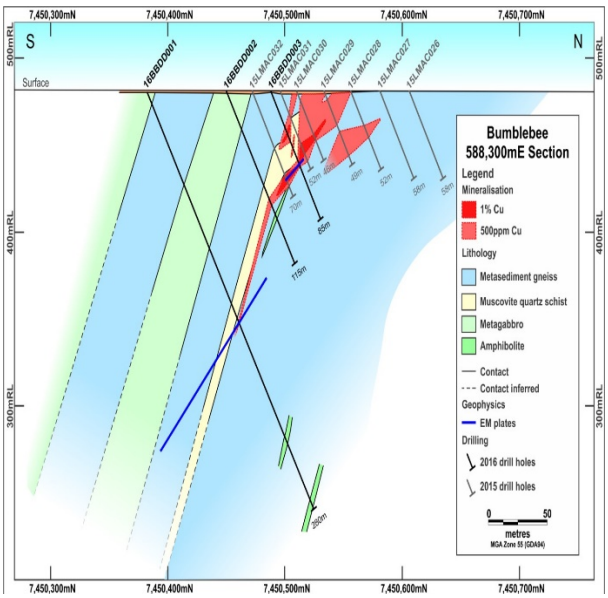

Figure 2. Schematic section through Bumblebee looking west, indicating the EM plate intersection and sulphide association.

DHEM was completed on the drill hole immediately after drilling completion. This data showed a strong in-hole response (Figure 3) associated with the intersected mineralisation, and while only associated with low-level metals, the use of soil sampling and EM at Bumblebee enabled IGO to target and intersect basement mineralisation. It has been interpreted that the elevated results associated with the shallower drilling appears to be the centre of the mineralised system and is associated with supergene enrichment in high-angle stringer veins above the main mineralised plane.

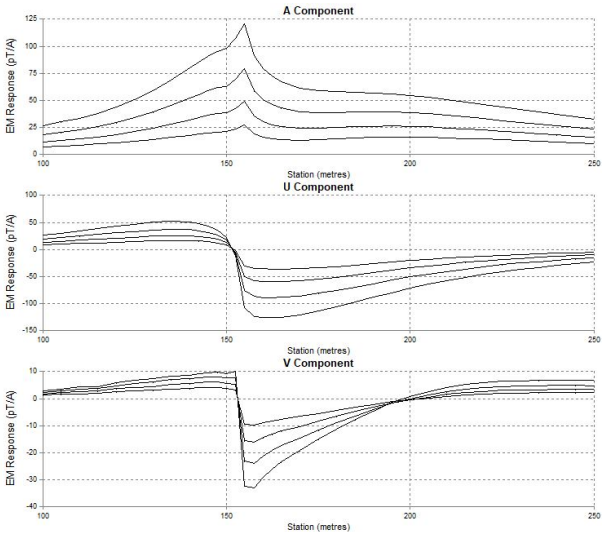

Figure 3. DHEM profile of 16BBDD001 showing late time channels (~24-60 ms). A clear in hole response is present at 155 m.

Following on from the Bumblebee discovery, a lower order soil geochemical response was identified ~2 km to the southwest and named the Grapple Prospect. A review of historical data found two existing lines of in-loop MLEM using a dB/dt sensor which detected an anomalous response that was subsequently drill tested. The source of the anomaly was explained as most likely due to strong clay-altered fault zones. In order to better

understand these results, nine lines of MLEM where completed over the geochemical anomalism, expanding on the area previously surveyed. This led to defining two distinct conductors, with one associated with stronger soil geochemical anomalism and outcropping ironstone (Figure 4). Modelling of the conductors show them to be of higher conductance than the Bumblebee anomaly (~1000-1500 S), steeply-dipping and again relatively shallow (~70 m to the top of the conductor). Reconciling this information with the available drill information it was considered the previous interpretation of EM results was not valid for explaining the geophysical anomaly.

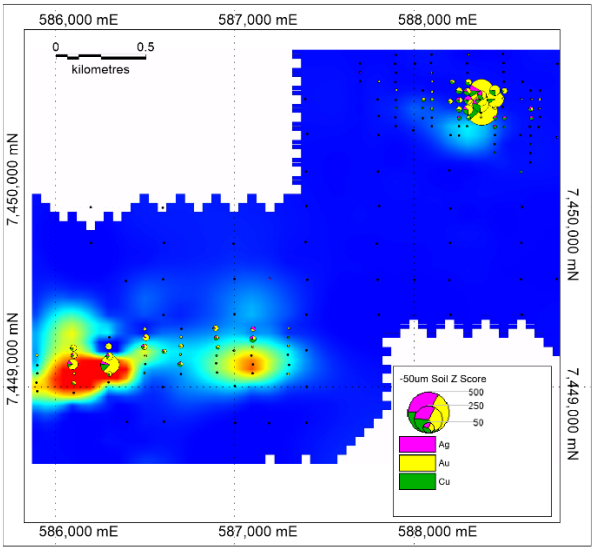

Figure 4. Slingram MLEM X component channel 27 (~27 ms) over Grapple and Bumblebee with multi-element pie chart Z scores from soil sampling.

The first two drill holes into the Grapple prospect were directed into the peak of the geophysical anomaly, with a hole into each of the eastern and western conductors intersecting dominantly pyrrhotite mineralisation with an absence of any significant Au, Ag, Cu, Pb, or Zn anomalism. Given the elevated response in the soils this again was not considered a suitable explanation for the soil geochemical anomaly. A third drill hole was collared under the peak soil geochemical response, coincident with an outcropping ironstone and the geophysical response. This drill hole entered a zone of multiple sulphide horizons from approximately 80m depth to approximately 160m depth, the most significant being a 9m interval from 85m depth which returned 1.81g/t Au, 49.1g/t Ag, 3.26% Cu, 3.63% Zn. This result confirmed the Grapple discovery (ABM Resources, 2016).

DHEM was conducted on all drill holes to confirm an effective test. In 16GRRC003 a complicated DHEM profile is observed corresponding to the multiple sulphide horizons, though an in-hole response is observed corresponding to the known mineralisation, with this result satisfying both the MLEM and geochemical anomalism. The DHEM on this hole was key in determining the MLEM response was due to a wide zone of conductors that could not be discriminated solely from the surface MLEM

IMPLICATIONS FOR EXPLORATION AT LAKE MACKAY

The discovery of the Bumblebee and Grapple prospects confirmed that EM and soil sampling are effective exploration tools in the project area. The focus has now shifted away from the known prospects to exploring the large tenement package in the South-Western Aileron Province.

This in itself provides a problem of how to effectively explore this large area, with the exploration focused at the time of discovery on ~517km^2 of tenure. Adopting the previous strategy of soil sampling followed by ground EM would prove a costly and slow exploration programme when exploring the expanded tenement portfolio consisting of over 8,000 km^2. Additionally, the broader project area has significantly more areas that were inferred to have thicker transported cover and these are not amenable to soil sampling techniques.

Large-scale AEM has been implemented at Lake Mackay as the key solution to exploring this tenure. Orientation surveying was completed at a number of prospects with the SPECTREM system chosen to complete the large survey, with ~14,000 line-km of surveying now completed at the project.

The delivery of this data has provided two key deliverables:

1) A detailed assessment of the cover thickness and where soil sampling will likely be effective (Figure 5a), and:
2) Direct detection of basement conductors which have the potential to represent economic mineralisation observed within the late Tau X component image (Figure 5b).

Filtering, ground truthing and ranking of additional targets is currently in progress and the combination of both soil geochemistry and EM methods are expected to expediate the discovery of further mineralisation.

CONCLUSIONS

The discovery of the Bumblebee and Grapple prospects at the Lake Mackay project has enabled some empirical relationships to be established to assist further discovery. That is, soil geochemistry will be an effective tool for identifying potential mineralisation outcropping or under very shallow cover. All discoveries to-date have a significant ground EM signature and this method can be used to target under surficial geochemical anomalies. Using this proven exploration methodology, the approach has been expanded to rapidly screen the larger tenement holdings using AEM. This will allow us to test under cover, deeper than has been enabled with soil sampling, though soil geochemistry will still form a crucial part of the exploration plan. It has been demonstrated that the strength of the soil anomaly or the strength of the EM response does not directly correlate to the size of mineralisation and as such it is critical that both data sets be used when evaluating targets and that a range of EM conductors are tested.

The application of AEM has generated a high-resolution cover thickness map in order to better target our application of soil sampling and better understand its effectiveness in areas where sampling has already been conducted, while also generating direct targets to follow up with ground EM. All targets considered worthy of drill testing will be reconciled with DHEM to ensure an effective test has been completed.

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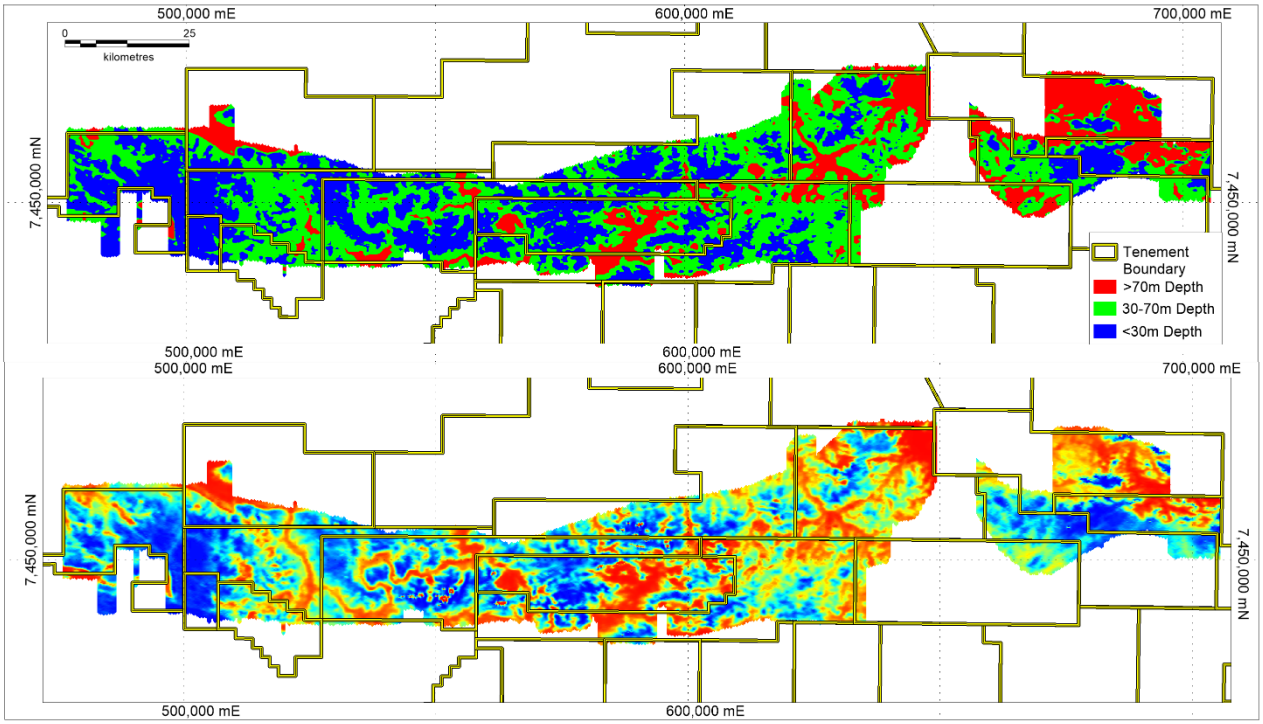

Figure 5. (a) (top): Regolith thickness product derived from SPECTREM AEM survey; (b) (bottom): SPECTREM AEM survey over IGO's Lake Mackay Project Tenements showing the Late Tau X component image.