Cost reduction for exploration through technology – or driving ‘success’

Rob Hough & Discovery Program CSIRO
UNCOVER
GEOSCIENCE
JOBS
WEALTH
PROSPERITY
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Roadmap for Exploration Under Cover: Unlocking Australia’s Hidden Potential

Increasing mineral discovery success
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Investment in low-impact, cost-effective technologies will assist in addressing the urgent need to increase the success rate of discovering new, internationally competitive Australian mineral deposits in increasingly challenging geological, environmental and social conditions.
Capricorn Distal Footprints Project

The Capricorn Research Team

Curtin University

PAWSEY supercomputing centre

Western Australia

Geological Survey of Western Australia

Capricorn Distal Footprints

CSIRO

Science and Industry Endowment Fund
Magnetic source depth, remanence and modelling

CSIRO “sweet spot” method used by GA (Exploring for the Future)
Foss & Austin.
Integrating Magnetic with Geochemical Modelling

GSQ projects

The Ore “pipe” is actually picking up multiple fabrics in different orientations, all along an intersection with a sub-vertical, N-S fault

Ernest Henry
IOCG

Courtesy, Austin et al.
Workflow – scale reduction.....

Deep crustal scale structures

Deep Geophysics
- 3D passive seismic
- 3D MT
- Gravity/mag models
- Basement domains & unit maps

Isotopes (Lu/Hf, Sm/Nd)

Tectonic environment
(Geodynamic drivers/ Basin development/Structural complexity through integrated geological/geophysical mapping)

Area Selection 1

Shallow & high resolution geophysics
(e.g. EM for regolith/cover/geological mapping to inform geochemical program
EM surveys designed to delineate conductors);
High resolution magnetics & gravity Surveys)

Depositional sites

Preservation

Camp scale Area selection

Geological analysis/mapping
Structural analysis

Fertility

Trace elements
(e.g. Trace elements in rutile/titanite; sulfur isotopes from rock chips)

Fertility

Geochemistry
(e.g. Landscape evolution maps, then regolith/hydrogeochemistry possible, trace elements in rutile/titanite from stream sediment samples).

Fertility, geodynamic throttle
Depositional sites
Smart sampling....
Guiding exploration using regolith. Laterite/Calcrete/Lag

Regolith research outcomes from CSIRO used in the discovery of over 20 million ounces of gold or over $24B “Ed Eshuys”
Exploration through cover

Transported cover of 50 m.

Model for exploring the Yamarna Belt

- Au anomaly in ferruginous pisoliths and interface at the Santana Prospect
- Arsenic anomaly in vegetation at the Smokebush Prospect
- Surface Au and As anomaly in authigenic ferruginous pisoliths, gravels and duricrust at the Smokebush and Toppin Hill prospects
- Ferruginous pisoliths in aeolian sands
- Ferruginous gravels
- Ferruginous duricrust
- As
- Mottled and fine-grained sandstones and siltstones
- Kaolinitic and gravelly sandstones and siltstones
- Interface anomaly
- Mineralisation
- Saprolite
- Bedrock

Salama, Anand et al.
Outcrop & Cover

Data supplied by GSQ and vetted with Dr Vladimir Lisitsin
Predictions of Cu (CSIRO / GSQ)
Surface geochemical mapping, 7 days, 310 sites, analysis and infill sampling on-the-fly
Optimised Sampling

- 6 mins per site (+4 mins travel/refuel)
- 280 samples on 4 km spacing 80 x50 km area
- 5 sample types (soil, rock, vegetation)
- IGSN/FAIMS – all integrated in tablets and QR code labels = Data capture and backup (FAIMS) – no more lost or missing sites or matching up photos/bags
How it’s done (~10 mins into 20 seconds)
Meanwhile back at base camp
How it’s done (~5 mins into 20 seconds)
Innovation in the **SAMPLING** approach

- SMART SAMPLING... how many samples are needed and where do you collect them
- In this example we could have done 50% less, big economic savings
- This is a rough example – it could be much better, we should achieve the same with 80% less samples, using the algorithm to guide next sample selection

![Image 1](image1.png)

**50% samples removed at random**

![Image 2](image2.png)

**100% samples**
Hydrogeochemistry of scale

Continental scale can provide major lithological information
Deposit scale can identify anomalies linked to weathering sulfides

Gray and Reid
Qld data to date

**Au (ng/L)**
- > 610
- 127-610
- 69-127
- 47 - 69
- 28 - 47
- 17 - 28
- 10 - 17
- 5 - 10
- 0 - 5

**F (mg/L)**
- > 13
- 6.4-13
- 3.2 - 6.4
- 1.6 - 3.2
- 0.8 - 1.6
- 0.4 - 0.8
- 0.2 - 0.4
- 0.1 - 0.2
- < 0.1
Latest Technologies....
The Drill Core Lab – Whole drill core to microns –
**Maia Mapper™**
A new wave of exploration technologies……
Lab-at-Rig
Multi-client approach to de-risking greenfields exploration
Deep Earth Imaging – digital twins

Knowledge Integration, digital rocks and Scaling
SME Engagement and technology transfer....

INDUSTRY-RESEARCH ENGAGEMENT

20 Participating COMPANIES

2.6 MILLION DOLLARS Invested in Projects

$30k to $250k
Smallest Largest Project

- DORAY MINERALS LIMITED
- GOLDROAD RESOURCES
- MATSA RESOURCES
- MARINDI METALS LTD
- SANDFIRE RESOURCES NL
- excelsior gold LIMITED
- ALKANE RESOURCES LTD
- Alligator Energy
- MUSGRAVE Minerals Ltd
- PepiniNi Minerals Limited
- beadell resources limited
- NEWEXCO GEOLOGY GEOPHYSICS DISCOVERY
- kibaran resources limited
- talga
- armourenergy
- Sipa Resources Limited
- MONTEZUMA MINING COMPANY LTD