Advances in Geological Understanding Driving Exploration in the Girilambone District

Mines & Wines Conference

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September 2019

ASX: AIS

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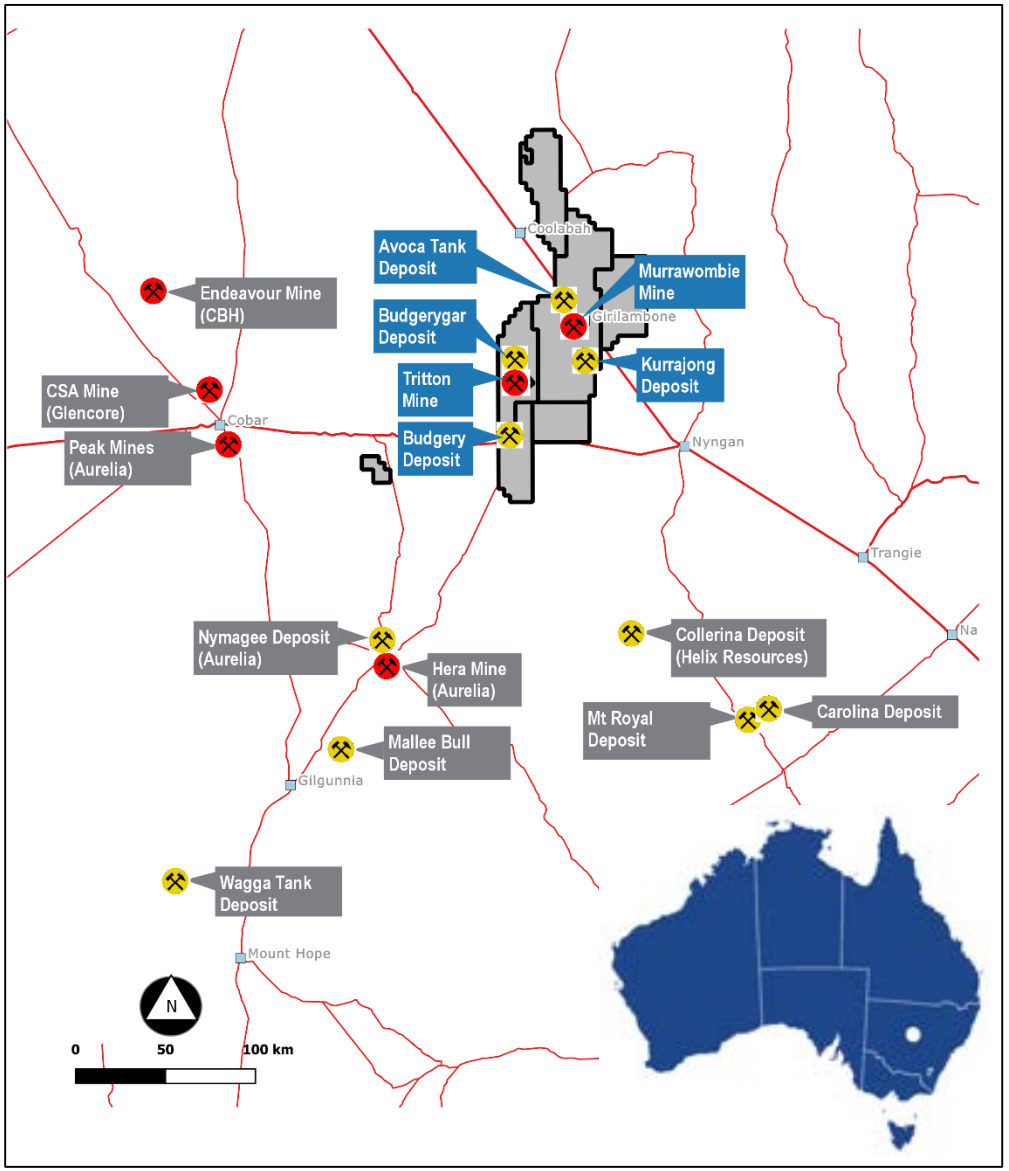
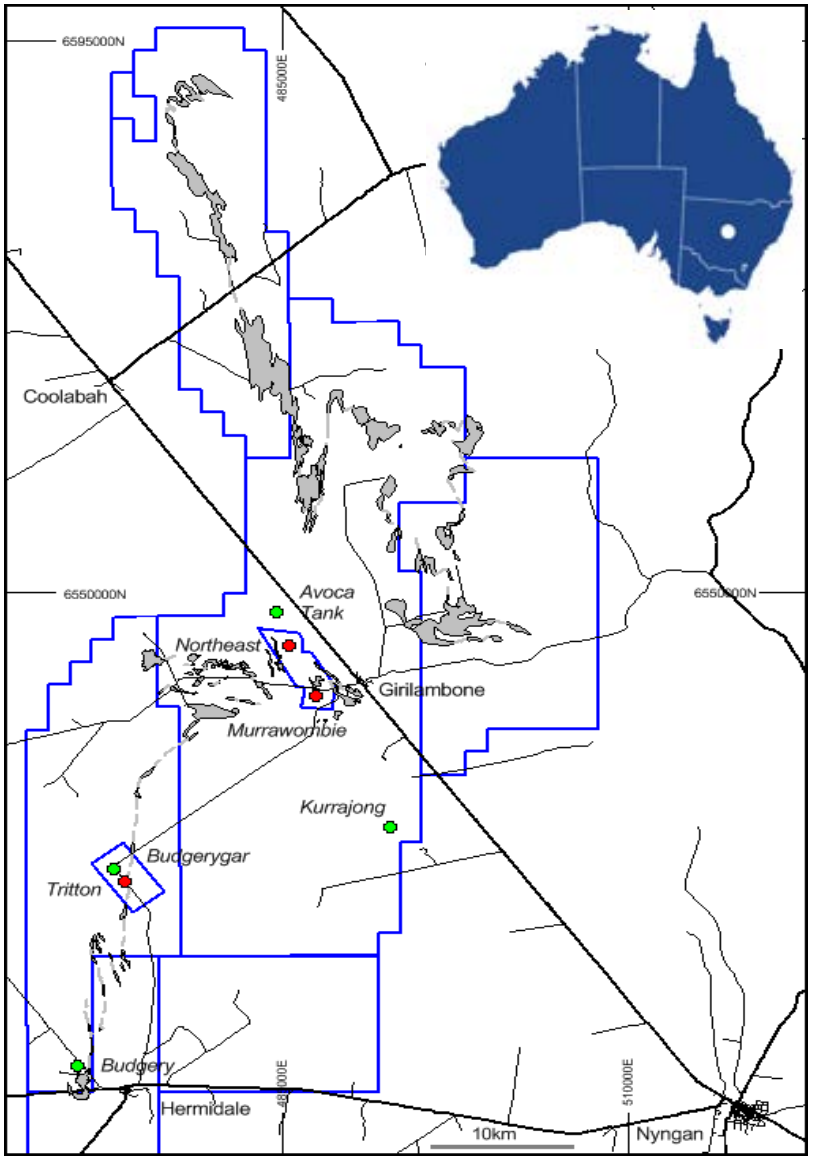
Introduction

- Background
- Structure and Mineralisation
- Age dating
- Murrawombie - Avoca Tank
- District Exploration
- Summary
- Acknowledgements



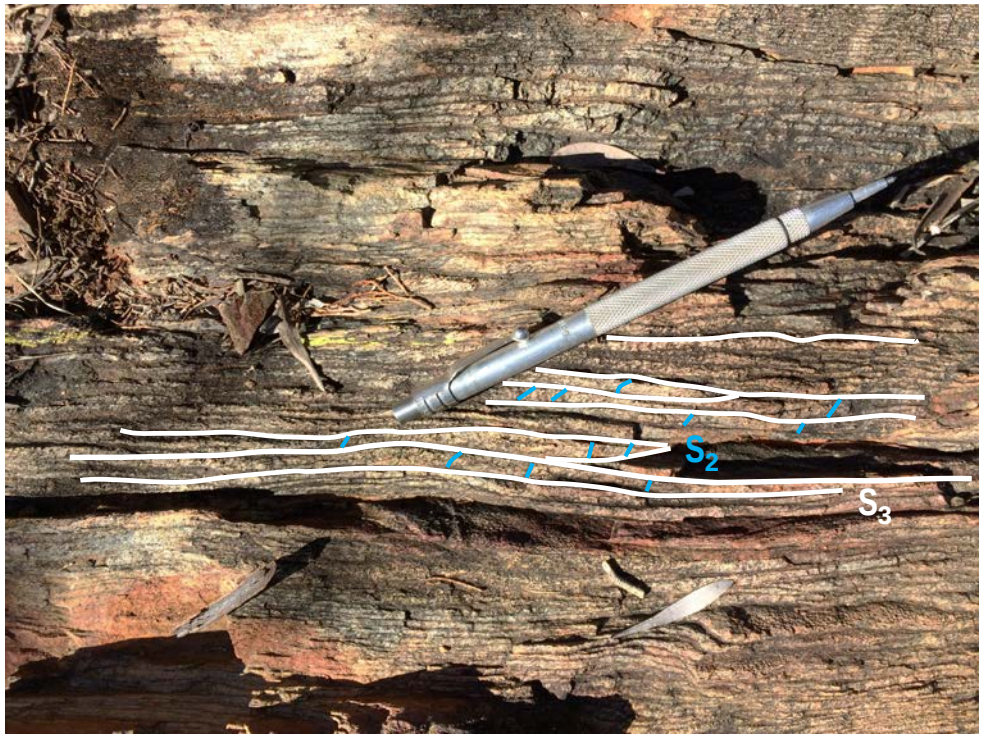
Background

- Aeris operates Tritton and Murrawombie underground mines
- Combined production of approx. 1.7Mtpa @ 1.7% Cu for 27ktpa of copper in concentrate
- 2,076 km^2 tenement package
- ~750kt of copper discovered to date (incl. current Mineral Resources) in lower half of tenement package
- Ordovician Girilambone Group turbidites:
  - Psammite-pelite-mafics
  - Lower Greenschist facies metamorphism and several phases of deformation
  - Marker horizon – Budgery Sandstone
- Mineralisation
  - Orebodies are flattened, pipe-like, strike 50-300m, width 5-80m, long plunge component 100's to a few 1000's metres
  - Pyrite-chalcopyrite-pyrrhotite, minor sphalerite-galena, trace gold
  - Massive, banded (veins), stringer, including chalcopyrite-rich, and disseminated sulphides
  - Spatially associated with mafics and stratigraphically below Budgery Sandstone - favourable horizon

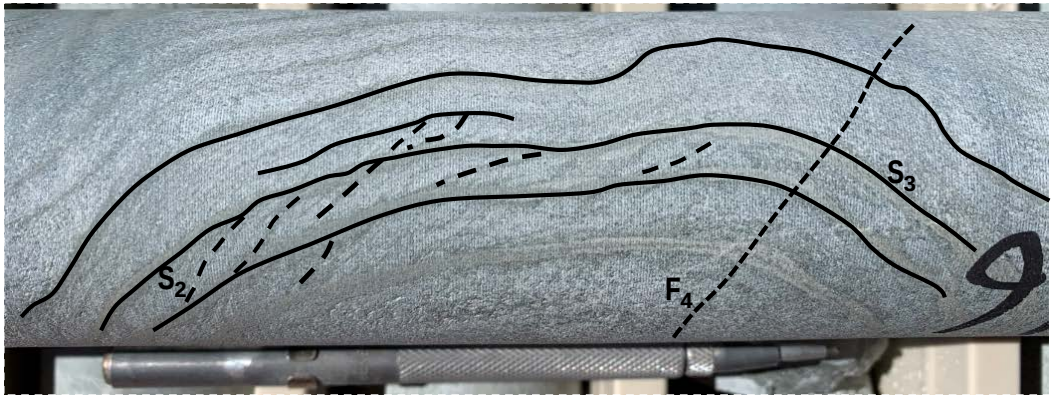


Structure

- Early ductile (D_1 and D_2)
  - Tight-isoclinal folding, bedding plane shear
  - Penetrative cleavage (S_2), differential layering
  - Lower Greenschist facies metamorphism
  - Difficult to differentiate S_0, S_1 and S_2
- Later ductile-brittle D_3
  - Open to tight folds
  - Spaced crenulation to penetrative cleavage
  - Retrograde metamorphism
- Later ductile-brittle D_4
  - Open folds
  - Weak crenulation, some cleavage development
- Host rock competency differences partitions strain between the mafics and massive sandstone bodies into the interbedded lithologies focussing shearing for D_2 and later D_3



Murrawombie: Budgery Sandstone outcrop

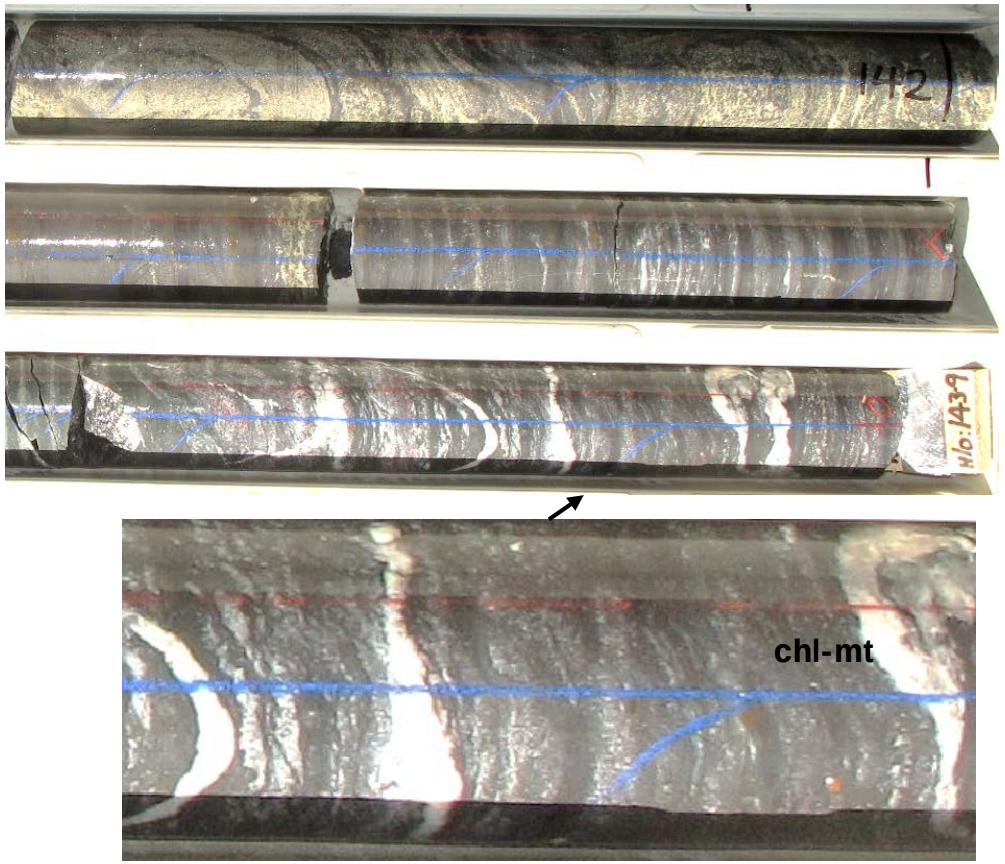


Tritton: TRGC1036, 116.3m, down hole to left

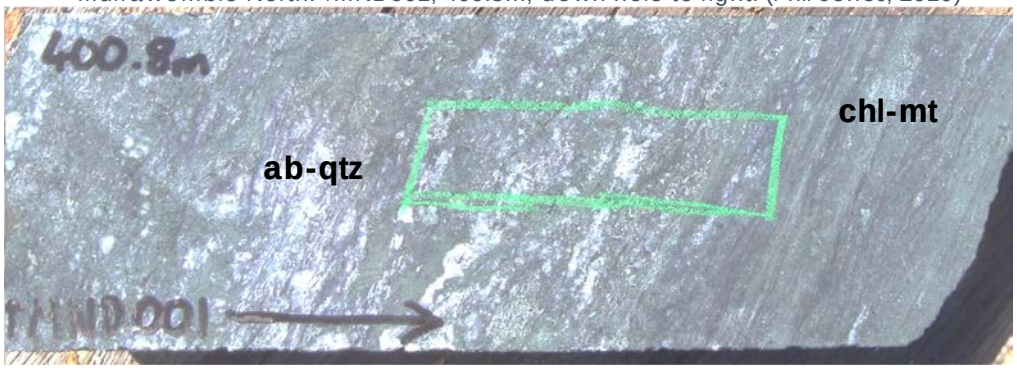
Mineralisation

- Mineralisation phases – early magnetite
  - Mafics weakly to variably magnetic - sparse primary magnetite
  - Magnetite mostly secondary
    - From metamorphism, hydrothermal alteration
    - Disseminated secondary magnetite (along S_2 and S_3 cleavage)
    - Narrow massive chlorite-magnetite zones/veins interpreted as shear zones (reactivated D_2 structures or early D_3)
  - Some pyrite and minor chalcopyrite accompanies magnetite

Avoca Tank: TATD003, 142m, down hole to right



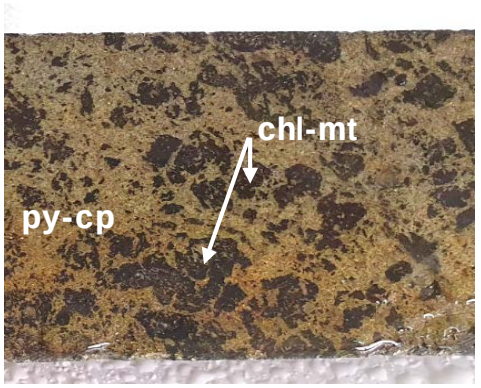
Murrawombie North: TMND001, 400.8m, down hole to right. (Phil Jones, 2010)

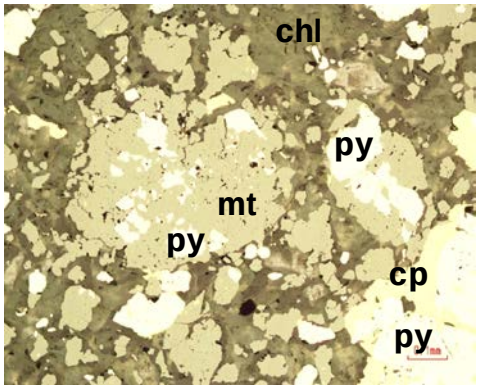


Mineralisation (2)

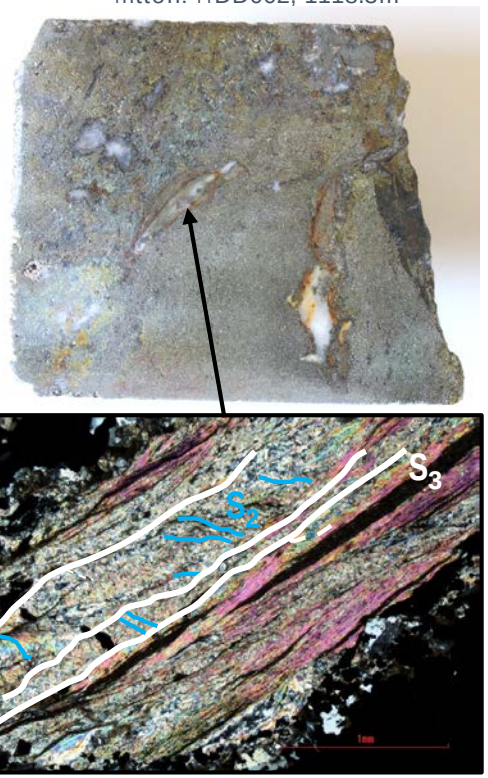
- Mineralisation phases – later sulphides
  - Early D_3 quartz-pyrite veins (+/- minor chalcopyrite) with qtz-sericite selvages parallel to reactivated S_2 and along S_3
  - Massive sulphide replacement of sediments and magnetite zones late D_3 to syn-D_4, +/- chalcopyrite
  - Chalcopyrite mineralisation overprint with pyrrhotite, sphalerite, galena, syn-late D_4
  - Probably more complex

Avoca Tank: TATD017 425.8m (Cherry, 2019) (Photomicrograph Simpson, 2019)



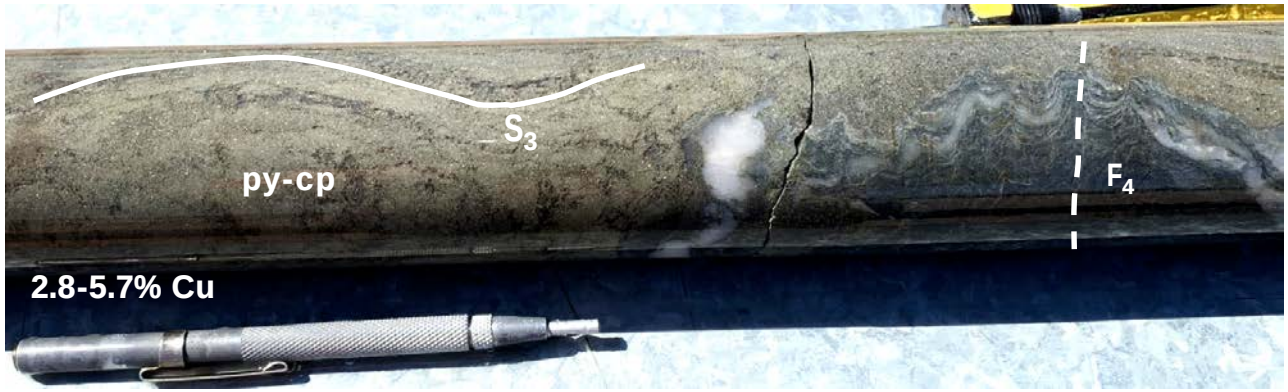


Tritton: TTDD002, 1118.3m



Photomicrograph courtesy of Simpson (2017)

Tritton: TRGC1037, 291.0m, down hole to left.



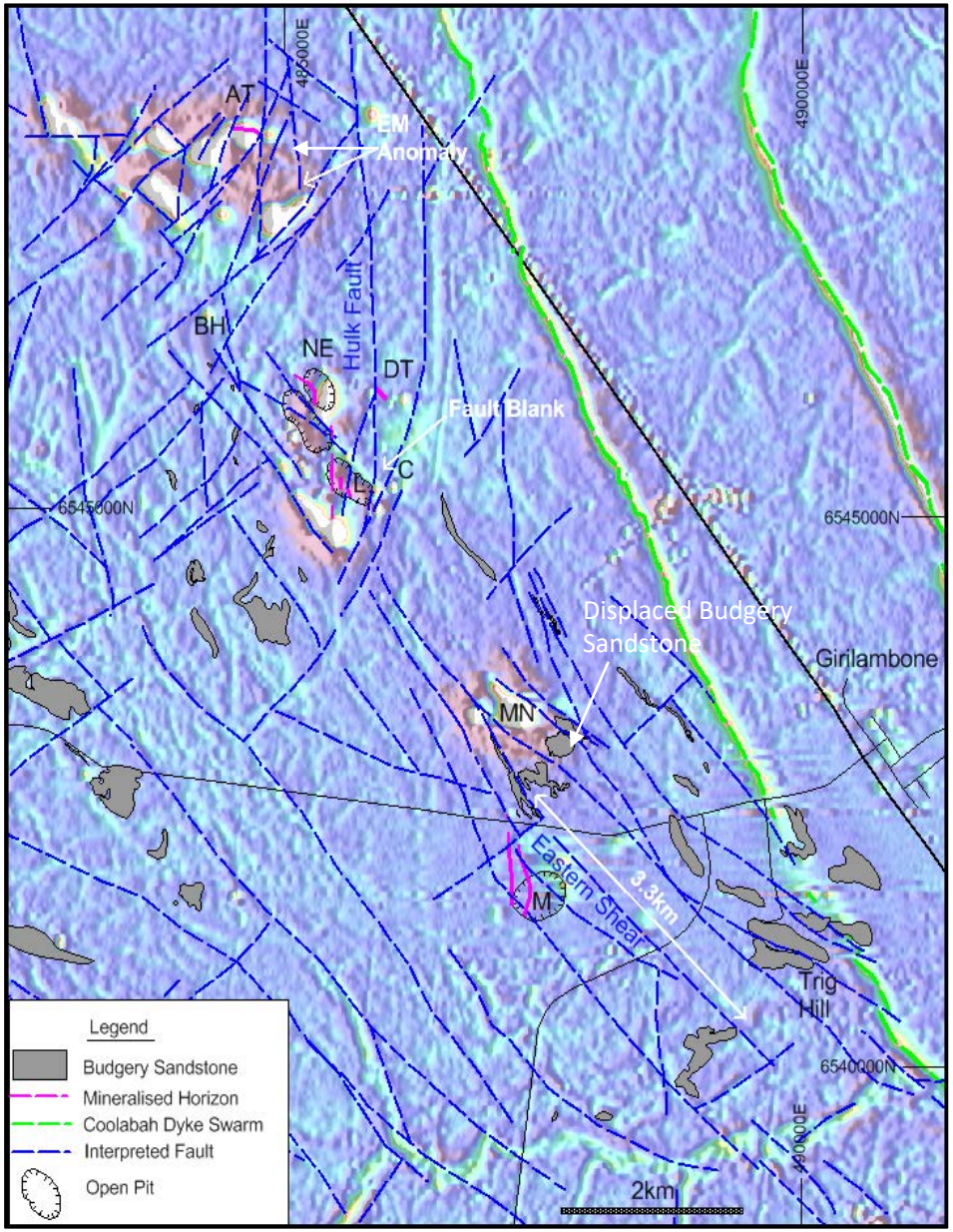
Age Dating

- Tritton mineralisation
  - Pb isotope dates at 490-470 Ma (Huston et al, 2013)
  - Pb isotope dates at 480-460 Ma (Downes, 2008), few dates at ca 390-380 Ma
- S_2 white mica $^{40}Ar/^{39}Ar$ 434.3 +/- 3.5 Ma (Fergusson et al 2005)
  - Youngest age for the early deformation phase (D_{1-2})
  - Timing = Benambran Orogeny
- Secondary magnetite-rich shears pre-date sulphide mineralisation and post-date but also utilise the S_2 foliation at Avoca Tank
  - U-Pb dates of titanite associated with magnetite at ca 430 Ma (Fitzherbert, 2019)

Murrawombie – Avoca Tank

- Thoughts on magnetite and Budgery Sandstone led us to revisit Murrawombie-Avoca Tank area
- Displaced block of Budgery Sandstone noted
  - ~3.3km apparent NW displacement east of Eastern Shear
  - Is Larsen's a continuation of Murrawombie mineralised horizon?
  - Is Avoca Tank Complex a continuation of Northeast mineralised horizon, similarly displaced?
  - Identified opportunities – poorly tested areas, including magnetic anomalies
- HP MLTEM (slingram) survey designed
  - EM anomalies defined near Avoca Tank
- Focus turned to Avoca Magnetic Complex

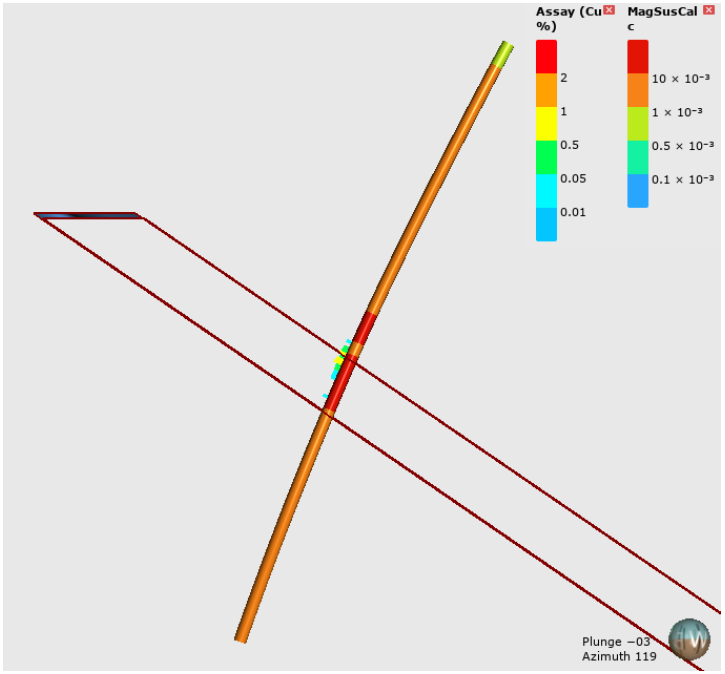
(M = Murrawombie, MN = Murrawombie North, L = Larsen's, C = Caribou, DT = Double Tanks, NE = Northeast, BH = Ben Hur, AT = Avoca Tank)



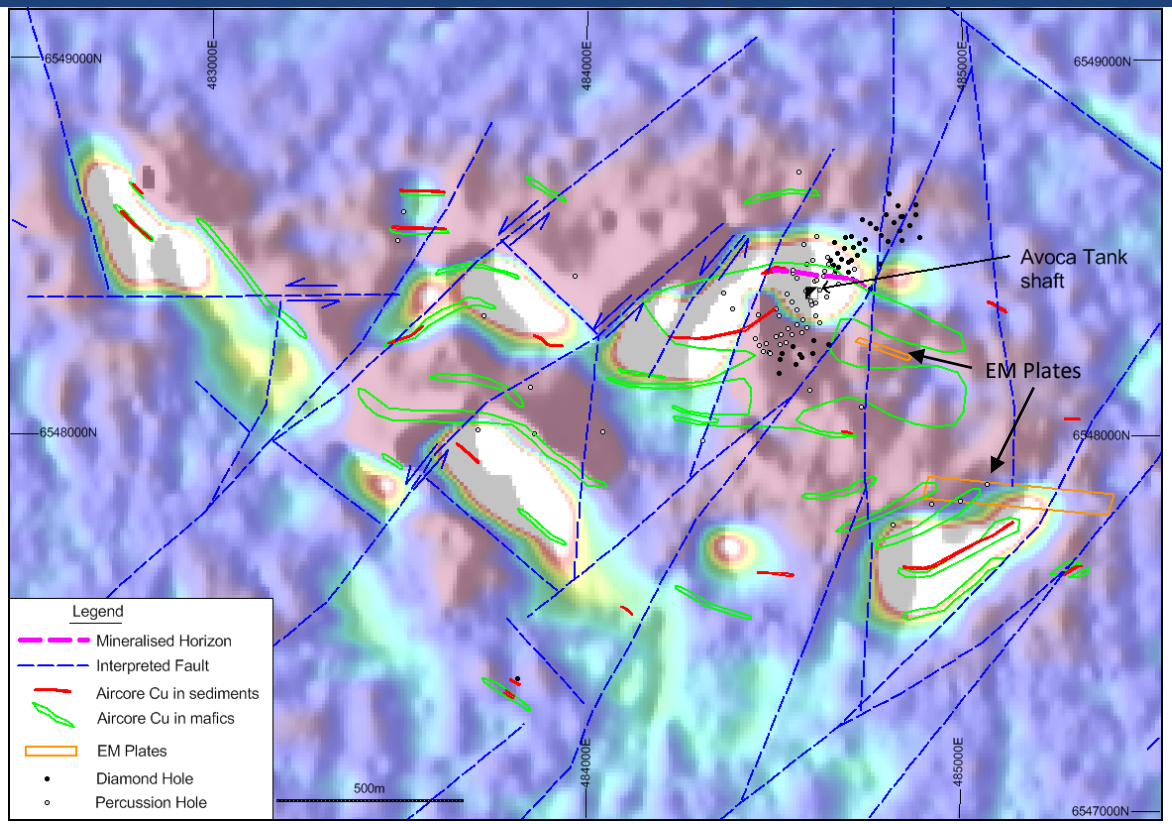
Background RTP1VD magnetics

Avoca Magnetic Complex

- Avoca Tank – Indicated and Inferred Mineral Resources of 0.9Mt @ 2.6% Cu, 0.77g/t Au
- Magnetic anomalism previously attributed to mafics - testing limited to geochemical anomalism adjacent to magnetic anomalies - unsuccessful
- Structural interpretation shows magnetic anomalies may be related



Courtesy of A. Cherry, 2019

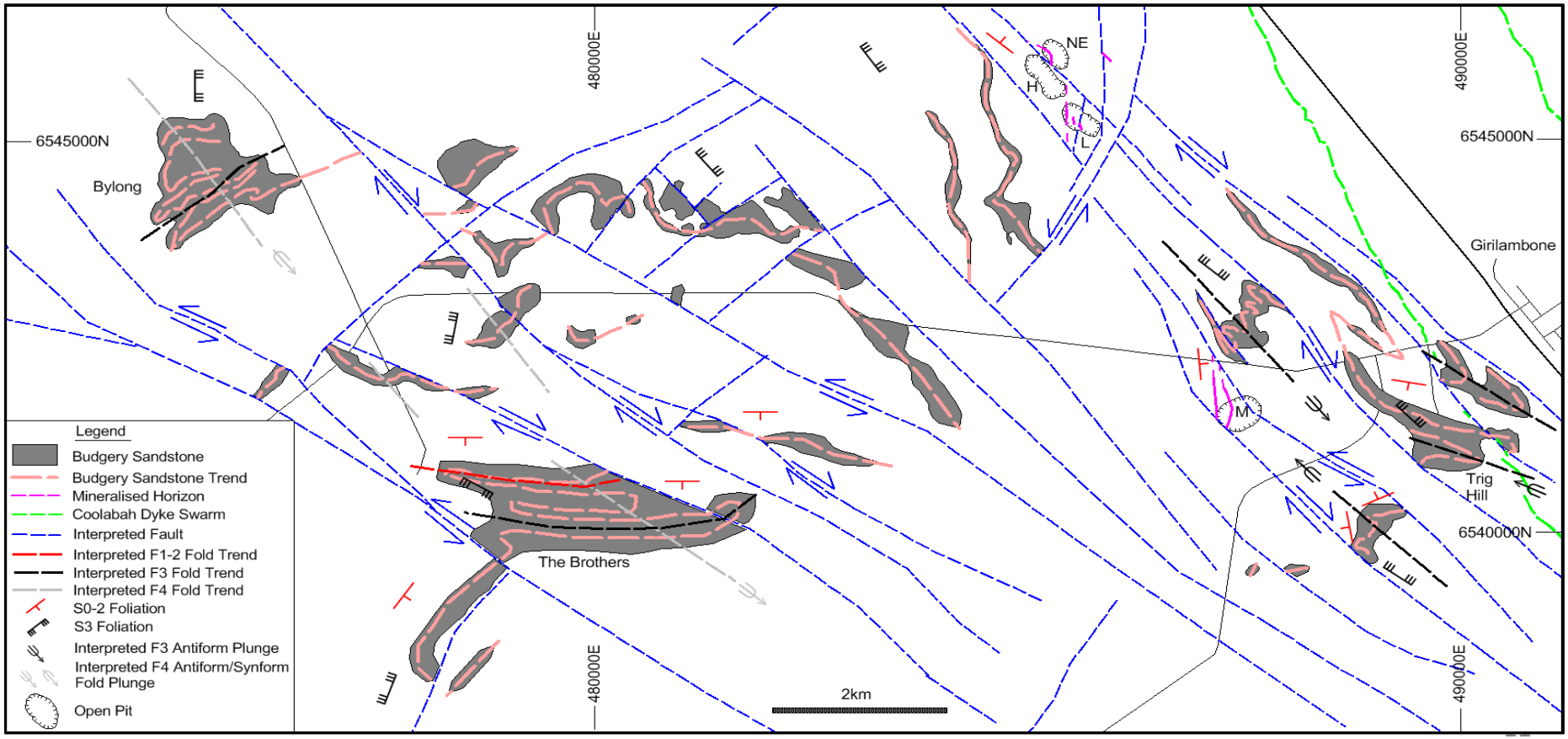


Background RTP1VD magnetics

- Most magnetite is secondary and associated with the sulphide mineralisation
- 3D modelling on Avoca Tank aeromagnetics confirms magnetic anomalies reflect the magnetite mineralisation
- 2D magnetic modelling with geochemistry underway to define drill targets

District Interpretation - Rockdale

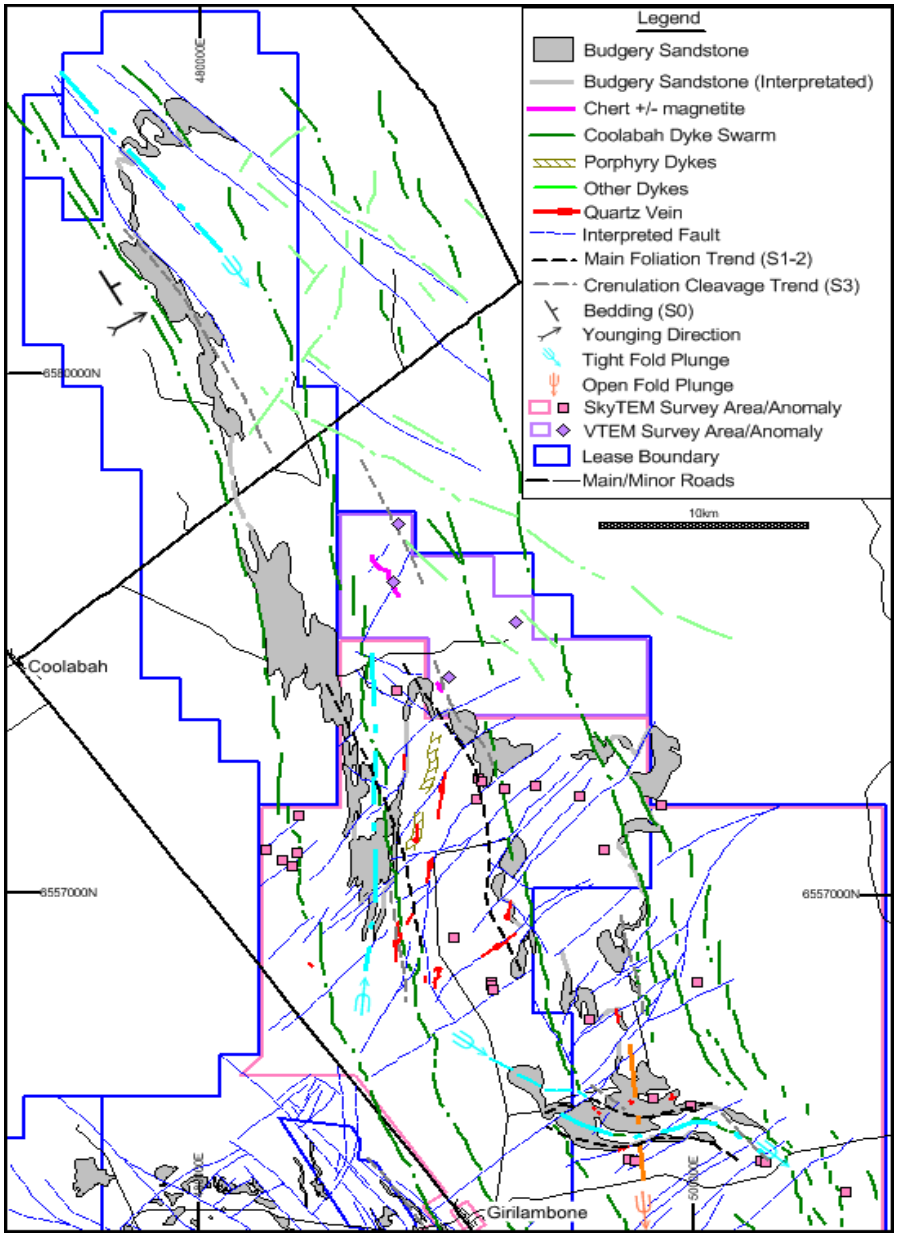
- Recent structural understanding at Murrawombie applied to Rockdale area
  - Magnetic interpretation identified structures and possible large displacements of Budgery Sandstone
  - Opens up potentially new mineralised horizons for exploration



(M = Murrawombie, L = Larsen's, H = Hartman's, NE = Northeast)

District Interpretation – Girilambone-Exley

- Mapping by Boucher (2017) built on earlier mapping by Crossing (2010), NSW Govt., Utah, Seltrust & Nord
- Interpretation using existing and new magnetic data from recent VTEM/SkyTEM airborne surveys
- Structure not fully understood at this stage:
  - Early tight upright folds – repetition of beds
  - Bedding parallel foliation (S_{1-2} and S_3 crenulation)
  - Late open fold warps S_{1-2} and S_3, best seen in south
  - Further structural mapping required
- New AEM anomalies identified
  - Some located in favourable structural/stratigraphic positions
  - Modelled for ground EM follow up



Summary

- Structure
  - Early ductile deformation (D_1 and D_2)
  - later ductile-brittle (D_3 and D_4) associated with mineralisation
  - Host rock competency contrast localises structures associated with mineralisation
  - Budgery Sandstone – crude stratigraphic marker horizon
  - Significant late shearing and faulting
- Magnetite
  - Most magnetite is secondary
  - An early oxidizing fluid precursor to sulphide mineralisation
- Sulphides
  - Post-magnetite
  - Early D_3 sulphide-qtz veining, replacement massive sulphides late D_3
  - Most copper mineralisation late D_3 to D_4
- Exploration Model
  - "Mineralised horizon" in footwall of Budgery Sandstone adjacent to mafics
  - Other favourable structural positions to consider
  - Secondary magnetite pre-dates sulphide mineralisation and causes magnetic anomalies
  - D_3 and D_4 deformation timing of sulphide mineralisation
- Exploration Approach
  - Airborne EM followed by ground follow up MLTEM
  - DHEM follow up the key for smaller deposits
  - Modelling of magnetic anomalies
  - Understanding structure – geological mapping
  - Geochemical anomalism

Acknowledgements

- Aeris Resources Ltd
- Numerous geologists and geophysicists who have worked in the area
- Current exploration team – Brad Cox, Chris Raymond, Jessica Hyland, Dr. Alex Cherry, Matt Green
- Mine Geology team
- Dr. Travis Murphy (CSA Global Consultants)
- Russell Mortimer (Southern Geoscience Consultants)
- Dr. Carol Simpson (petrological services)
- John Crossing – Compass Geological
- Dr. Rod Boucher – Linex Pty Ltd
- Steve Collins (Arctan Services Pty Ltd)
- John Donohue (GeoDiscovery Group)
- SRK Consulting
- NSW Geological Survey
- Highpower EM Geophysical Services
- UTS Geophysics Pty Ltd
- Skytem Australia Pty Ltd

Questions?