Presentation Outline

• Presentation Outline
• Central Gawler Gold Province
• Mineral Systems Review Approach
• Methodology
• Revised Mineral Systems
• Exploration Opportunities
Discover Gold Initiative

• Start of Dedicated Project – Discover Gold
• **Key Messages**
  • CGGP Oversimplification
  • Four Revised Mineral Systems
  • Data highly localised to major deposits
  • Previous surface geochemistry of variable quality
  • New exploration opportunities
Central Gawler Gold Province

- Central Gawler Gold Province
- Height of calcrete exploration frenzy
- Hiltaba Magmatic Event responsible for everything
- Empirical boundary
- Corresponds with current edge of Gawler Range Volcanics (GRV)
- Zone of exposure
Central Gawler Gold Province

- SRTM Image
- Interpreted basement
- Gold occurrences / mines
- GRV blanket
- Dune systems
Central Gawler Gold Province

- Thin zone between rock and soft place
- Yellow = aeolian sediments
- Orange = colluvial sediments
- Green = transported sediments
- Pink/Grey = bedrock
Central Gawler Gold Province

- CGGP originally to explain Au only
- Olympic Region for IOCG
- Hiltaba occurs throughout both
- Au region in fact much wider
- Fundamental lithospheric boundary
  - Mineralisation
  - Lithology
  - Metamorphic grade
  - Heat flow (Reid 2019)
Mineral Systems Review Approach

- Source
- Transport
- Trap
- Overprint

- Standard Mineral System Model (Lewis and Downes 2008)
Mineral Systems Review Approach

- Approximately 100 mines, deposits and occurrences were reviewed.
- Key deposits (Mines) acted as “type” deposits.
- Selected widely at outer limits of data set, to define potential limits.
- Collected what data was available. Highly variable quality.
- Host rocks, sulphide assemblages, element suites, veins styles, alteration, deformation (pre-, syn-, post-).
- Four broad groups of mineral system were defined (may be more).
- Strong overprinting of systems by subsequent events leads to confusion.
Gold Mineral Systems

- Orogenic
- Sediment
- Greenstone
- Banded Iron Formation
- Oxidised Intrusion Related
- Low Sulphidation Epithermal

- Gold Mineral Systems (Robert 2007)
Time Space Plot

- **1590-1575Ma**
  - Hiltaba Mineral System – Intrusion Related

- **1596-1587Ma**
  - GRV Mineral System – LS Epithermal

- **1735-1690Ma**
  - Hutchison Mineral System - Orogenic

- **2465-2410Ma**
  - Archean Mineral System - Orogenic
Archean MS Time Space Plot
Archean Mineral System

- **Energy Source**
  - Sleaford Orogeny
    - (2465 – 2410 Ma)

- **Fluid/Metal Source**
  - Basinal Fluids
  - Magmatic Fluid?

- **Migration Path**
  - Shear zones

- **Deposition**
  - Shear Zones within Greenstone belts
  - BIF associated Fault zones

- **Outflow Zone/Foot Print**
  - Shear Zones?
## Archean Mineral System

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Christie MF</th>
<th>Hilga MF</th>
<th>Harris GB MF</th>
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<tbody>
<tr>
<td>Host</td>
<td>Christie Gneiss – Sediment/felsic</td>
<td>Christie Gneiss – Mafic, UM, BIF, sediment</td>
<td>HGB mafic, ultramafic</td>
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<td>Sulphides</td>
<td>Pyrite, Pyrrhotite, Arsenopyrite</td>
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<td>Elements</td>
<td>Au, As, Bi, (Ag, Co, Ni, Cu, Te)</td>
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<td>Veins</td>
<td>Quartz-pyrite</td>
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<td>Quartz-calcite-pyrite</td>
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<td>Alteration</td>
<td>Biotite?</td>
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<td>Carbonate, Biotite, Talc, Chlorite</td>
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<td>Style</td>
<td>Orogenic Sediment</td>
<td>Orogenic Greenstone/BIF</td>
<td>Orogenic Greenstone/BIF + OIR – epithermal LS alkalic</td>
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<td>Post Deposition Modification</td>
<td>Regional granulite facies metamorphism</td>
<td>Generally greenschist facies metamorphism, some granulite.</td>
<td>Generally greenschist facies metamorphism, deformation along regional shear zones</td>
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Hutchison MS Time Space Plot
Hutchison Mineral System

- **Energy Source**
  - Kimban Orogeny (1735 – 1690Ma)

- **Fluid/Metal Source**
  - Basinal Fluids
  - Magmatic Fluid?

- **Migration Path**
  - Shear zones, Fault zones

- **Deposition**
  - Carbonates
  - BIF associated Fault zones

- **Outflow Zone/Foot Print**
  - Shear Zones?
Hutchison Mineral System

- Iron ore drilling program
- Mainly drilling magnetic highs
- Low magnetic zone, alteration?
- 4m @ 4.575 g/t Au
## GRV Mineral System Time Space Plot

### Gawler Craton Au Mineral Systems

<table>
<thead>
<tr>
<th>AGE (Ma)</th>
<th>Christie Region</th>
<th>Wigena and Hans Greenstone Regions</th>
<th>Mount Woods Region</th>
<th>Nuyts Region</th>
<th>Gawler Range Volcanic Region</th>
<th>Clevel and Coota Regions</th>
<th>Spencer Region</th>
<th>Olympic Region</th>
<th>TECTONIC EVENT</th>
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**Notes:**
- Foliate intrusive
- Mafic intrusive
- Foliate volcanic
- Mafic volcanic
- Sandstone
- Dolomite
- Iron formation
- Mafic dyke or sill
- IOCG
- Orogenic
- Intrusion Related Au
- Epithermal Au

**Events:**
- Gawler Diorite c. 925 Ma
- Karoonda-Otway Orogeny
- Hindmarsh Event 1510-1375 Ma
- Greenschist to granulite facies
GRV Epithermal Mineral System

- **Energy Source**
  - Hiltaba Magmatism (1596 – 1587 Ma)

- **Fluid/Metal Source**
  - Basinal Brines
  - (Magmatic Fluid?)

- **Migration Path**
  - NW fault zones
  - NE fault zones
  - Basal contact of GRV

- **Deposition**
  - Archean Granites
  - Palaeoproterozoic Sedimentary Basins
  - Palaeoproterozoic Granites

- **Outflow Zone/Foot Print**
  - U/C Contact Zones
  - Upper GRV
GRV Epithermal Mineral System

- GRV blanket
- Hydrothermal circulation
- Metal/sulphur scavenging
- Rapid release along fracture zones
- Possible fluid mixing
Hiltaba IR System Time Space Plot
Hiltaba Intrusive Related Mineral System

- **Energy Source**
  - Hiltaba Magmatism (1590 – 1575 Ma)
- **Fluid/Metal Source**
  - Magmatic Fluid
  - (Basinal Brines?)
- **Migration Path**
  - Pluton Trail?
  - Volcanic centers
  - Major Structures
- **Deposition**
  - Pluton margins to surface volcanism
- **Outflow Zone/Foot Print**
  - Regional Scale Alteration Zones
Gawler Craton S Isotope Study

- Barnes/Paris magmatic source
- Tarcoola/Telephone dam sediment source
- Weednanna potentially Archean (MIF) sediment contribution

Morrissy et al 2018
Exploration Opportunities

- Continuation of defined Mineral Fields under cover
- Historic Geochem needs review
- Further study into system characterization (Isotopes)
- Alteration of Iron Formations (Archean & Palaeoproterozoic)
- Central-Western Gawler – “the Great Unknown”
Conclusions

• Start of Dedicated Project – Discover Gold

• Key Messages
  • CGGP Oversimplification
  • Four Revised Mineral Systems
  • Data highly localised to major deposits
  • Previous surface geochemistry of variable quality
  • New exploration opportunities
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