SA Mineral System Drilling Program

Collaboration towards mapping mineral systems undercover

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The DISCOVERY challenge...

The covered minerals search space across 80% of South Australia!
Geoscience initiatives in support of improving mineral exploration in Australia
Addressing the discovery challenge...

- Pre-competitive surface geology mapping, geophysics, geochemistry, mineralogy, drilling...

![Maps and data visualizations](data.png)
Addressing the discovery challenge...

- Collaborative drilling...
- Stratigraphic drilling...

- What about using drilling for mapping and retrieving samples from undercover?

- Combine track-record of governments undertaking drilling but also providing geological maps...

2016-17 PACE Discovery Drilling
We need to....

• Better understand and map geology in covered areas
• Map and test mineral systems under cover
• Retrieve samples from under cover for further analysis
• Develop a degree of confidence for geophysics
• Make drilling cheaper / faster
• Ensure that government regulation and data delivery keeps pace with these developments
Further understanding of 1590 Ma mineral systems

- $2.5m + $0.65m + in-kind = $8m
- 14 cored holes, 7868m, ~ 8 months
- Collaborative partners: GSSA with Deep Exploration Technologies CRC, Kingston Resources, Minotaur Exploration, service sector
A 1590 Ma crustal section for South Australia?
TRENDS:

Olympic Domain
Cu-Au-U
(Wallaroo Gp, Hiltaba granites)

Spencer Domain
Cu, Pb, Zn, Ag, Au ± Co, Ni
Archean Granite, schist, Moonabie/Pandurra

Cleave/Coulta Domain
Pb-Zn-Ag, to Ag-Pb Mn, Fe
Hutchison Gp schist dolomite marble.
Sleaford granites

Nuyts Domain
Au-Ag (± Cu, Mo, PGE)
St Peters Suite granites, abundant Hiltaba granite
**Mapping Mineral Systems Undercover**

- Increase the size of the target
- Predict where you are within the mineral system

**Key**

- Hematite
- Magnetite
- Hematite – Magnetite
- Albite
- K-Feldspar
- Sericite
- Sericite – Chlorite
- Chlorite
- Copper Shell

**Emmie Bluff 3D Model**

- Alteration Voxet
- 500 m x 500 m x 10 m cell size

- 2 km
- 10 km

**Emmie Bluff 3D Model**

- Copper Shell (0.8%)
- 500 m x 500 m x 10 m cell size

- 2 km
- 10 km

10x vertical exaggeration
Key questions formapping 1590Ma Mineral Systems in South Australia

1. Prospectivity of the Gawler Range Volcanics (GRV)?
2. Depth of cover? (what is cover here?)
3. What was the nature of mineralizing fluid-flow?
4. What are the characteristics of mineralisation trap sites?
MSDP05 – proof of concept

• Epithermal veining over ~30m within 160m wide alteration zone
1. Prospectivity of the Gawler Range Volcanics?

• Investigator Resources Limited

Volcanic hosted alteration systems (August 2016)
2. Depth of Cover?

Gairdner Dolerite Ave. ~130 ppm Cu

Beda Basalt Ave. ~150 ppm Cu

GRV Basalt Ave. ~50 ppm Cu
2. Depth of Cover?

- Basalt
- Rhyolite
- Adelaidean

Highly reflective mixed felsic and mafic units of the lower GRV

Weakly reflective felsic and mafic units of the lower GRV

Base Adelaidean
Base Roopena Basalt
Base weakly reflective GRV
Base GRV
3. Mineralising Fluid Flow?

- Fluid-flow in NW-trending structure – Peltabinna area
- MSDP drillholes – brittle fracturing
- Alteration intensifies within volcaniclastic units which have clearly facilitated fluid-flow

*Importance of volcaniclastic units as well as structures*
4. Mineralisation trap characteristics?

Mt Double – Minotaur Exploration

- Mineral potential of trap sites – GRV margin, basement carbonates

Imiter, Morocco

Drillholes

Major Controlling Structure (e.g., Uno F. Buried/blind)

Geochemical Anomalies

But outbound of Major controlling structures

Ag, Pb

Modified from Leistel and Qadrouci 1991
4. Mineralisation trap characteristics?

**MSDP11** – magnetite-rich, magnesian skarn

Alteration associated with Hutchison Gr metacarbonate
More Than Just Drilling Holes…

1. Legacy for further geological study
2. DET CRC Technology pull-through for cheaper / faster drilling
3. South Australia Drill Core Reference Library
4. South Australia Resource Information Gateway (SARIG)
DET CRC – cheaper, faster drilling, rapid data collection

Challenge - collecting sufficient data in covered terranes

MSDP – support the pull through of technology

Lab-at-Rig

Wireless Sub

AutoSonde
South Australian Drill Core Reference Library

minerals.statedevelopment.sa.gov.au/geoscience/drill_core_reference_library
South Australian Drill Core Reference Library operations

Nelson Discovery Hall  Woodall Laboratory  Holloway Geoscience Theatre
Now at the South Australia Drill Core Reference Library...
New: South Australian Resources Information Gateway

https://map.sarig.sa.gov.au
Mineral Systems Drilling Program

Want to know more?

- MSDP webpage - video series
- Core now available for inspection!
- Core display - MSDP05, MSDP10, MSDP11, MSDP12

minerals.statedevelopment.sa.gov.au/msdp
Where to from here?

National Drilling Initiative (NDI)

• MSDP set the scene with concept and CT Drilling Rig trials

• The next major step change for Australian pre-competitive geoscience?
MinEx CRC: Research Activities

Area of Research
- Australian National Drilling Initiative (NDI)
- Drilling for Definition of Mineral Deposits
- Optimising Conventional Drilling

Partners
- Geoscience Australia State Surveys
- Industry Partners Research Organisations

CRC Activities
- data compilation for the NDI
- depth of cover and interfaces
- basement mapping with drill rig
- geochemical background
- corridor 3D seismic surveys
- petrophysical vectoring
- auto 3D geology modelling
- turbocoring

- coiled tubing drilling (CTD) for definition of mineral deposits
- trialling CTD in Chile
- composites for CTD
- petrophysical logging for CTD
- real-time downhole assay
- borehole seismic inversion
- drilling automation
- rock properties from drilling data
- reverse circulation (RC) drilling

Significant greenfields CT drilling in NDI pulls through existing technology and provides ideal platform for development of CT for brownfield and drill-out operations
3. Where to from here?

National Drilling Initiative (NDI)

Eastern Gawler (Olympic Domain)

**Task 1:** Drilling and resampling program to identify and map key aspects of the mineral systems under cover

10 x 10 km pattern with depth to basement 1000 m

- 416 holes
- 203,200 m
- $10.2M @ $50/m
- 41,600 km²

337 holes

Source: SARIG

HyLogger Drill holes

Known Mineralisation

Previous Drilling

Nominal Drill Pattern
3. Where to from here?

e.g. Eastern Gawler (Olympic Domain)

National Drilling Initiative (NDI)
- Geological surveys access ‘new hammer’ for mapping under cover
- Step-change in geological survey work required to write the prospectus for exploration under cover
- Leveraged cash from CRC Program to support analysis of NDI and related data
- Experience gained by, and success of, previous collaborative drilling programmes such as SA MSDP
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