Cave Management at Carrapateena

Glen Balog

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Forward Looking Statements

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One of Australia’s largest undeveloped copper deposits; regional South Australia.

Iron oxide copper-gold deposit located about 500 m below the surface.

Underground Sub Level cave mine, initial 20 year mine life.

Infrastructure onsite includes a processing plant, tailings storage facility, airstrip and village.

Block cave potential in pre-feasibility study.
Carrapateena Sub Level Cave
Cave Management

/ Caveability confidence improved.
  – from initial stall risk, to steady cave growth expected (without preconditioning needed).

/ Early cave management.
  – Stuart Shelf cover sequence – fines generation and water sources to manage.
Caveability confidence
Understanding the Cover Sequence & Caveability
Caveability confidence
Understanding the Cover Sequence & Caveability

*Initial Feasibility Study Update (FSU) description*
Caveability confidence
Understanding the Cover Sequence & Caveability

Current description

Upper Whyalla.  
3 Domains; Upper Whyalla top shale, Upper Whyalla core, Upper Whyalla base shale  
Ave. 145MPA  
Ave. GSI 52

Dolomite.  
2 Domains; Lower & Upper Dolomite  
Ave. 75MPA  
Ave. GSI 42

Lower Whyalla  
Ave. 35MPA  
Ave. GSI 75
Caveability confidence improved

Understanding the Cover Sequence & Caveability

/ Updates to rock mass data from development mining and re-interpretation of core.

/ Total orebody knowledge continues to improve from original FSU data, feeding into updated cave growth modelling.
Early cave management
Stuart Shelf cover sequence

/ Woomera Shale:
  – GSI 30
  – UCS 50MPa
  – UTS 7.5MPa
  – High clay fraction to fine grained silts

/ Lower Whyalla Sandstone
  – GSI 66
  – UCS 34MPa
  – UTS 2.5MPa
  – Small size aeolian sands
Early cave management

Groundwater

Tent Hill Aquifer: potentially 32 L/s

Whyalla Sandstone Aquifer: ~6 L/s
Early cave management

Risk conditions

/ Mud rush conditions:
   – fine material
   – water
   – trigger

/ Carrapateena:
   – Mud forming material (clays or fine fragmentation)
     Woomera Shale; Micas
     Lower Whyalla Sandstone; fines
   – Water (rainfall or ground water)
     Tent Hill Aquifer
     Lower Whyalla Aquifer
   – Triggering mechanism (uneven draw or seismic event)
Cave markers to support cave management

Planned instrumentation

/ Elexon smart markers.
/ Elexon cave tracker markers and beacons.
/ Metso ore tracker markers.
/ Grade and Mineral markers.
Data collection during production:

/ Marker data
/ Mineralogical makeup
/ Fragmentation
/ Water balance
/ Track water through cave
/ Pumping data, rainfall data correlation
/ Cave geometry and subsidence zone

Further work
Further work

- Ongoing slump testing regime to determine susceptibility factors.
- Mixture of lower Whyalla sandstone and Shales result in highest slump.
- To test an array of mixtures (i.e. in combination with ore).

- Probabilistic assessment required to determine susceptibility and develop effective site specific Trigger Action Response Plans (TARPs) to manage risks.
Cave management next steps
From FSU to Operational Readiness

/ Caveability confidence
  – Seismic tomography array.
  – Intensive mapping of first two levels.
  – Purchase of Acoustic Tele-Viewer (ATV) and trained staff. Re-evaluate existing open holes.

/ Early cave management
  – Risk assessment and identification of operational risks to manage.
  – Seismic system installed early (including an active source system).
  – Significant program underway for smart markers, beacons, and metso tags.
Thank you