Mineral systems modelling of sediment-hosted Zn-Pb and Cu-Co mineralisation within the Mount Isa Inlier, Queensland

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Summary

• Long history of mineral systems modelling of Zn-Pb and Cu-Co mineralisation – relatively well understood
• Primarily aids camp-scale targeting, and must be complemented by deposit and footprint insights
• Large opportunity to extract additional value from existing studies and data to create value for explorers
• Current SREP NW Mineral Province Discovery Program has this value creation as its central aim
Selected world class Sediment-hosted BM deposits
Tonnes and Grade
Recent history – discoveries and studies

DNRME NW Mineral Province Discovery Program
NW Mineral Province – value from existing and new data

GIS Compilation of previous studies
4D structural-lithological-strat models
Geochemistry undercover
Footprint compilation/study
Existing deposits – Atlas/drillcore
Prospectivity modeling
Geomechanical modeling
Mineral System Component I: metal and fluid sources

Mineral System Component II: triggers and drivers

Both well-addressed by Previous Speakers…
(clearly in place for the NW Mineral Province)
Mineral System Component III: Architecture and fluid pathways
Regional Structure

• Relatively well-studied and understood
Zn-Pb-Ag targeting criteria

- Zn-Pb-Ag - Important features in magnetics
  - Identify basin-stage and pre-existing basement structures
  - Major intersection zones focus formation of thick, carbonaceous basins and subsequent fluid flow
  - Must use a combination of geology and magnetics to be effective
Favourable Hosts

- Gun, Loretta and River supersequences

(Huston, 2018)

(GSQ Geology 2017)
Camp-scale target zones

- Intersections of basin-stage faults
- Favourable stratigraphy
- Followup
  - Dense, conductive pyrite haloes
  - Halo geochemistry

(Targets – NWQMP 2001)
Regional Setting – Isa Cu (Co)
Cu (Co) occurrences

- Strong structural control
- Close to mafic volcanics
Cu-Co target zones

- Strong structural control
- Close to mafic volcanics
- Carbonaceous host
- High strain zone during E-W shortening event

(Targets – NWQMP 2001)
Mineral System Component IV: Depositional mechanisms
Cu – Pb – Zn zoning

- Current Cu and Pb-Zn consistent with a single zoned system

cf Walford Creek (less studied)
Aeon Metals (2017)
www.aeonmetals.com.au
(Dan Johnson)
Basement Alteration

Magnetite-destructive alteration in basement

Modelled Magnetic Susceptibility
Isa System Halo Zoning

$\delta^{18}O$

Pyrite

Manganese

Thallium

(Waring, 1991)

(Painter, 2003)
Depositional mechanism

• Structural control
  – Syn to pre-basin fault geometries, focusing sub-basin development and fluid flow

• Depositional control
  – Redox control of carbonaceous lithologies, with permeability enhanced within rheologically heterogeneous rhythmites
Toolkit – camp selection

- Solid geology
- 4D tectono-stratigraphic models from geology and geophysics
- Targets based on prediction of sites of sub-basin formation and fluid focusing
- Innovative predictive models – data analysis/geomechanical

(Mustard et al - pmd*CRC I2)

(GMEX 2017)

(NWQMEP 2010)
Toolkit – camp exploration

- Deposit atlas and core library – halo recognition
- Electrical geophysics (eg MT for mapping of pyritic halo)
- Geochemical toolkit – targets under cover
- Lithogeochemical and mineralogical halo analysis
- Geomechanical modelling
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