# Gravity anomalies as trap sites in prospectivity modelling of the Eastern Gawler Copper-Gold Belt

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## Introduction

**The Woomera Prohibited Area - Eastern Gawler region is highly prospective for IOCG deposit styles (amongst other styles/commodities), ranging from hematite-rich breccias to magnetite rich skarn-style alteration and mineralisation (Figure 1). To aid exploration for such targets, mineral potential modelling has been conducted and a method for extracting anomalous regions from newly released gravity and magnetic grids was developed.**

**IOCG mineral potential modelling has been conducted based on methods and criteria outlined in Schofield et al (2013) and Huston and van der Wielen (2011). The aim of this mineral systems modelling is to define regions containing a spatial association between key characteristics of IOCG-type targets in the Eastern Gawler Copper-Gold Belt.**

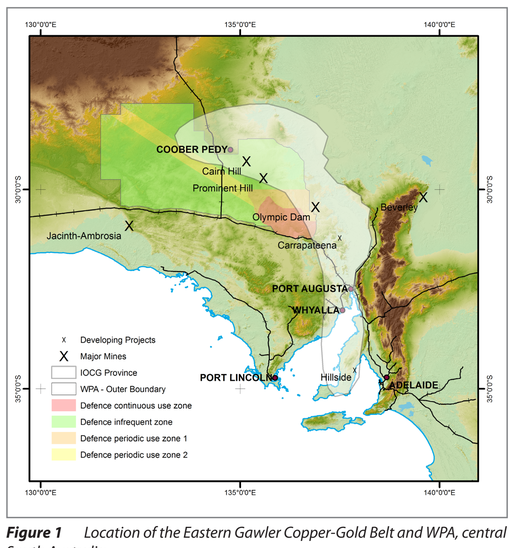


***Figure 1*** *Location of the Eastern Gawler Copper-Gold Belt and WPA, central South Australia.*

## Mineral Systems Modelling

Mineral systems modelling conducted in this study uses key mineral systems components, and proxies used to map these criteria. Mineral systems components adopted for this study are; Sources of Metals and Fluids, Heat Sources, Fluid Conduits, and Potential Trap Sites. Inputs used in the mineral systems modelling of this study are loosely based on a study of the IOCG potential of the Arunta Block (Schofield et al, 2013), however GIS-generated potential field anomalies have been used instead of regional inversions. Compared with regional coarse-scaled inversions, GIS-generated anomalies (as detailed) have the capacity to better resolve potential trap sites for IOCG mineralisation.

The inputs used in modelling are detailed in Figure 4. Geological inputs are generally derived and adapted from the South Australian Solid Geology dataset (Cowley, 2006). As shown in Figure 4, individual proxies are combined (using spatial overlay), into a weighted overlay for each of the primary mineral systems components. For example; *mafic intrusion polygon + felsic intrusion polygon → Heat Sources.*

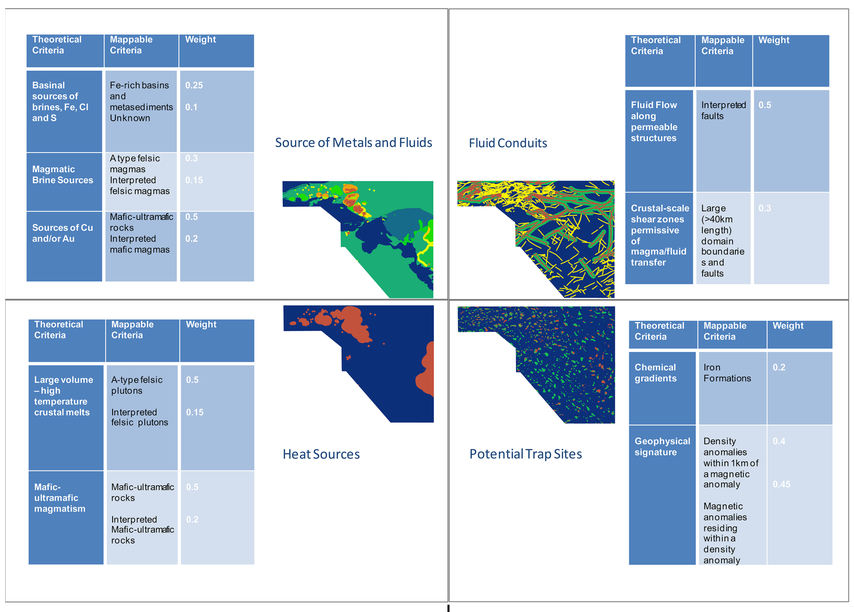


***Figure 4*** *Modelling input criteria according to Mineral Systems components, and assigned weights.*

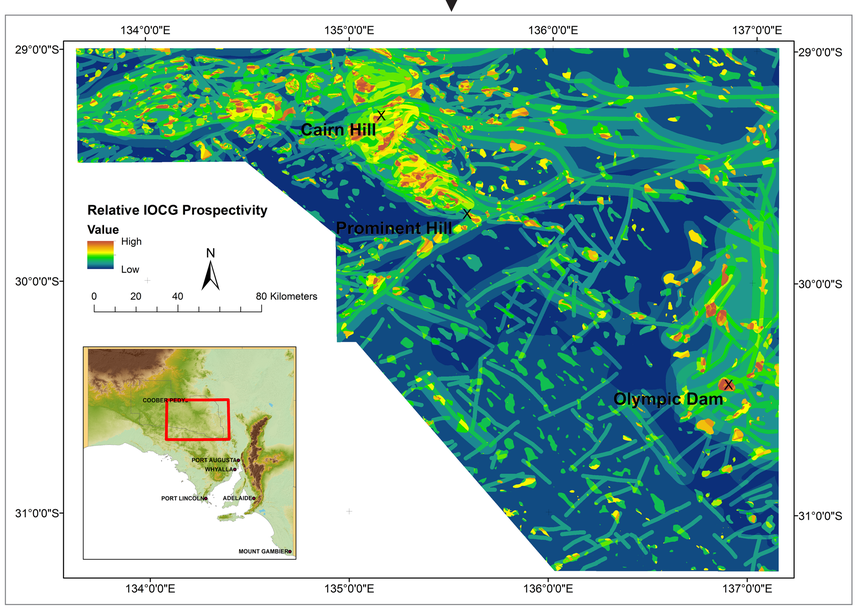


***Figure 5*** *Relative Prospectivity of the Eastern Gawler – WPA region for IOCG deposits.*

## GIS Potential Field Anomalies

A methodology has been created to extract anomalous regions from gravity and magnetic grids for use as inputs into mineral potential modelling (intermediate steps graphically represented in Figure 2 A-F). Such regions are important mappable criteria as they represent locally anomalous density and magnetic susceptibility, and can signify mineral accumulations.

The methodology detailed below is applied to residual TMI-RTP and Gravity grids, using an ArcGIS geoprocessing script;

1. Contours are generated at an interval defined by the analyst (0.1 mGal was used for gravity and 5 nT was used for TMI) (Figure 2 C (TMI-RTP) and D (Gravity))
2. A perimeter distance threshold is set by the analyst. Distances used were 30 km for gravity datasets and a combination of 60 km and 30Km for magnetic datasets (running the script once at 30 km and again at 60 km).
3. The contours selected during step 2 are converted to polygons, before being attributed with the contour value at the perimeter of each anomalous region (Figure 3).
4. Centroids of these polygons are then generated and the grid value underlying each centroid is transferred to the centroid as an attribute.
5. The centroid value is then transferred to its parent polygon using a spatial join.
6. Potential field anomalies are defined by selecting polygons whose centroid value exceeds the perimeter value (Figure 2 E (TMI-RTP) and F (Gravity)). Polygons whose centroid value is lower than the perimeter value are discarded.
7. The remaining anomaly polygons are intersected with the residual grid and "zonal statistics" are calculated as additional polygon attributes, enabling ranking by area/magnitude of each anomaly (Figure 3).

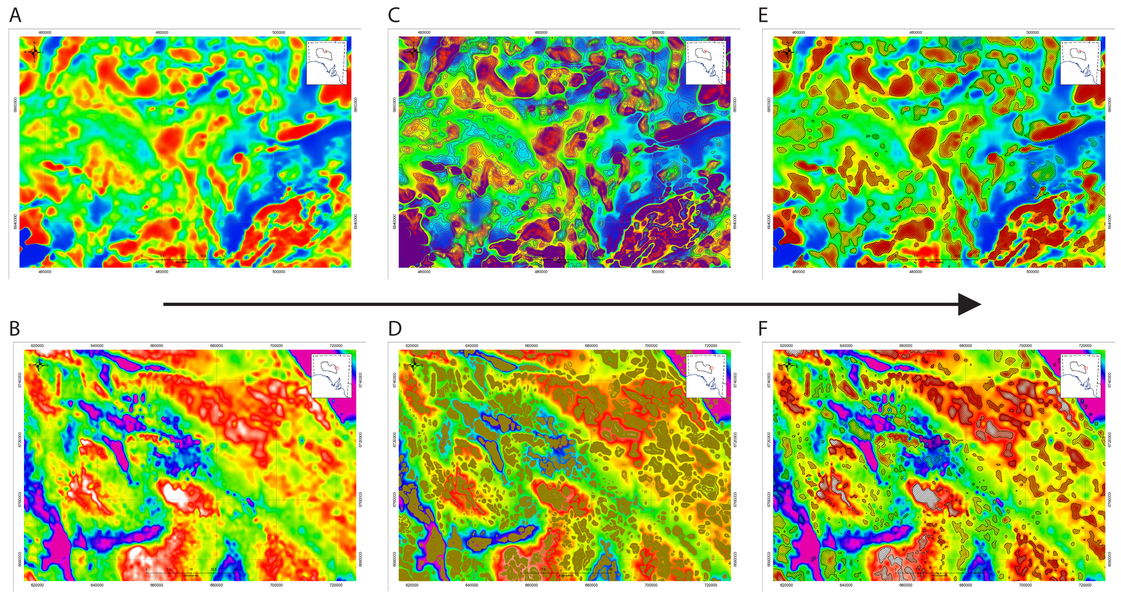


***Figure 2*** ***A.*** *Residual TMI = Reduced to pole TMI minus Reduced to pole TMI upward continued 1000m;* ***B.*** *Residual Gravity = Bouguer Gravity minus Gravity upward continued 1000m;* ***C.*** *Residual TMI-RTP contours up to 60Km in length;* ***D.*** *Residual gravity contours up to 30Km in length;* ***E.*** *Residual TMI-RTP anomalies defined by polygons whose centroid value exceeds the perimeter value;* ***F.*** *Residual gravity anomalies defined by polygons whose centroid value exceeds the perimeter value;*

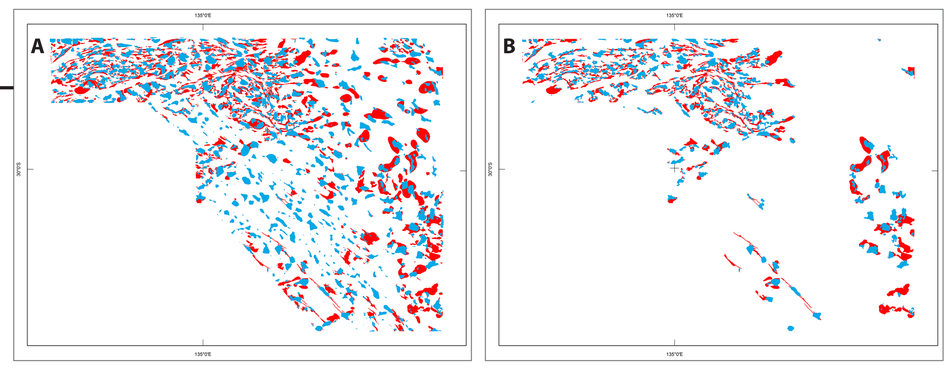


***Figure 3*** *Residual gravity anomalies (Blue) overlain on residual TMI-RTP anomalies (Red)*
***A.*** *All anomalies*
***B.*** *Gravity anomalies > 2 mGal and TMI-RTP anomalies > 300 nT.*

## Conclusions

GIS-based anomaly extraction (using the above method), successfully identifies both "stand-out" geophysical anomalies as well as more subtle features highlighted by residual techniques.

Combining extracted anomalies with geophysical interpretations and drillhole/outcrop geology, using the mineral systems modelling method detailed above, enables a ranking system of the classic density anomaly targeting system.

Successful identification of known mineral deposits and occurrences highlights the merits of this approach (Figure 5), whilst additional, un-tested, targets have been identified (Figure 6).

Regional metamorphic grade of host rocks, alteration mineralogy, rock geochemistry and depth to basement are all considered important facets of regional prospectivity, and are not considered in this initial modelling. Size, shape and magnitude of anomalies on the prospect scale are also important characteristics when targeting. Including such parameters will be the focus of future work.

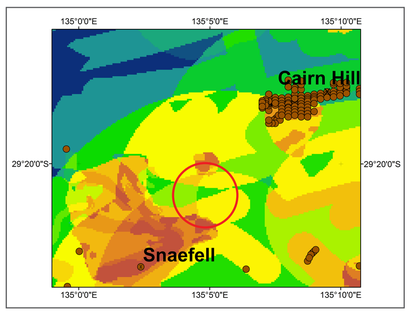


***Figure 6*** *Untested and not drilled Target (circled) to the SW of Cairn Hill. Basement intersecting drillholes are shown in brown.*

## References

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