Latest MinEx CRC results in Cobar and their application to exploration

4 May 2021

Acknowledgements

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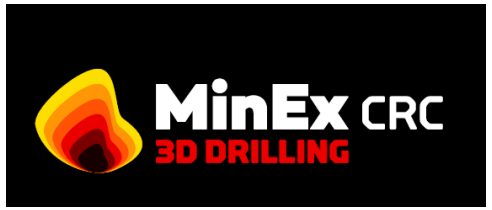
- This presentation includes work with these MinEx CRC sponsors:

- Kenex Pty Ltd.



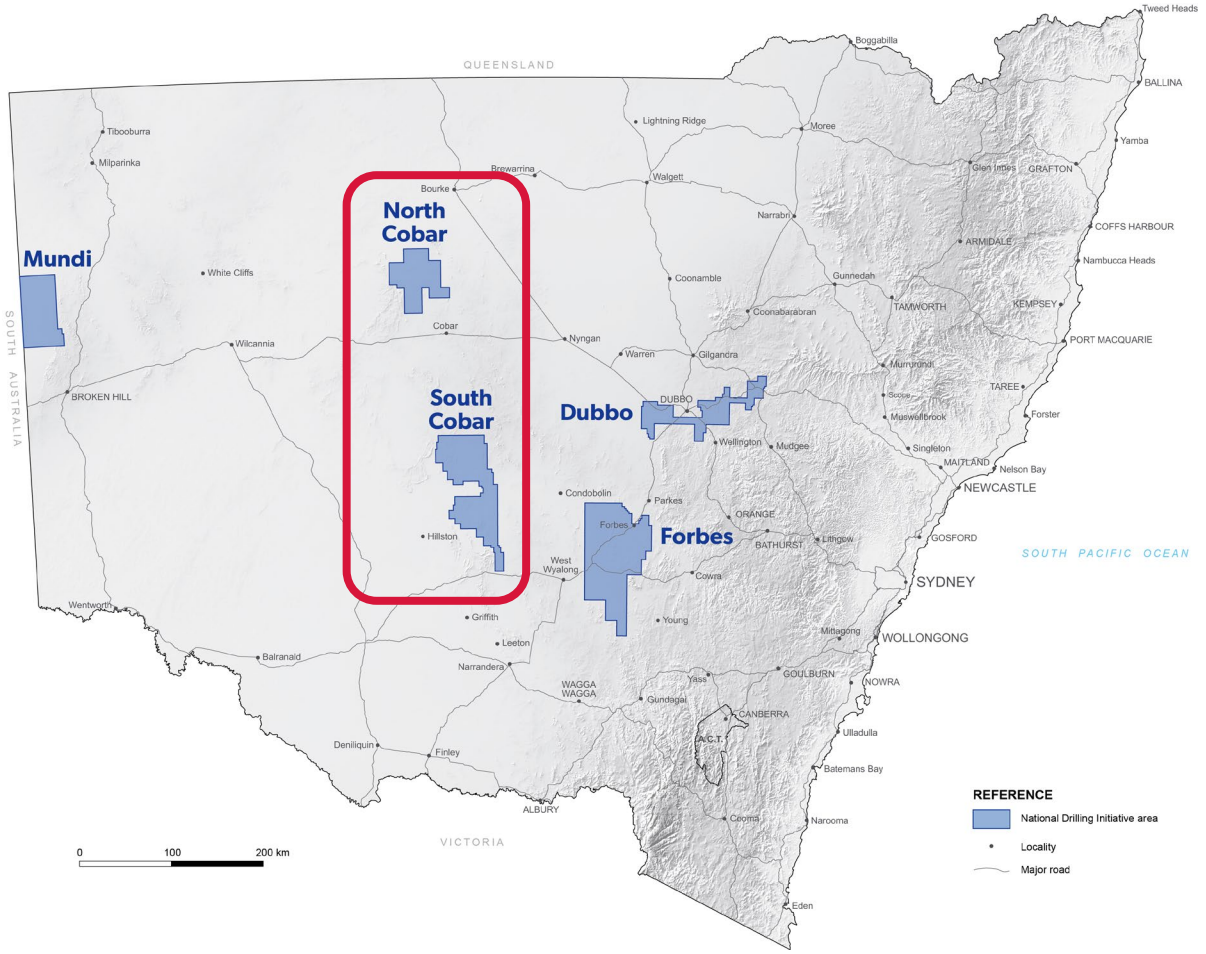
MinEx CRC in NSW

NSW GOVERNMENT

National Drilling Initiative (NDI) areas in NSW

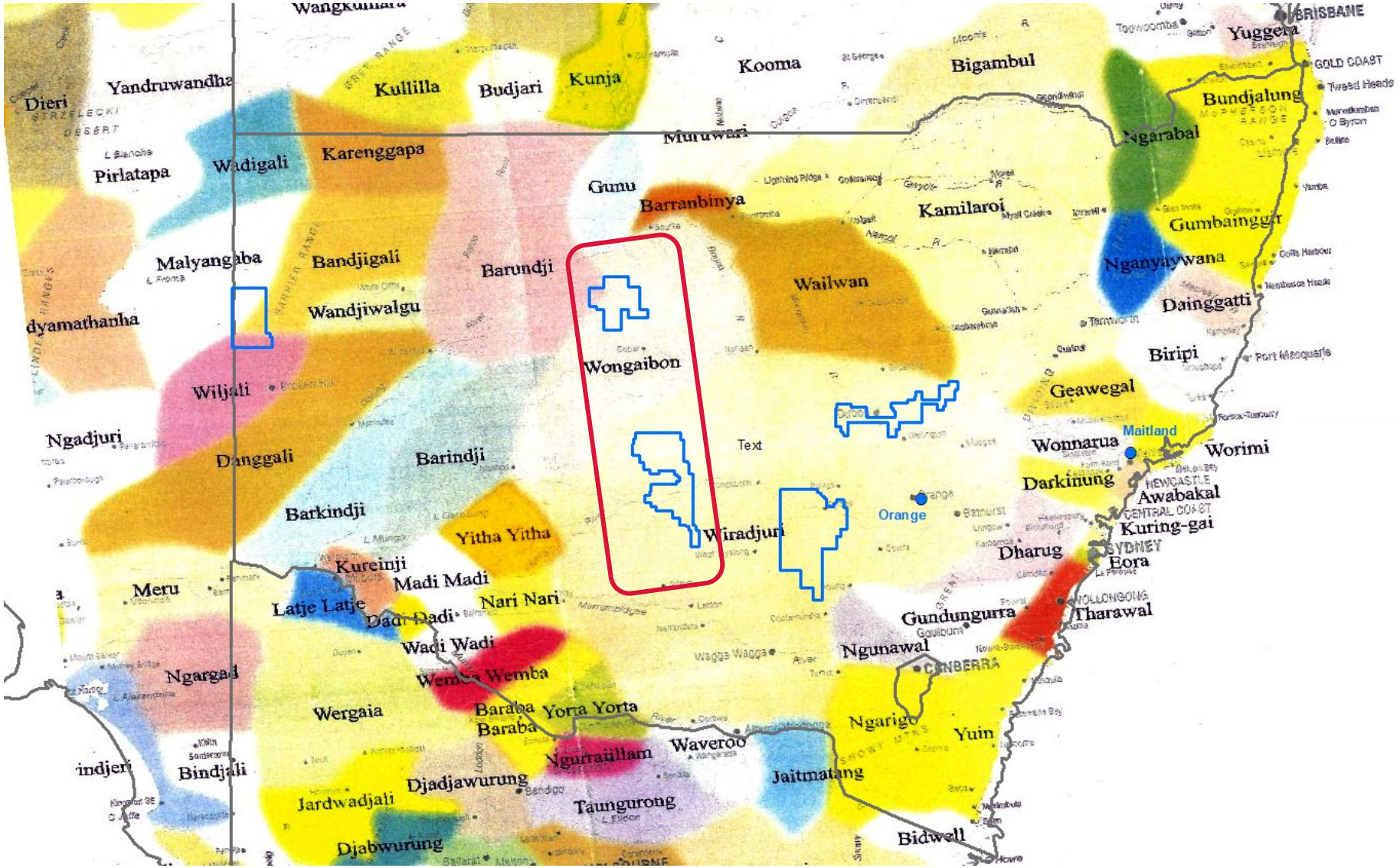
- Undercover extensions of known mineralised terranes
- Depth to basement (i.e. cover thickness) is under 500 m over the majority of the area
- Away from sensitive land (e.g. national parks, and regions with known and important groundwater aquifers)
- Integrated program of data compilation, mapping, geochemistry, geophysics and drilling over 10 years
    - Regional drilling program

→ Goal is to help drive a new generation of discoveries

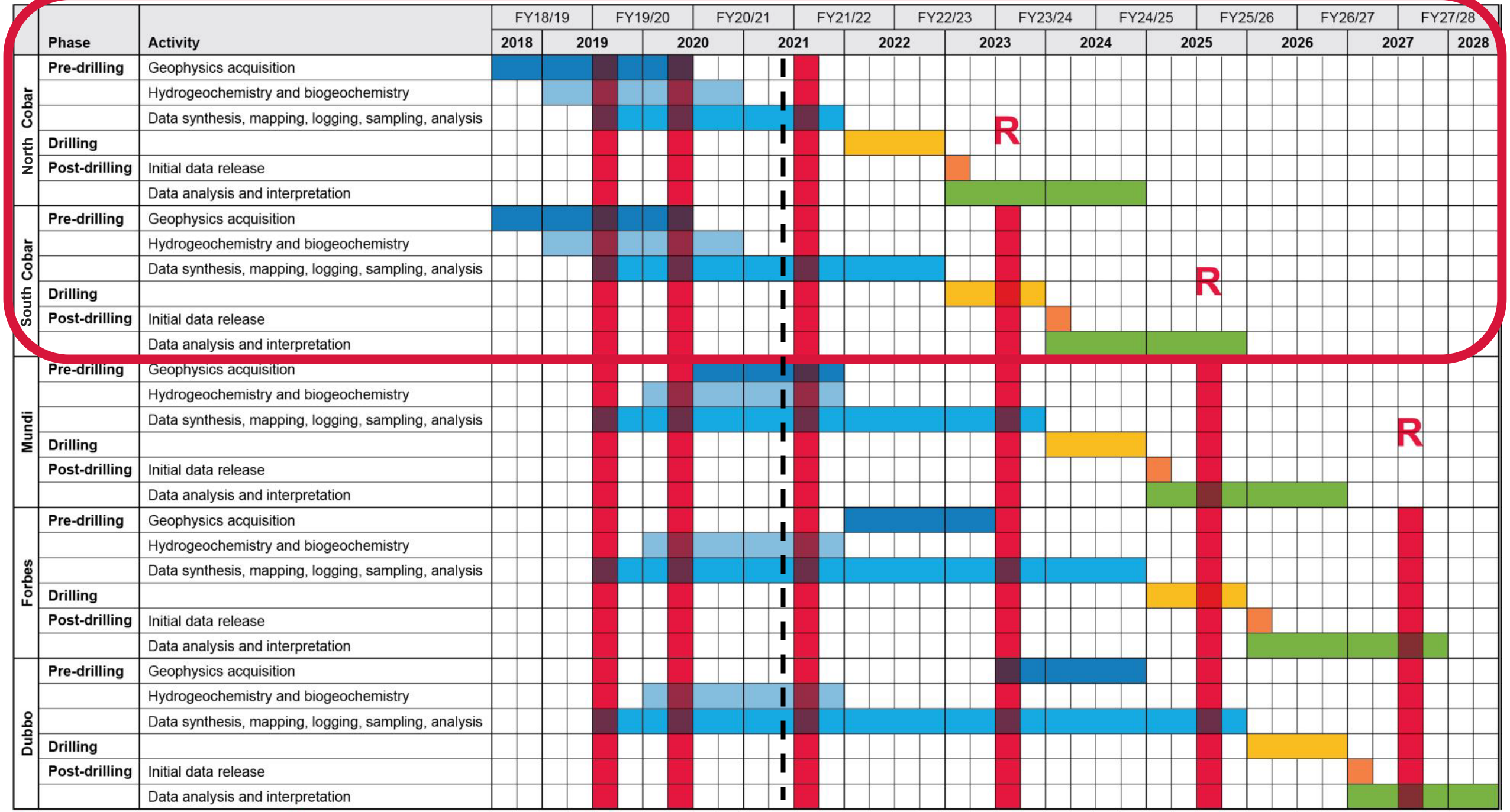


NSW GOVERNMENT

MinEx NDI areas and Traditional Custodians



NSW GOVERNMENT


FY18/19
FY19/20
FY20/21
FY21/22
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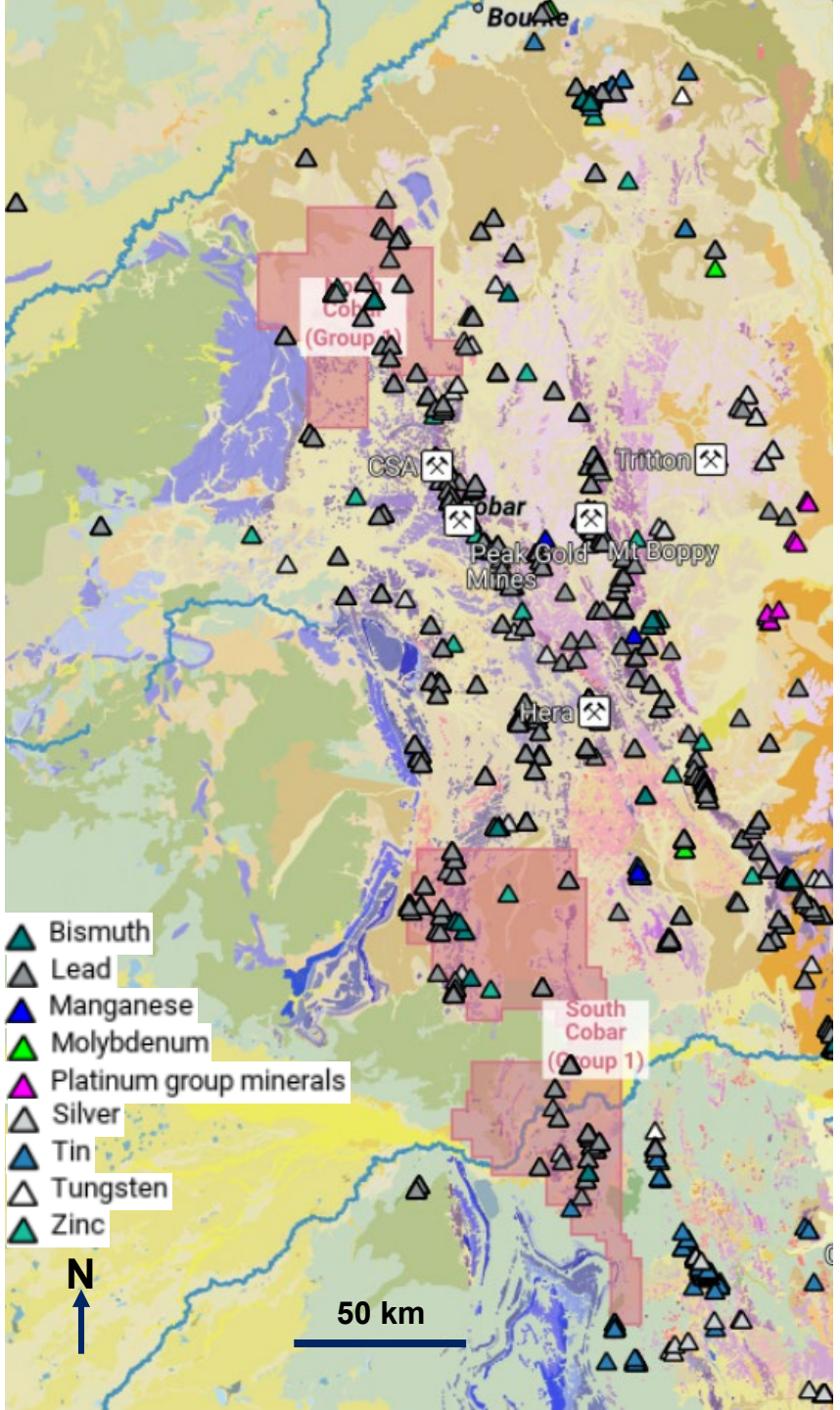
FY23/24
FY24/25
FY25/26
FY26/27
FY27/28
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
Phase
Activity
North Cobar
Pre-drilling
Geophysics acquisition
Hydrogeochemistry and biogeochemistry
Data synthesis, mapping, logging, sampling, analysis
Drilling
Post-drilling
Initial data release
Data analysis and interpretation
South Cobar
Pre-drilling
Geophysics acquisition
Hydrogeochemistry and biogeochemistry
Data synthesis, mapping, logging, sampling, analysis
Drilling
Post-drilling
Initial data release
Data analysis and interpretation
Mundi
Pre-drilling
Geophysics acquisition
Hydrogeochemistry and biogeochemistry
Data synthesis, mapping, logging, sampling, analysis
Drilling
Post-drilling
Initial data release
Data analysis and interpretation
Forbes
Pre-drilling
Geophysics acquisition
Hydrogeochemistry and biogeochemistry
Data synthesis, mapping, logging, sampling, analysis
Drilling
Post-drilling
Initial data release
Data analysis and interpretation
Dubbo
Pre-drilling
Geophysics acquisition
Hydrogeochemistry and biogeochemistry
Data synthesis, mapping, logging, sampling, analysis
Drilling
Post-drilling
Initial data release
Data analysis and interpretation
R
R
R
R
R = NSW Government relinquishment of MAA
= expression of interest application commencement
Correct as at 18/05/2020

Cobar Basin – mineral systems and geology overview

NSW GOVERNMENT

Why Cobar?

- World class precious and base metal mineral province
  - Continuous mining for 150 years since discovery of the Great Cobar deposit in 1870
- But mining requires new discoveries to extend mine life
- Current exploration boom in the basin with significant discoveries in the last 10 years
- Some companies are looking for a ‘hub and spoke’ mining model
- GSNSW program is focused away from the main line of lode to where the basin goes undercover to the north and south (MinEx CRC areas)



MinView – surface geology with mineral occurrences

Cobar Basin mineral systems

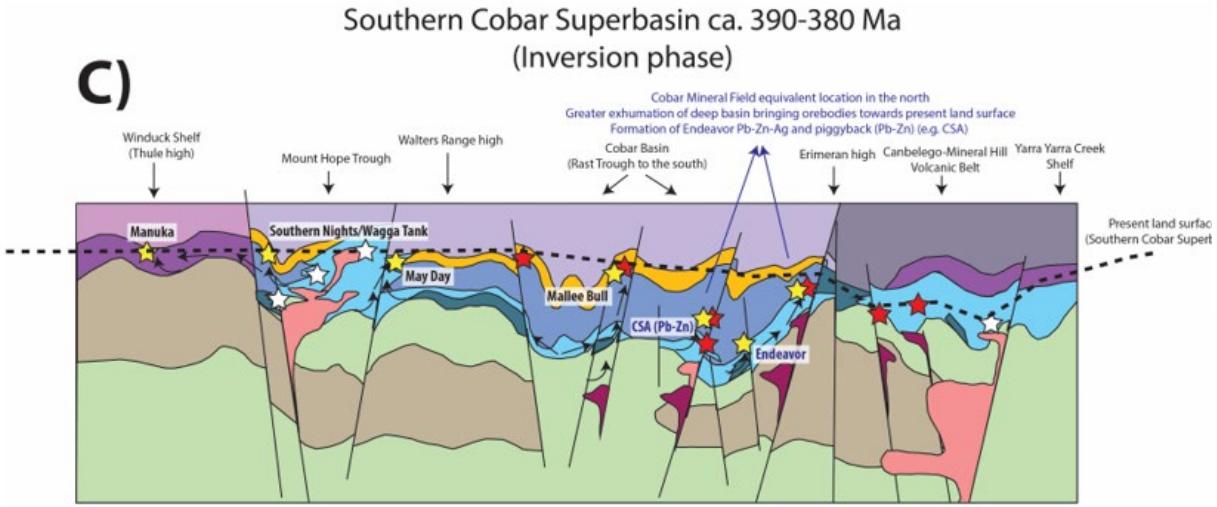
Cobar mineral systems are classified into two groups.

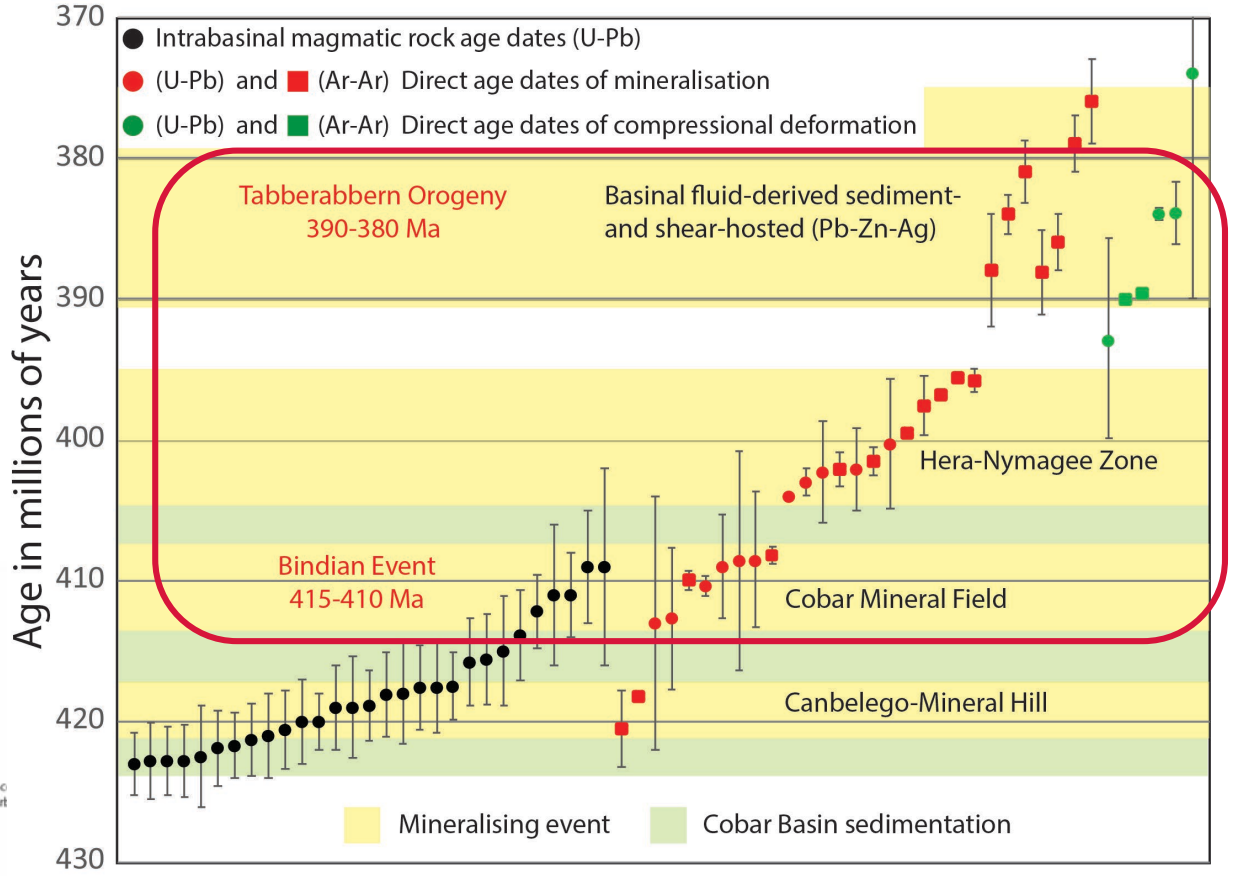
Magmatic

~415–400 Ma: transitional rift to sag phase magmatic-related systems (Cu–Au±Zn; high-T)

Non-magmatic

~390–380 Ma: syn-inversion non-magmatic mineralisation (Pb–Zn–Ag; low-T).

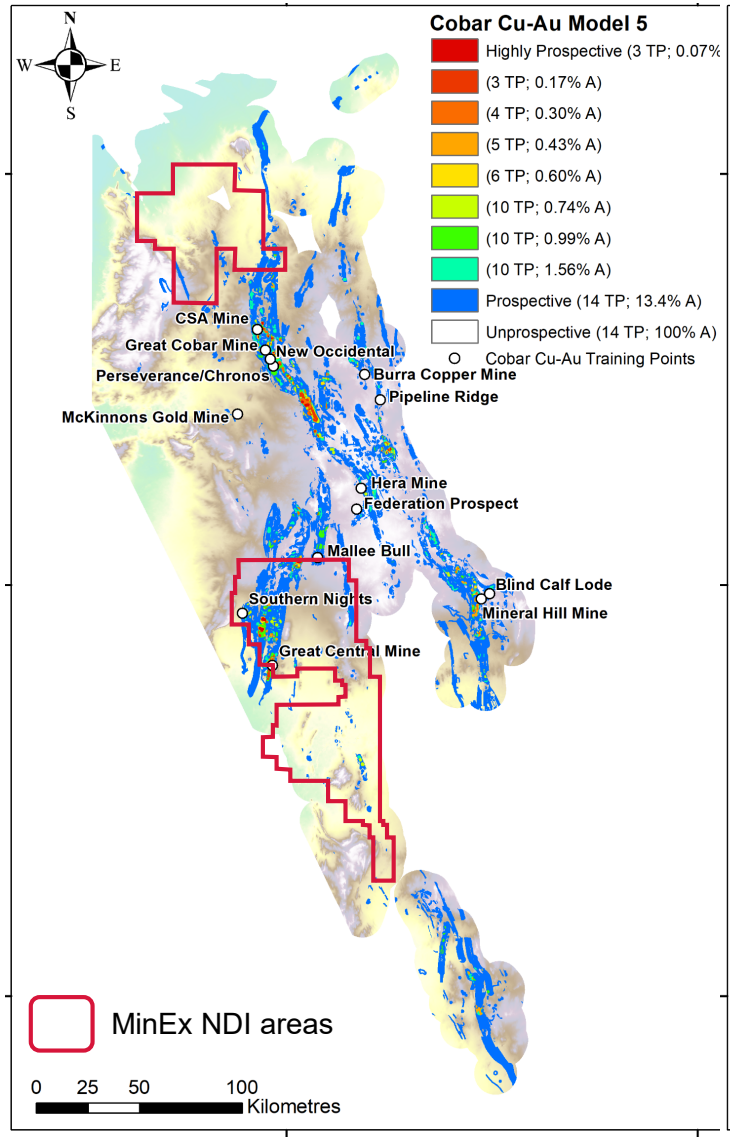


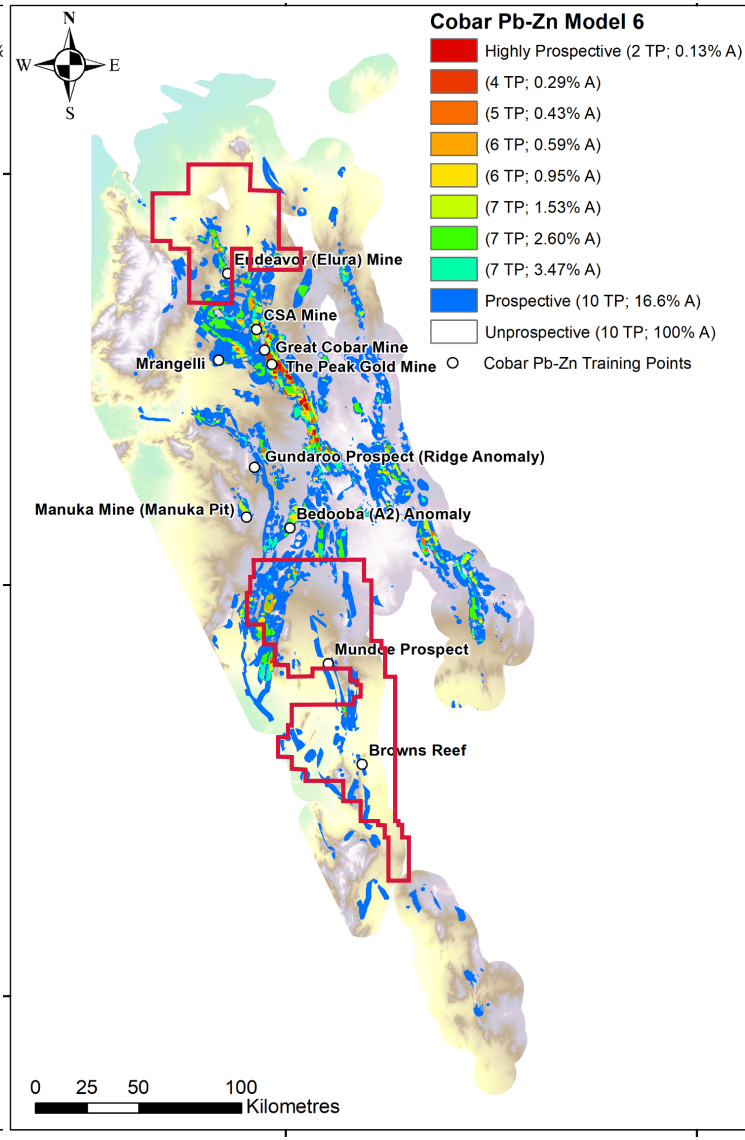


Compilation of direct dating of mineralisation and zircon U-Pb dating for intra-basin magmatic rocks (Fitzherbert and Downes 2021 and references therein; GS2021/0042)

Central Lachlan Orogen Mineral Potential Mapping

- Existing data synthesised and Mineral Potential Mapping completed in 2020
- In conjunction with Kenex Pty Ltd (granite Sn–W, Cobar Cu–Au, Cobar Pb–Zn systems)
- Predicted location of known deposits and highlighted new areas of potential mineralisation, but data skewed towards outcrop
- Available data:
  - Report (DIGS): GS2020/0741.
  - Data package i.e. GIS layers (DIGS): https://search.geoscience.nsw.gov.au/product/9261
  - MinView (https://minview.geoscience.nsw.gov.au/)

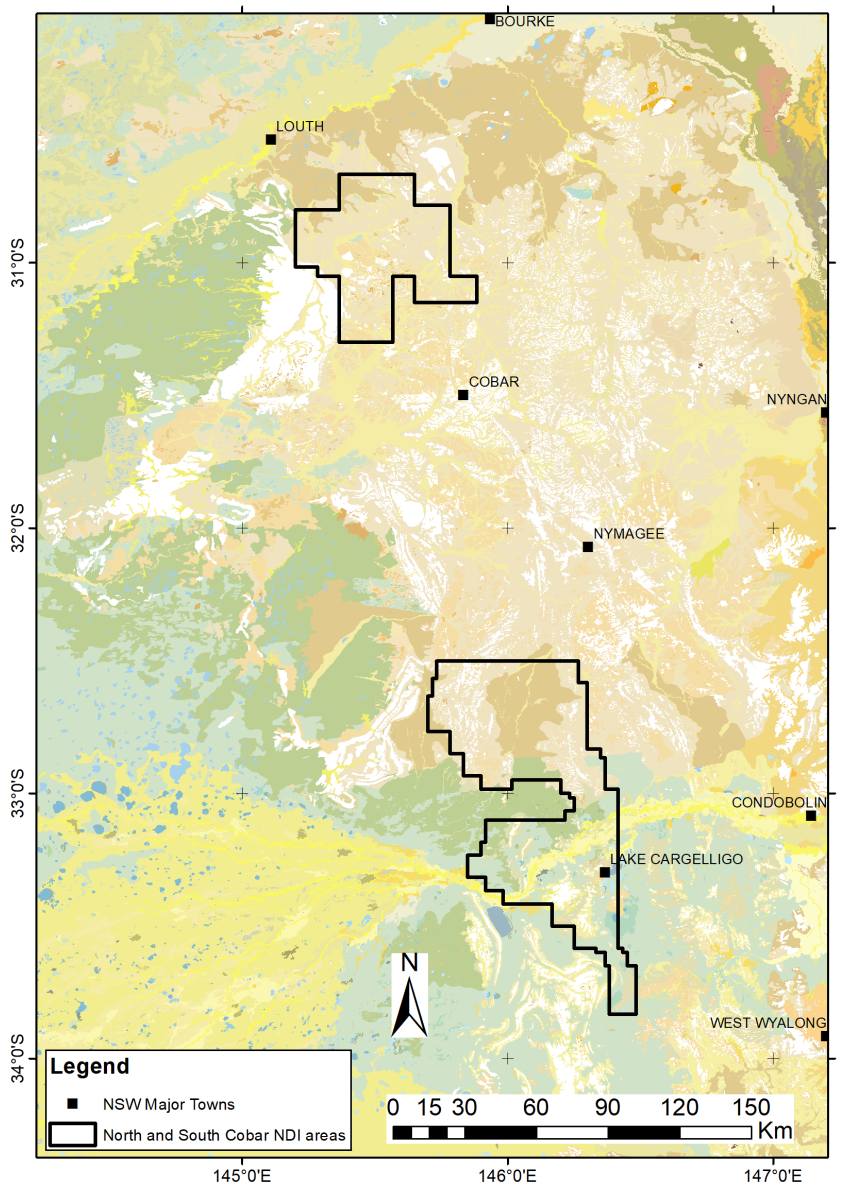


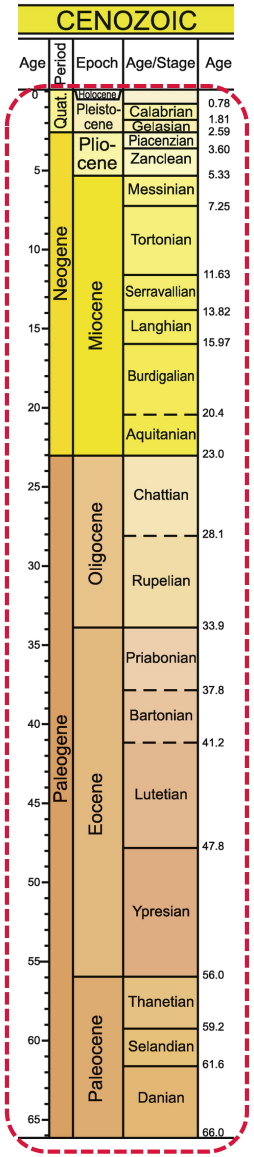


Cenozoic units

Cenozoic cover (NSW Seamless Geology)

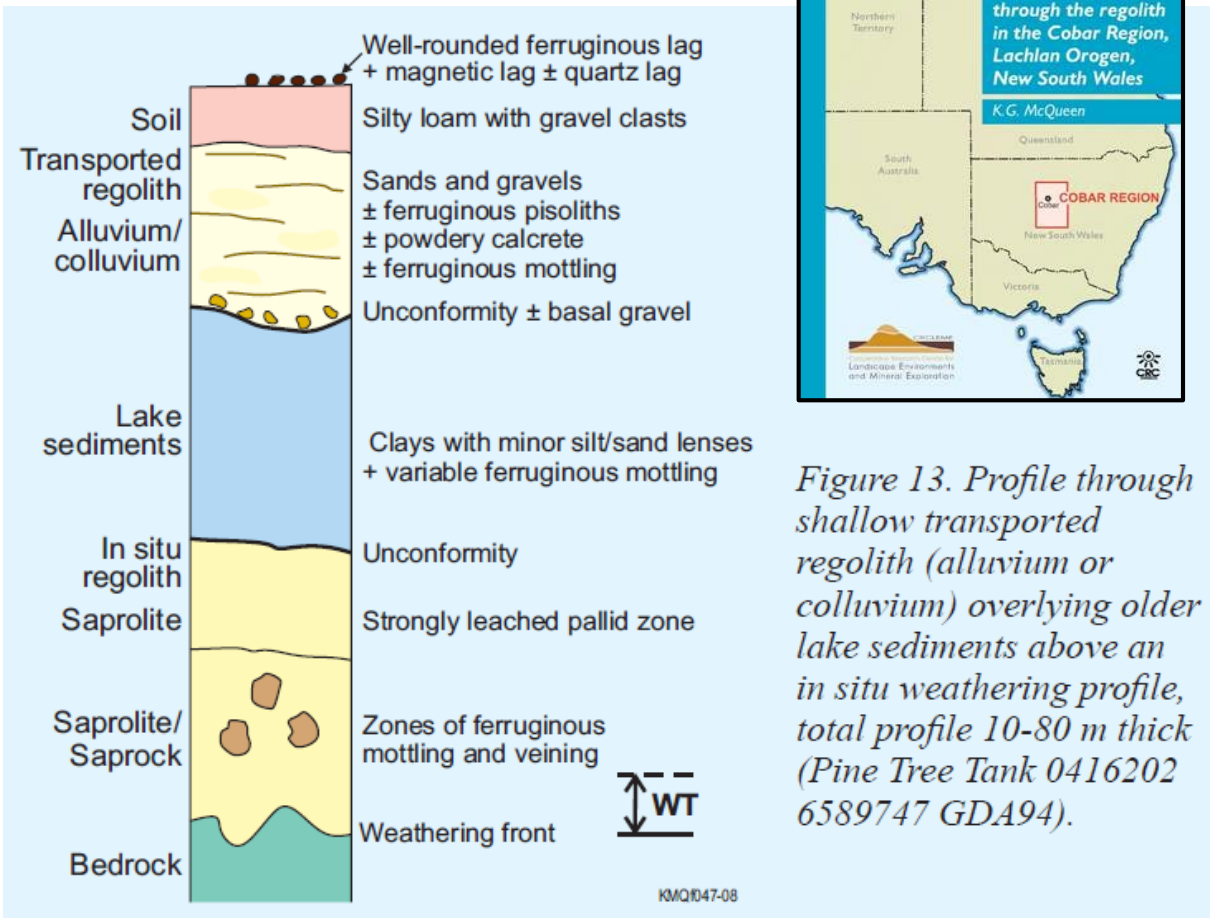
- Mixed residual, transported (colluvial and alluvial) deposits and soils
- Bedrock exposed and development of regolith since the end of the Mesozoic Era (<65 Ma)
- Includes palaeochannel deposits
  - Older contain clays and sands with little ferruginous material (non-magnetic)
  - Younger (<5 Ma) contain abundant ferruginous and magnetic grits/gravels (magnetic)
- Varied palaeolandscapes





NSW Seamless Geology dataset v2
(Colquhoun et al. 2020) – Lachlan Orogen layer

Transported cover and weathered palaeolandscape



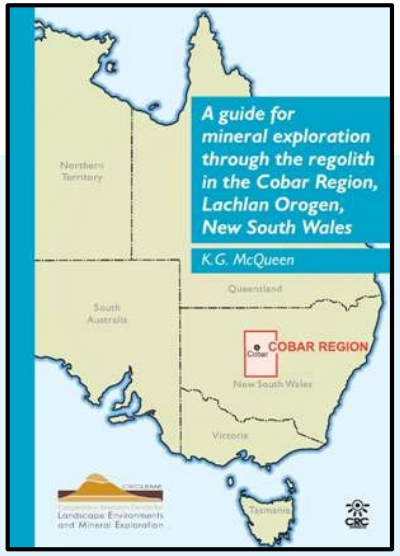


Figure 13. Profile through shallow transported regolith (alluvium or colluvium) overlying older lake sediments above an in situ weathering profile, total profile 10-80 m thick (Pine Tree Tank 0416202 6589747 GDA94).

Source: McQueen (2008); http://crcleme.org.au/Pubs/cobar/COBAR%20guide.pdf

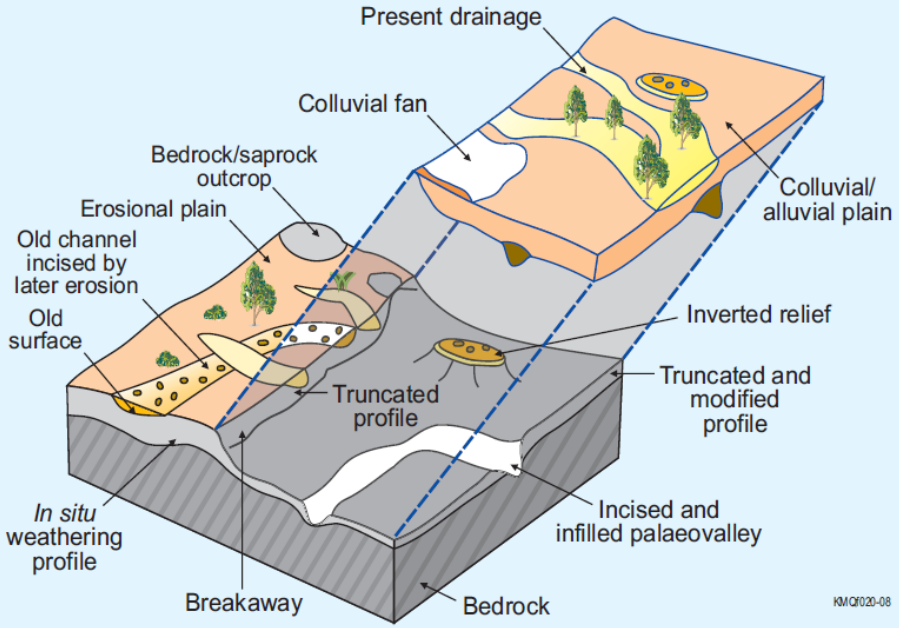


Figure 8. Block diagram summarising the main regolith-landform components of the Cobar region.

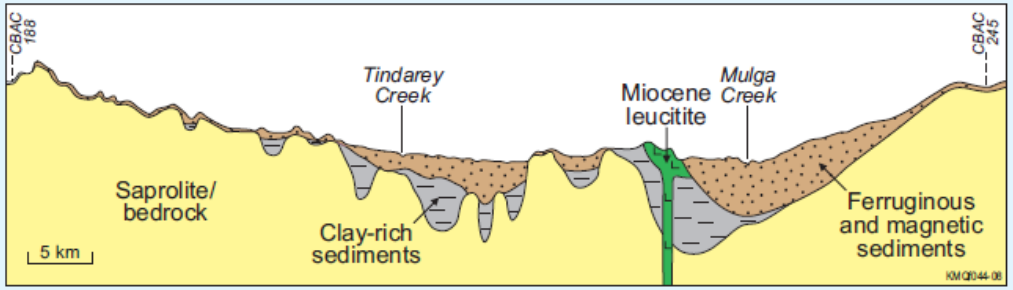
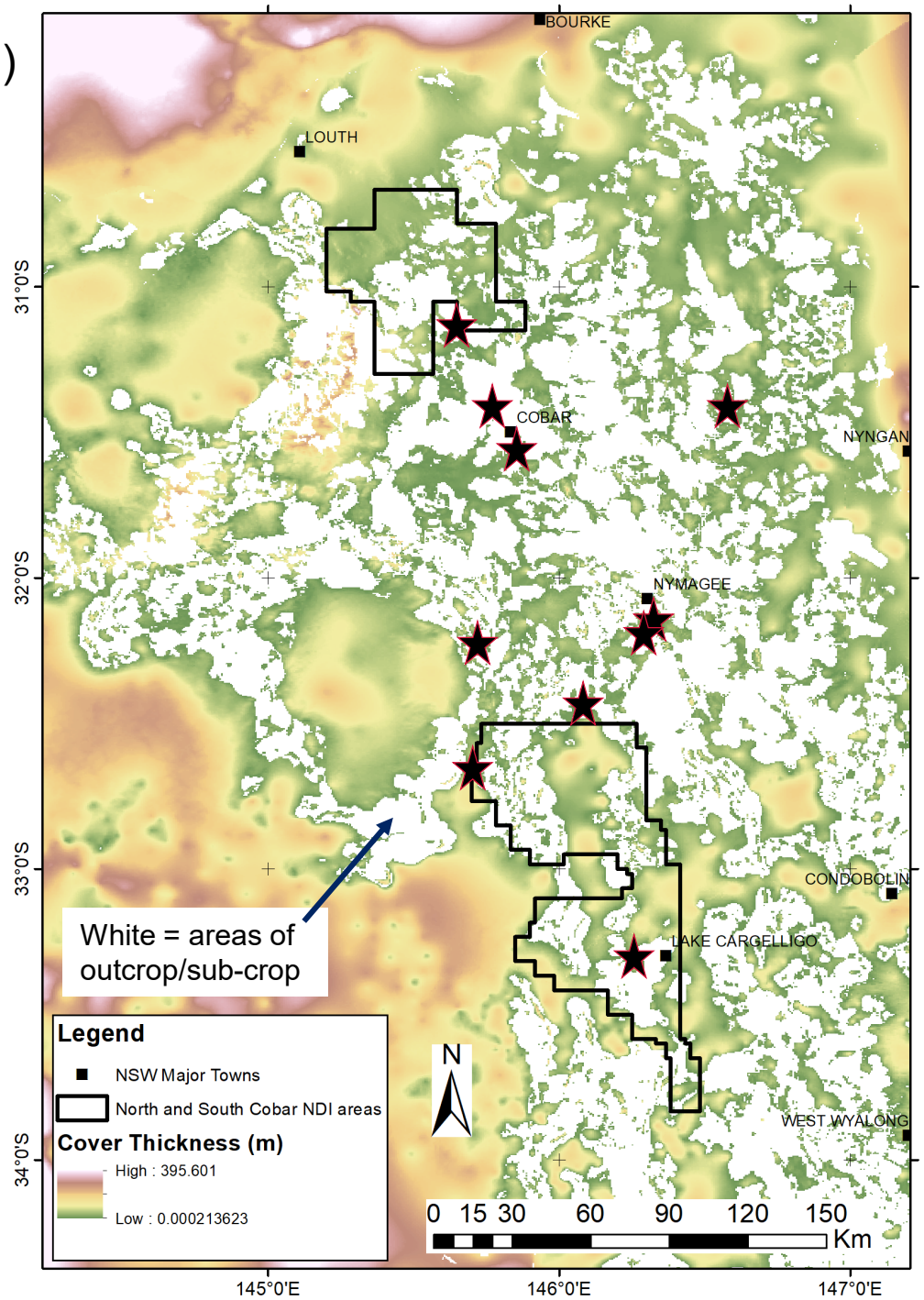


Figure 5. Schematic cross section from a roadside drilling traverse to the southwest of Byrock. This shows the positions of major palaeovalleys and relationship of different types of infilling sediments (from Chan et al., 2004). VE = 100.

Cover thickness (post-Carboniferous)



★ Mine or identified prospect

The Cobar NDI challenge

- Mapping prospective basement geology under transported cover and a deep *in situ* weathering profile

- Characterising cover to develop exploration criteria and assist basement geology mapping

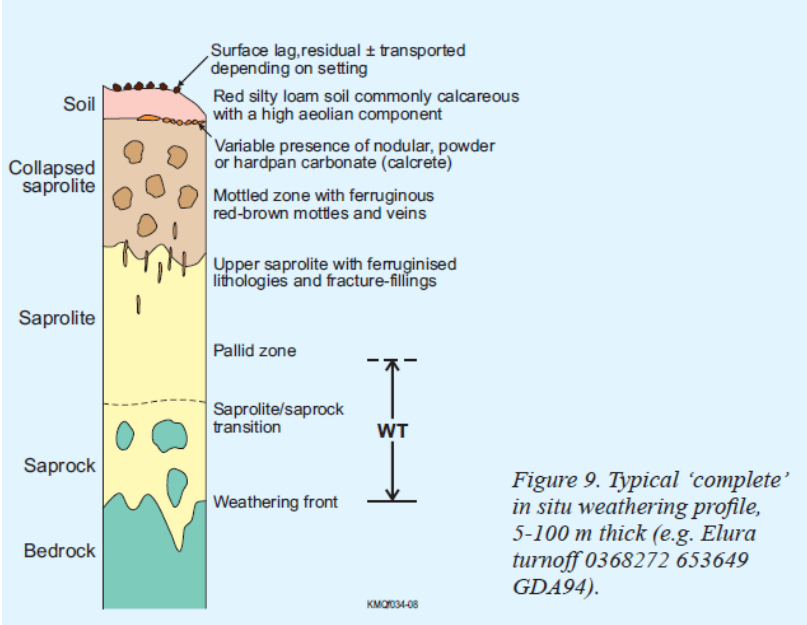
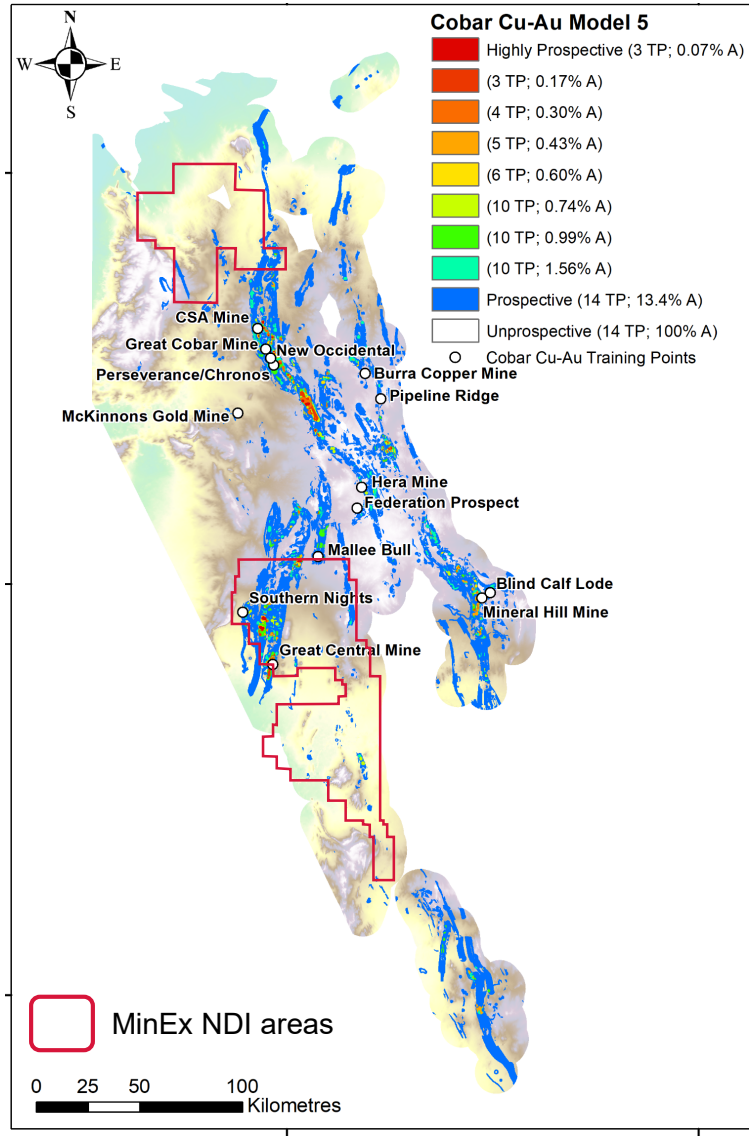


Figure 9. Typical 'complete' in situ weathering profile, 5-100 m thick (e.g. Elura turnoff 0368272 653649 GDA94).

Source: McQueen (2008); CRC LEME

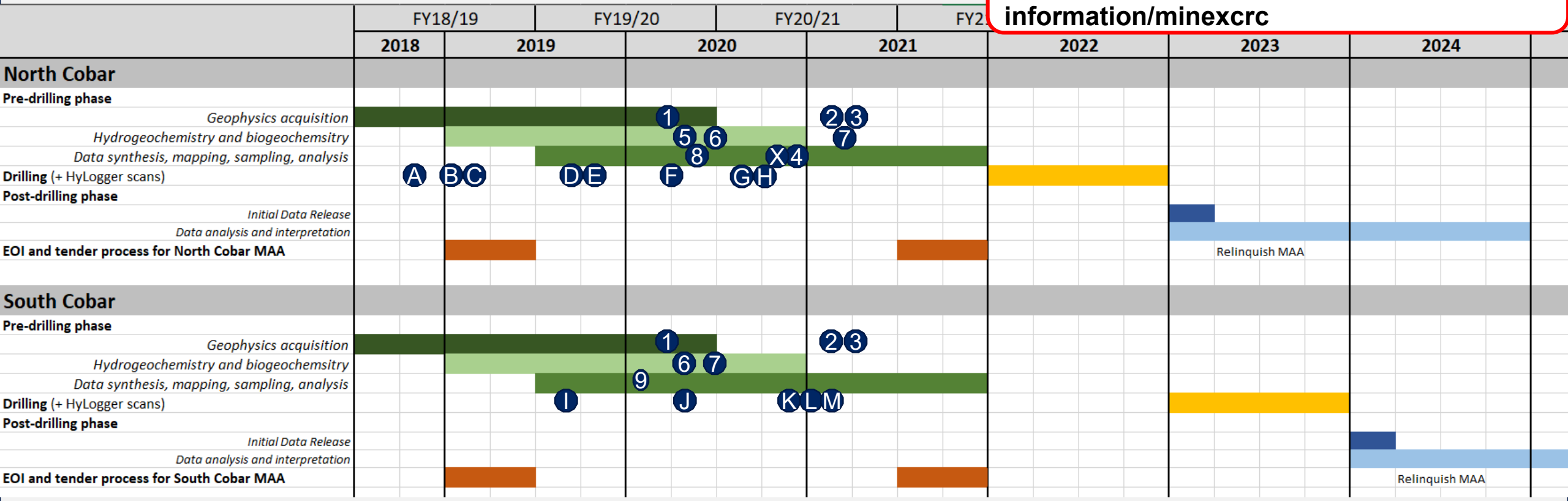


Work and results to date

NSW GOVERNMENT

Cobar MinEx CRC data release dates @ 1/4/2021

https://www.resourcesandgeoscience.nsw.gov.au/miners-and-explorers/geoscience-information/minexcrc



Airborne EM Survey

1. Data release on MinView (MV)
2. Intrepid Inversion data (MV)
3. Company In-fill data (MV)

Other Reports

4. NDI Workplan (DIGS)

Hydrogeochemistry

5. Groundwater quality report letters delivered to landholders
6. Hydrogeochemical data (MV)
7. Hydrogeochemistry report (DIGS)

Audit & Gap Reports

8. North Cobar (DIGS)
9. South Cobar (DIGS)

Min. System Reports

X. Cobar model (DIGS)

HyLogger Data & Interp.

A-H. North Cobar data released on AuScope Discovery Portal (ADP)
H-M. South Cobar data (ADP)

N Cobar a.Furney Tank **b**.Mallee Bull/Sandy Ck./Wirlong **c**.Blue Mtn **d**.Burri **e**.Arrawa **f**.Anomaly2 **g**.Kiri Grid **h**.Louth **S Cobar i**.Kilparney **j**.Wagga Tank **k**.Euabalong **l**.Mt Hope **m**.Browns Reef/Mundoe/P4

HyLogger™ – ‘the stats’

5-year Cobar HyLogger™ snapshot (2016–2020)

- Drillholes scanned = 109 (grand total since 2009 = 158)
- Metres scanned = 29.6 km (grand total = 40.8 km)
- Key scanning campaigns
  - MinEx CRC NDI drillholes (regional)
  - Endeavor; CSA; Great Cobar, Chesney, Peak, New Occidental, Hera, Blue Mountain, Wagga Tank–Southern Nights, Canbelego, Mineral Hill
- Available in MinView (https://minview.geoscience.nsw.gov.au/)
- Available on AuScope NVCL portal (http://portal.auscope.org.au/)

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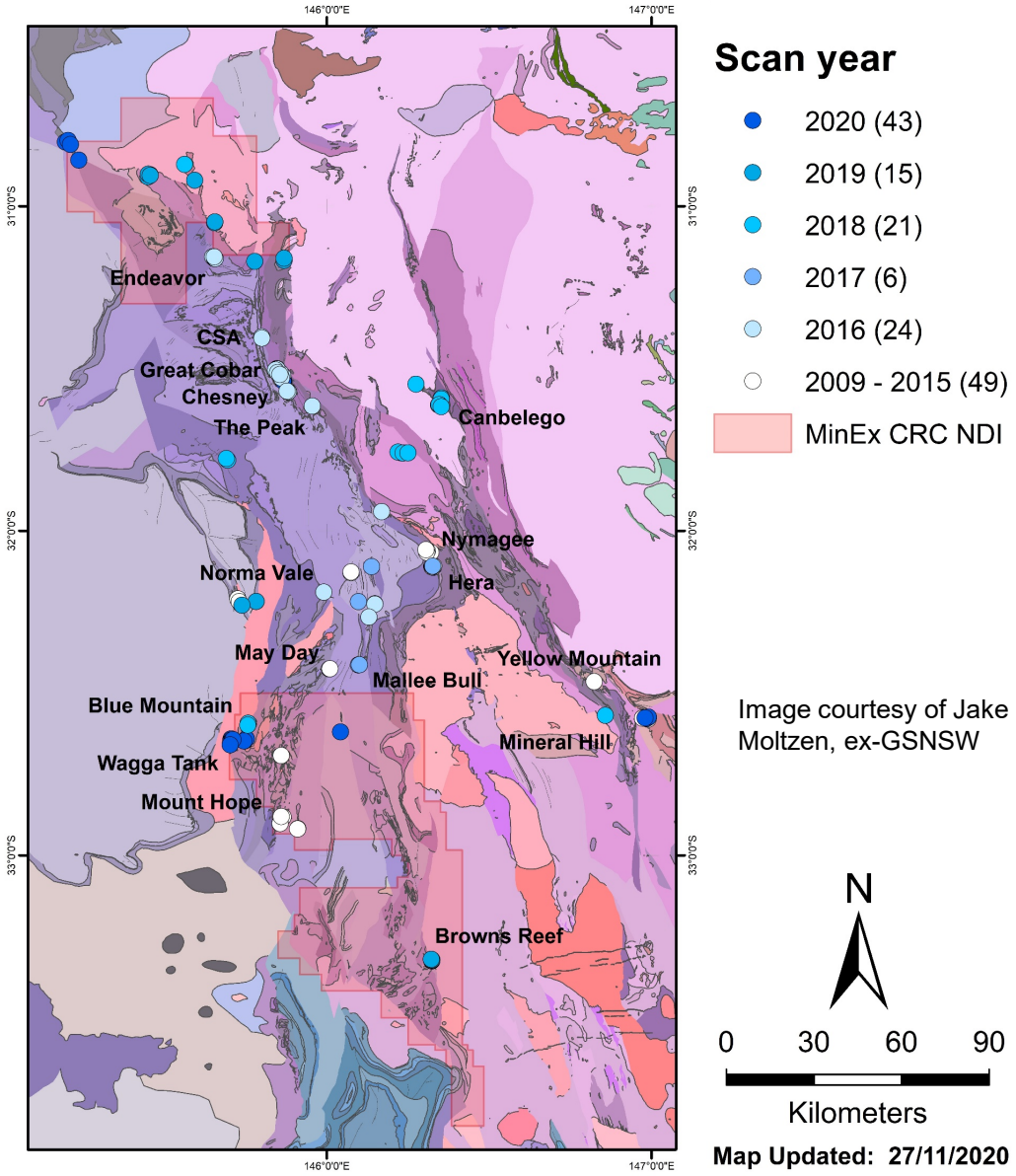
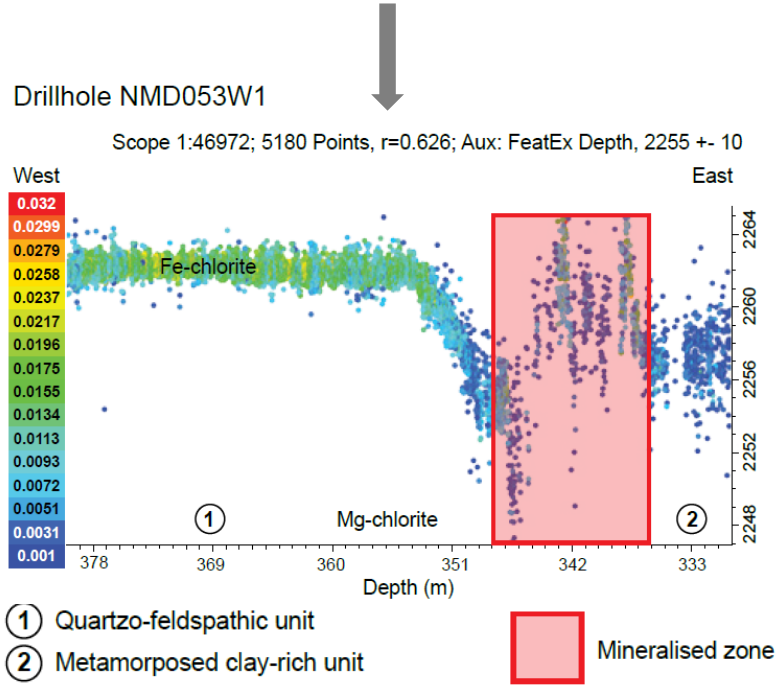
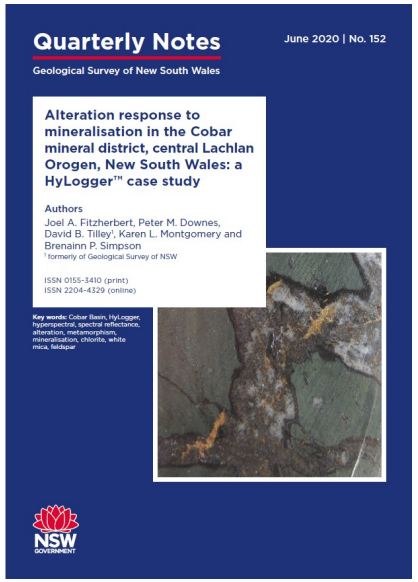
Cobar HyLogger Drillholes

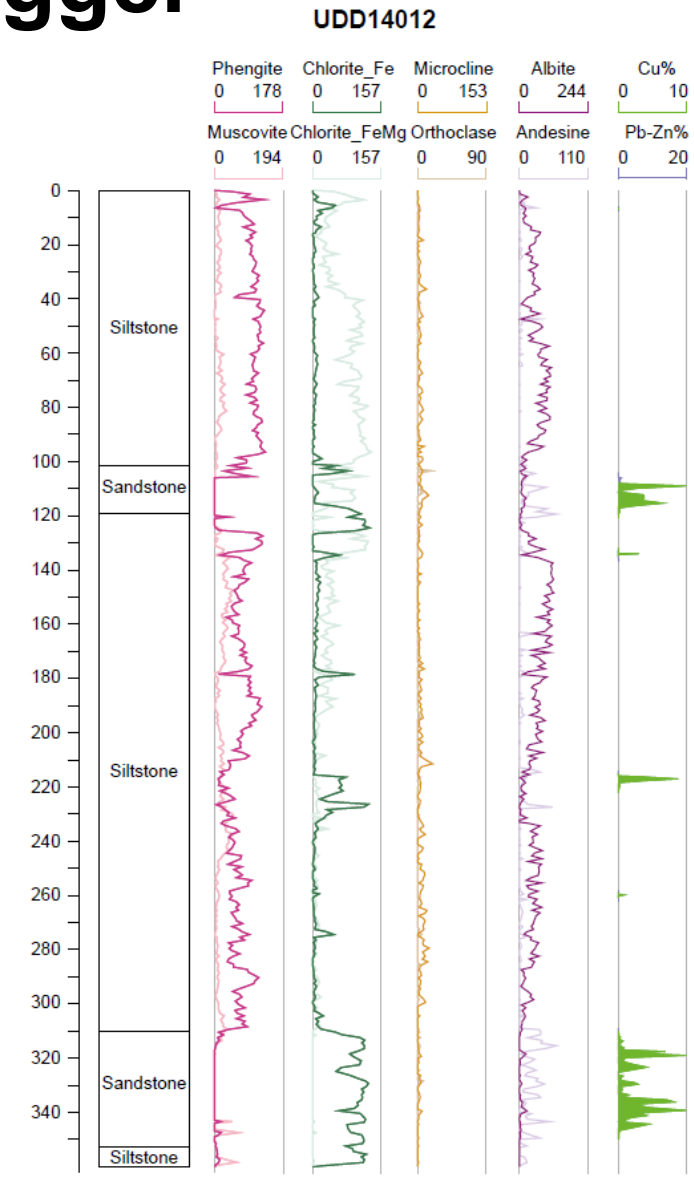


Alteration and mineralisation – HyLogger™

- Common alteration patterns for Cobar-type ore bodies (with exceptions! Fitzherbert et al. 2020, QN152)
  - Quartz-productive
  - **Fe-chlorite** productive and **Mg-chlorite** destructive
  - **Albite** (and K-feldspar) destructive
  - **Phengite** destructive and **muscovite** productive
- More Mg-chlorite in proximal alteration (Downes et al. 2016)

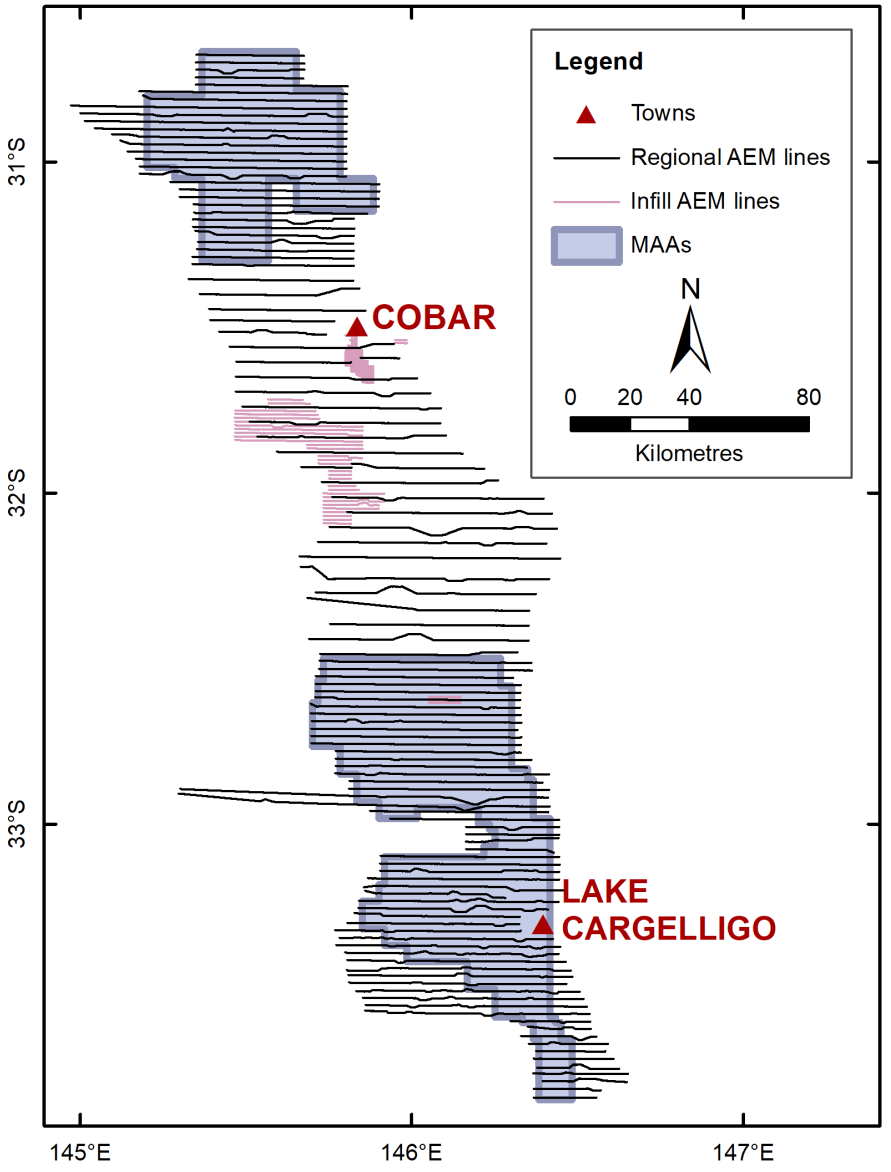




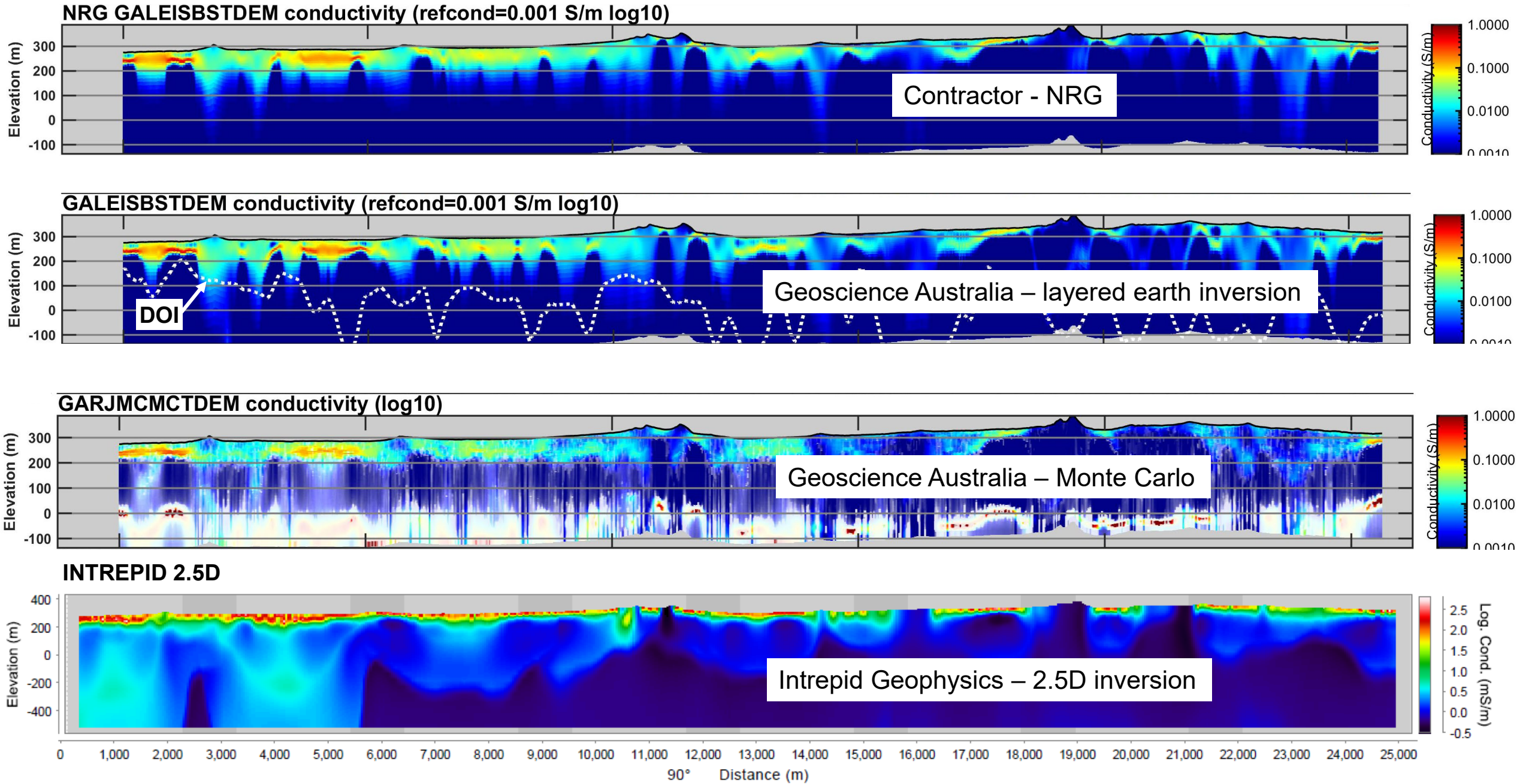


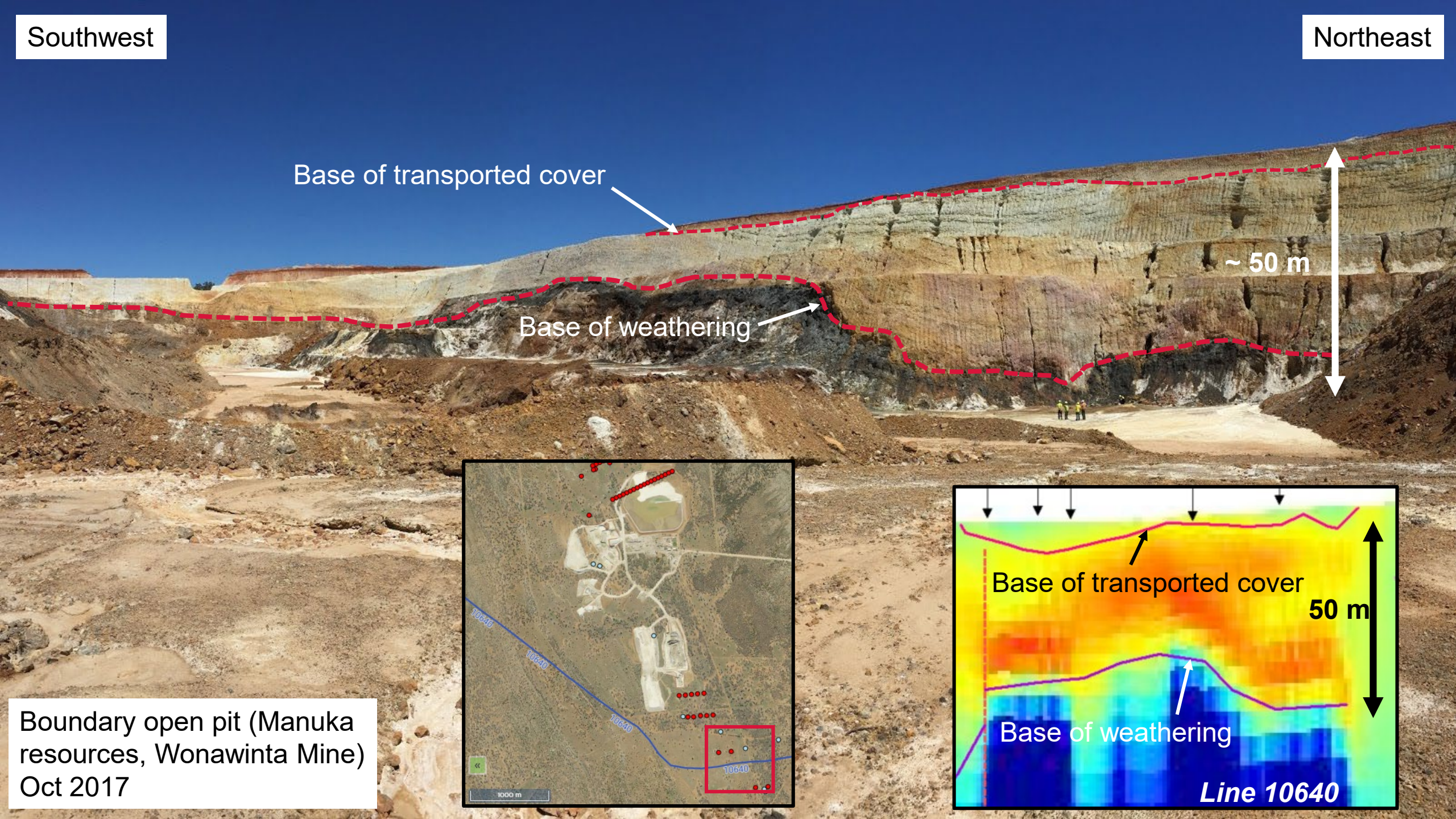
Cobar airborne electromagnetic (AEM) survey

- Collaborative project between Geoscience Australia and GSNSW – largest AEM survey in NSW (Sept 2019)
- Heli-borne time-domain system (Xcite™) – flight height of 60 m, sensor suspended 30 m below, DOI up to ~400 m
- 116 east–west (**black**) lines; 2.5 km and 5 km apart; 5,908 line km; 19150 km^2
- Four infill areas funded by industry (pink lines); all are now publicly available
- Data processed and publicly available from MinView and GA's portal and e-catalogue



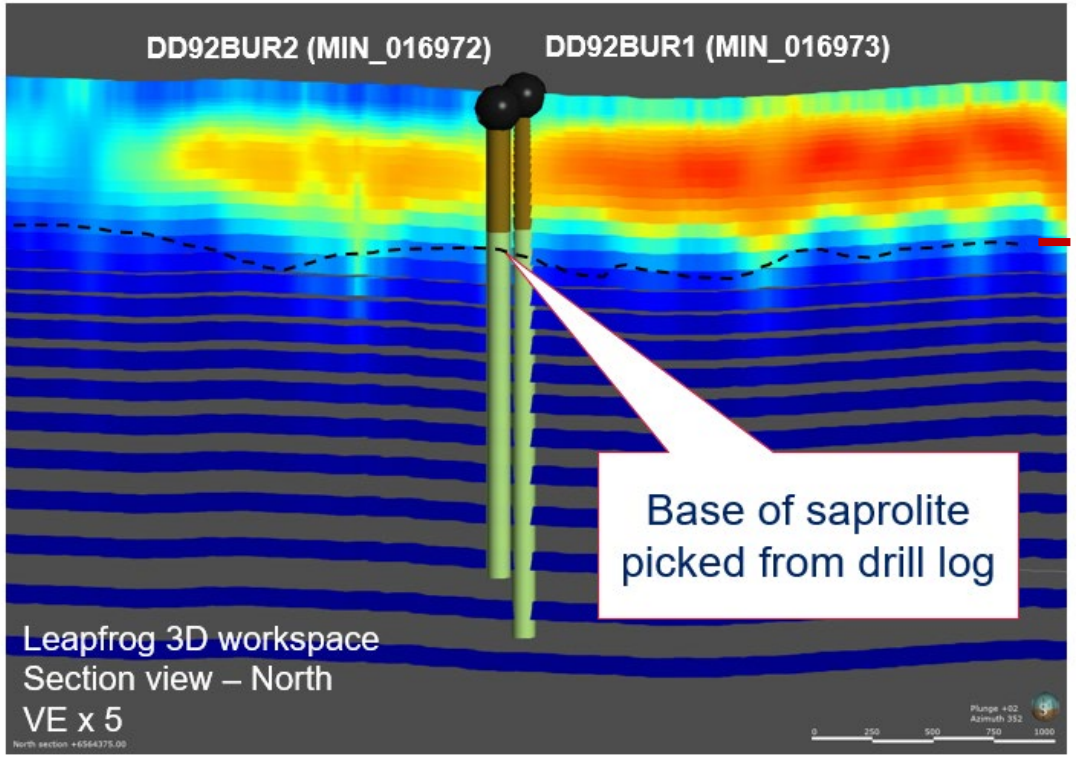
Line 10680: Inversions

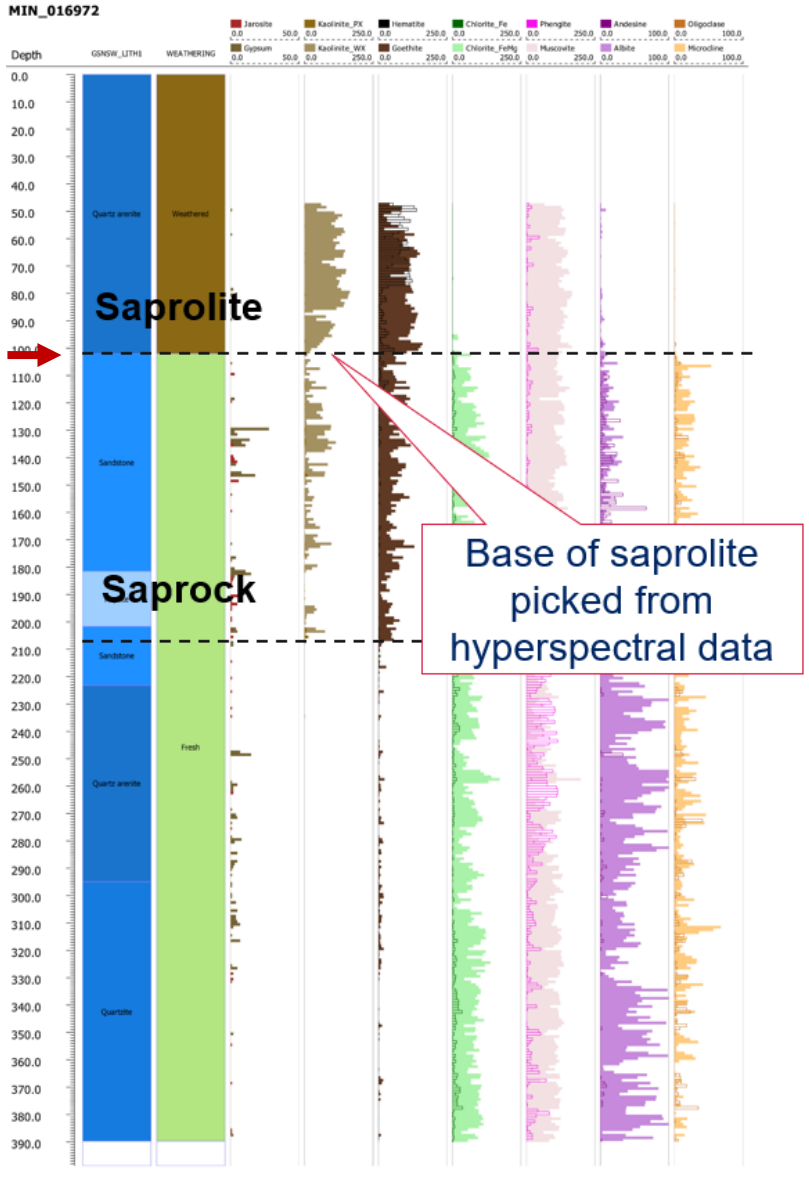




Boundary open pit (Manuka resources, Wonawinta Mine) Oct 2017

AEM interpretation, HyLogger^{TM} and drill log data



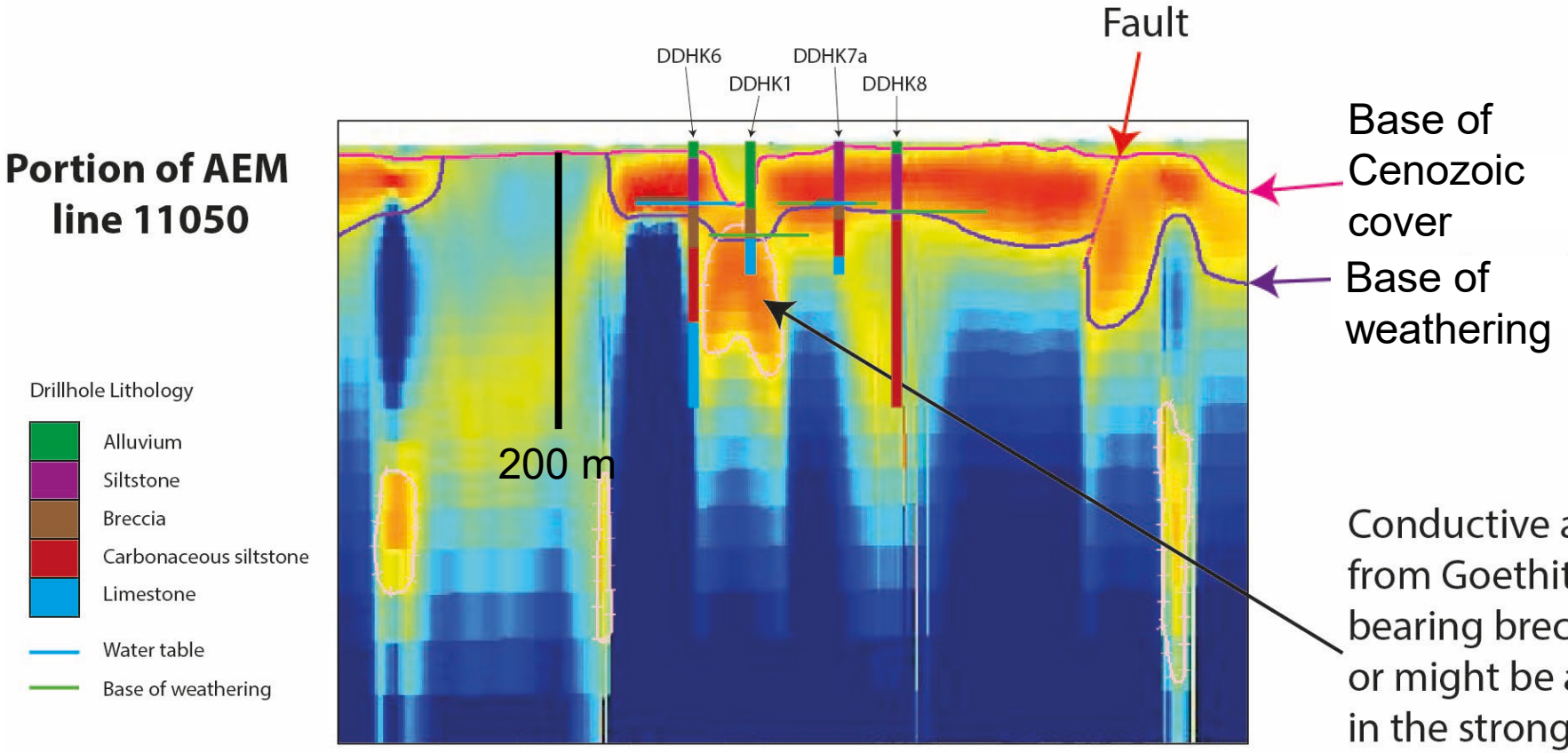


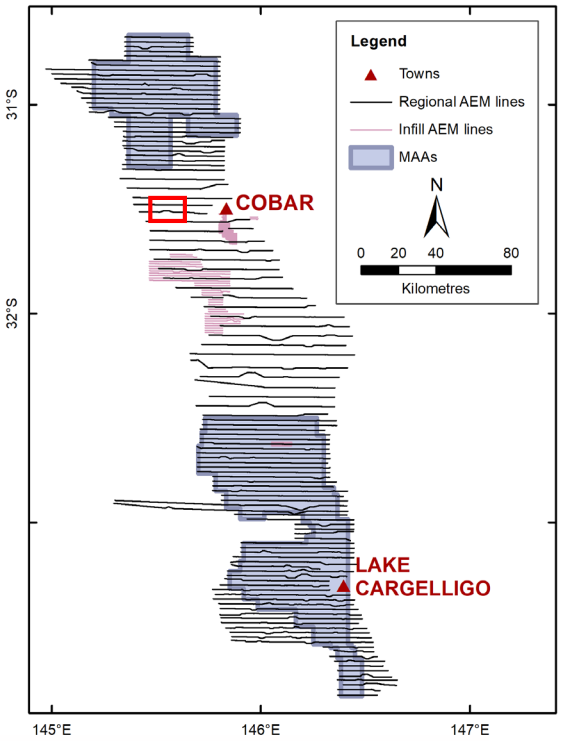
NSW GOVERNMENT

Images courtesy of Karen Montgomery, GSNSW

AEM interpretation and drillhole data

AEM interpretation matches with information in drillhole lithology logs.

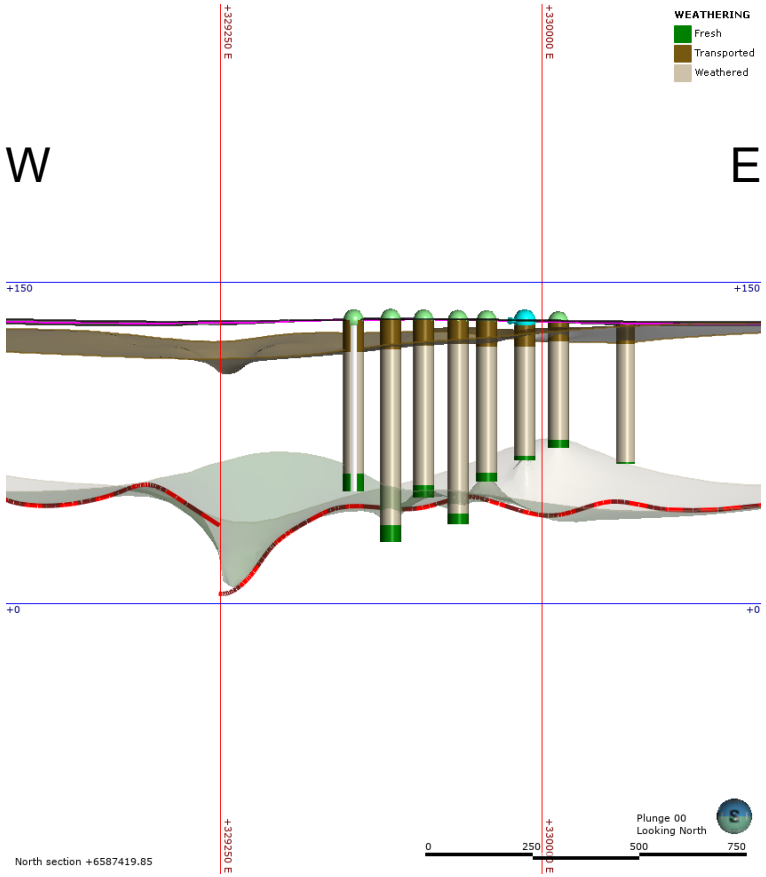




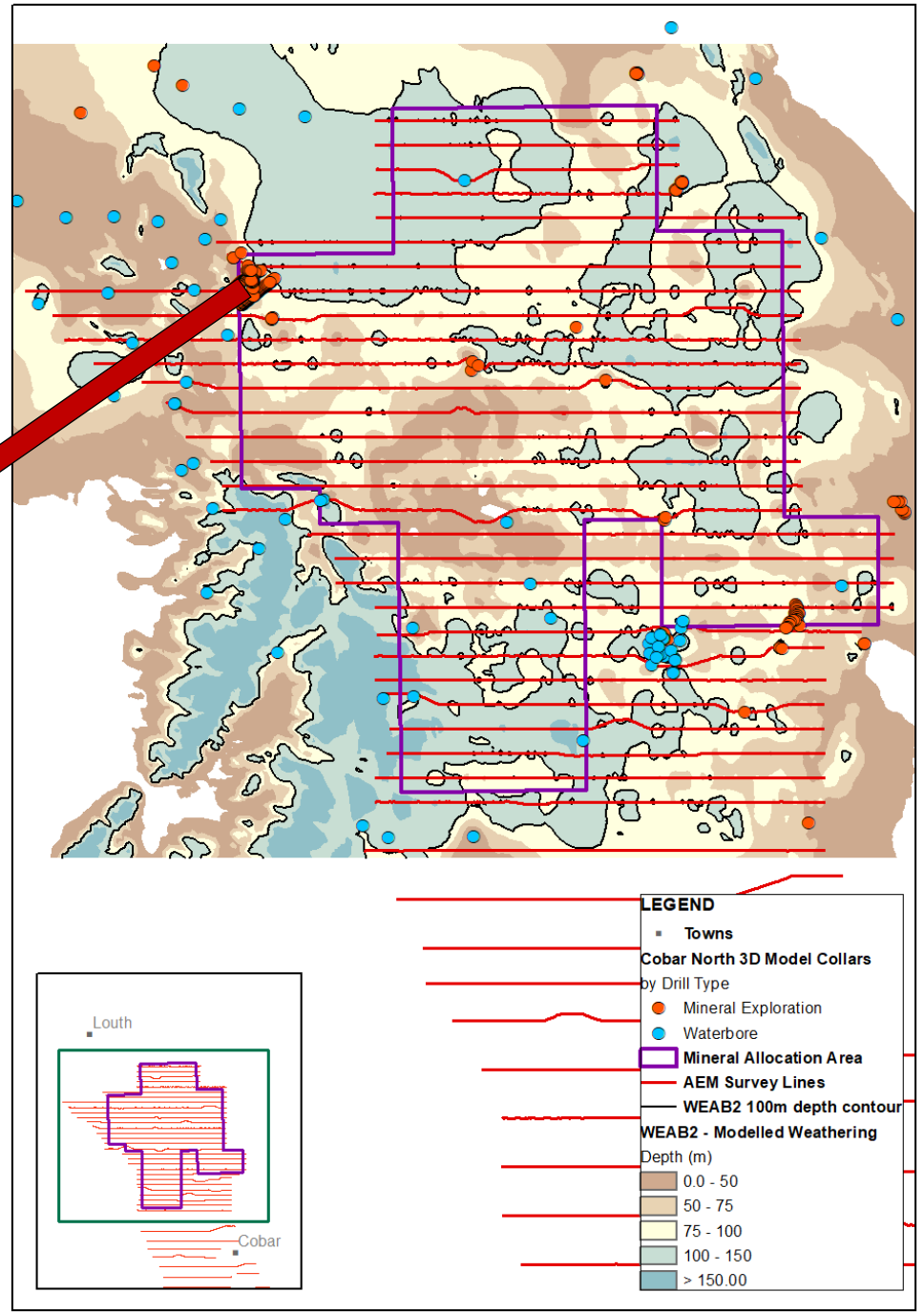
Conductive anomaly could result from Goethite and minor sulfide bearing breccia (52-70m depth DDHK1) or might be an artifact due the break in the strong surface conductors

Image courtesy of Liann Deyssing, GSNSW

3D integration of data



AEM line 11080; 5x VE; Leapfrog 3D workspace view

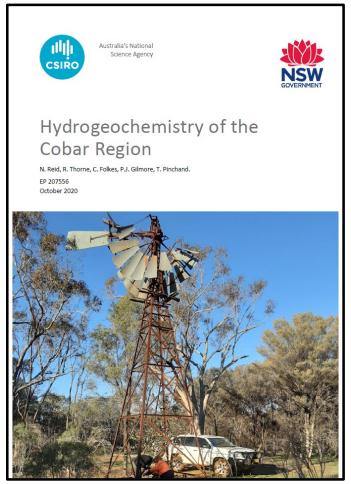


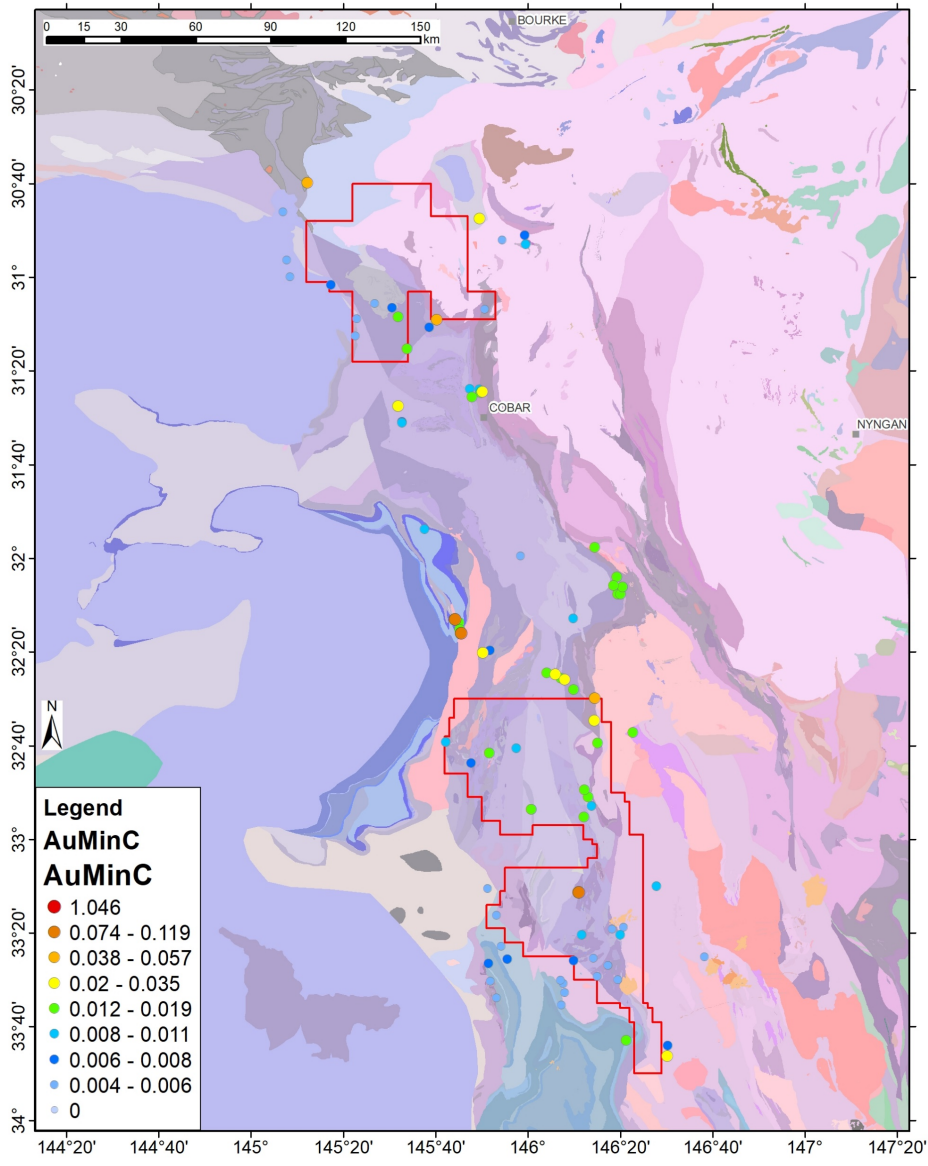
Images courtesy of K. Montgomery, GSNSW

Cobar hydrogeochemistry

- In collaboration with CSIRO
- 86 waterbores sampled (+ previous data)
- Analyses
  - Full suite of trace elements
  - O, H, D isotopes
  - (Hydro)-chronology
- Hydrogeochemistry data available in MinView
- Comprehensive report: GS2021/0054

AuMinC index = 2*[Au+As+Ag+Sb]
– most successful for finding Au-related Cobar-type deposits?





Hydrogeochemistry and mineral potential

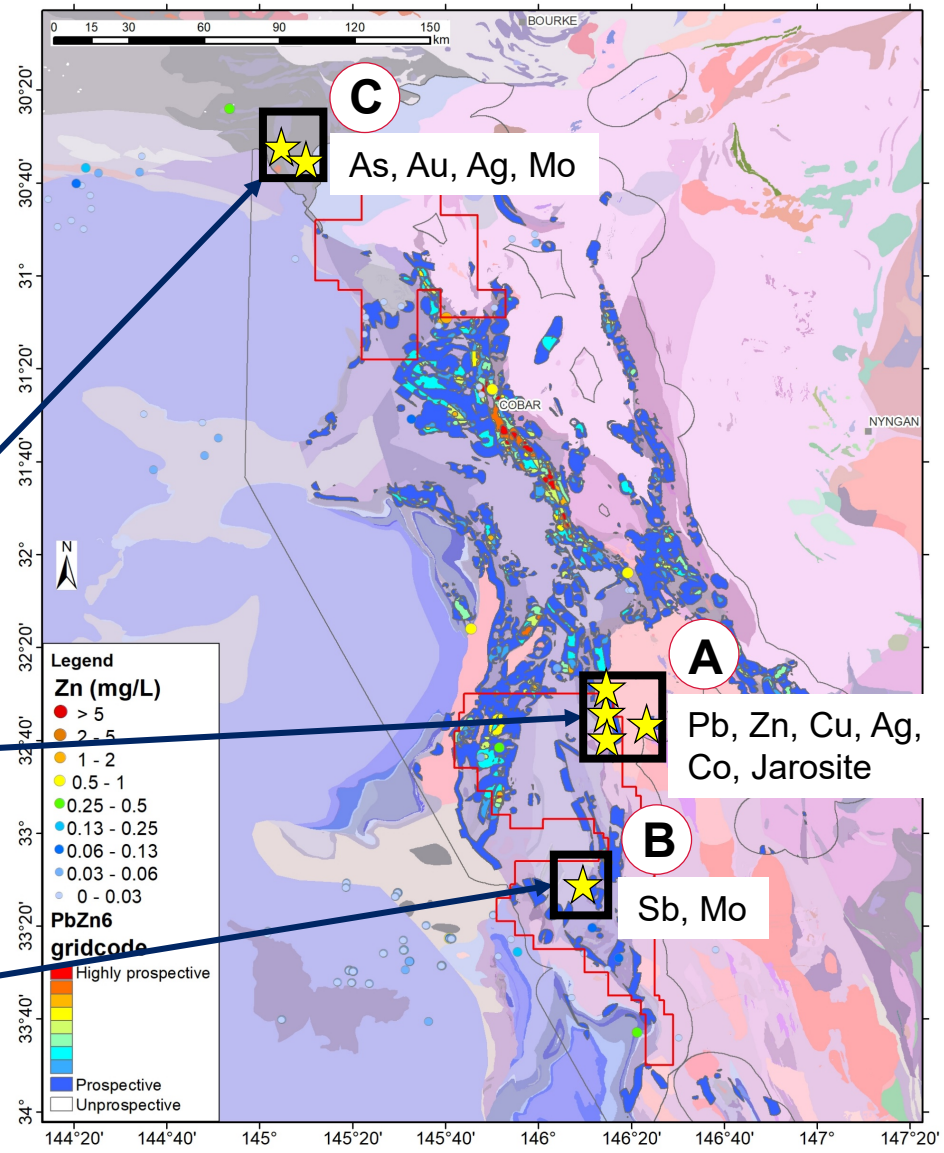
- Highest groundwater concentrations of Cu, Au, Pb, Zn (or other pathfinder chemical species) correlate with high prospectivity for:
  - Cu-Au-(±Zn) mineral system
  - Pb-Zn-Ag mineral system.

- BUT, also some areas with high concentrations of these elements not in areas of mapped high prospectivity……

Area C: elevated concentrations of As, Au, Ag, Mo

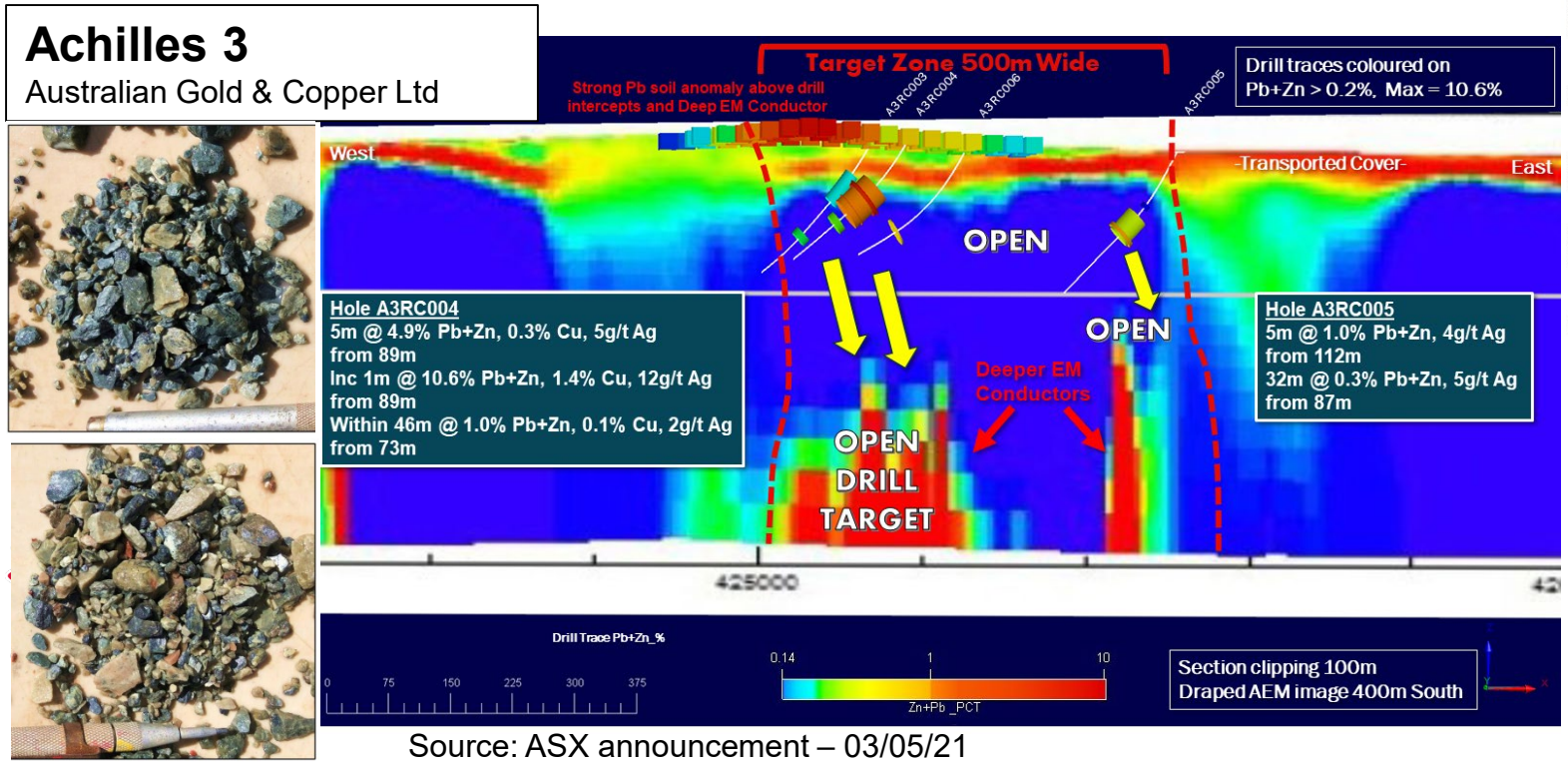
Area A: up to 400 ppt Ag, Cu 880 ppb, Pb 114 ppb, Se 13 ppb, Zn 2800 ppb. Oversaturated with respect to Jarosite, suggesting free SO_4 in the region

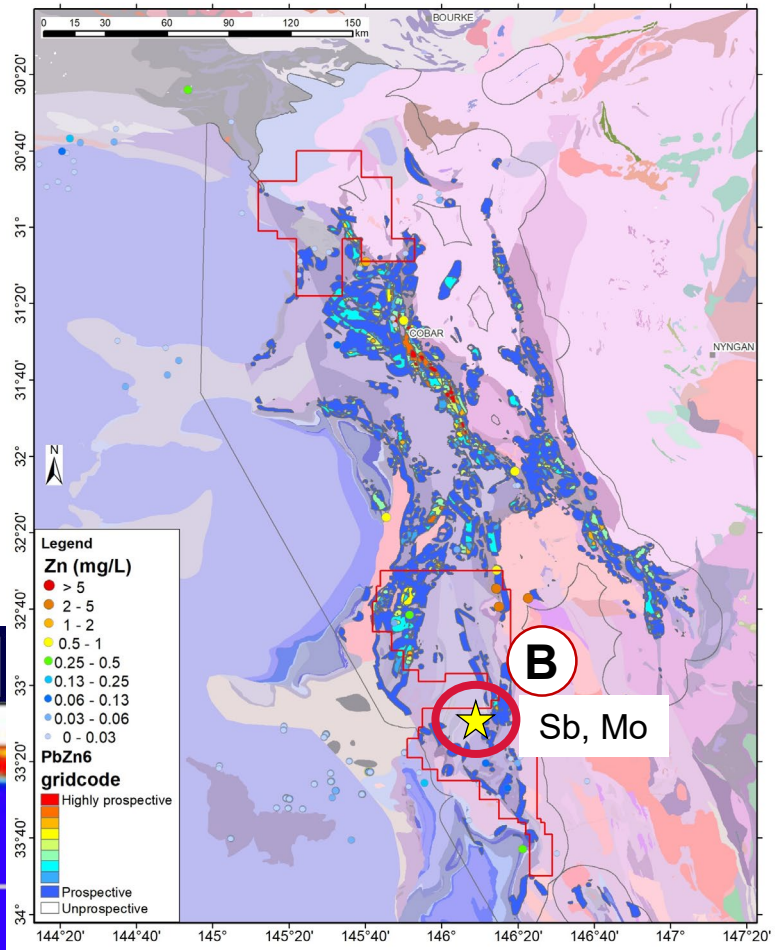
Area B: multi-point, multi element anomaly with elevated concentrations of Mo 50 ppb and Sb 10 ppb



Cobar AEM and hydrogeochemistry

- Hydrogeochemistry ~2 km south of the Achilles 3 prospect showed anomalous Mo and Sb (area B)
- Also coincident Pb soil anomaly with EM and AEM anomalies at depth
- >1200 m, 7-hole RC drilling – intersected 500 m-wide base-metal sulfide zone (galena, sphalerite and chalcopyrite) above conductor

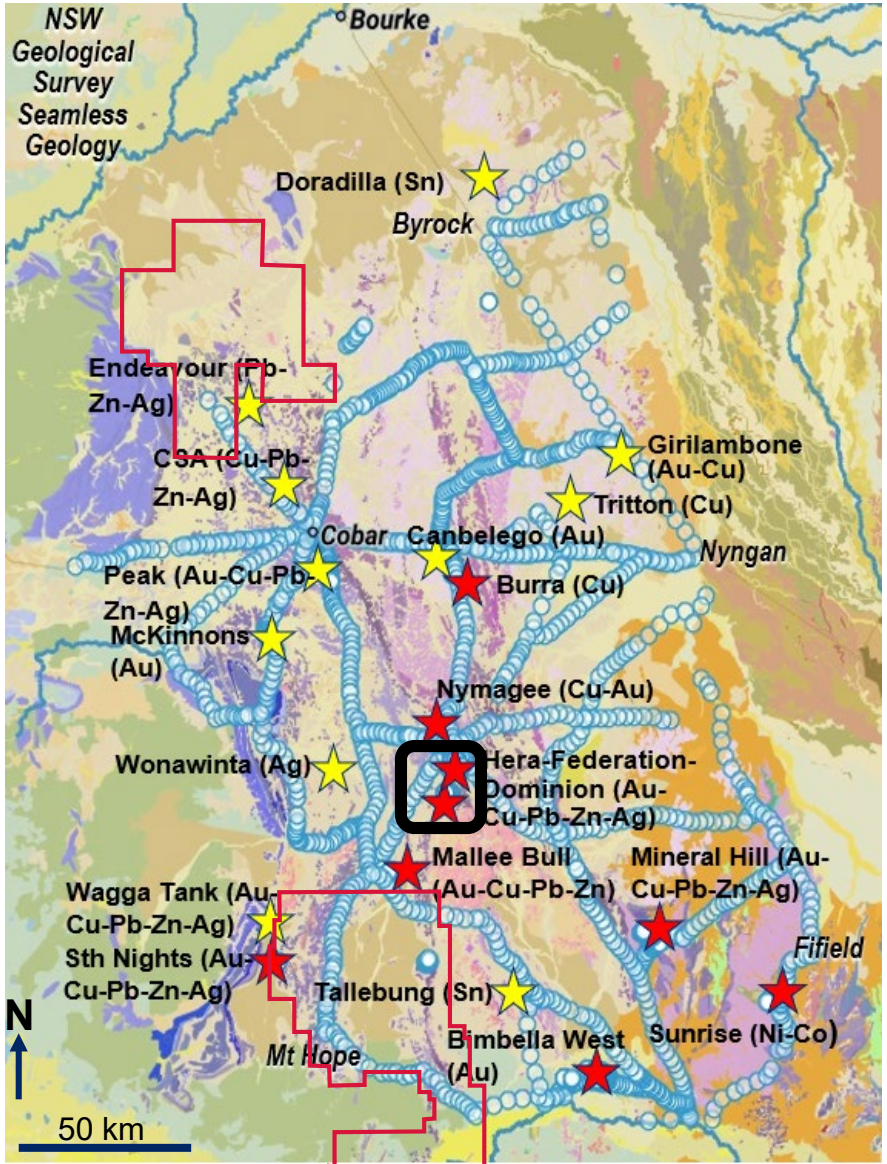




Source: ASX announcement – 03/05/21

Cobar biochemistry – Joe Schifano PhD (UNSW)

- Study area covers ~42,000 km^2 or 5.2% of NSW!
- Sampling Cypress Pine trees
- 1,330 low density regional samples along roadsides (MinEx CRC funded assays)
- 10 high density deposit / mine sites and prospects for 1,040 samples (all industry funded)
  (***Aurelia Metals, Peel Mining, Golden Cross Res, Clean Teq, 3E Steel Pty Ltd, Quintana Res.***).
- Potential sample sites: funding/access/time dependent
- 2,370 pine samples for 66 elements assayed MSA06 microwave digest/ICP-MS at LabWest



Cobar biogeochemistry & soil geochemistry

- Pb, W, Cd (for Zn), Sb, As are showing excellent potential as vectors to mineralisation (biogeochemistry)
- Standard soil and Ultrafine+ (CSIRO) soil geochemistry are highlighting other chemical vectors – ongoing work

ICP-MS pines and soils

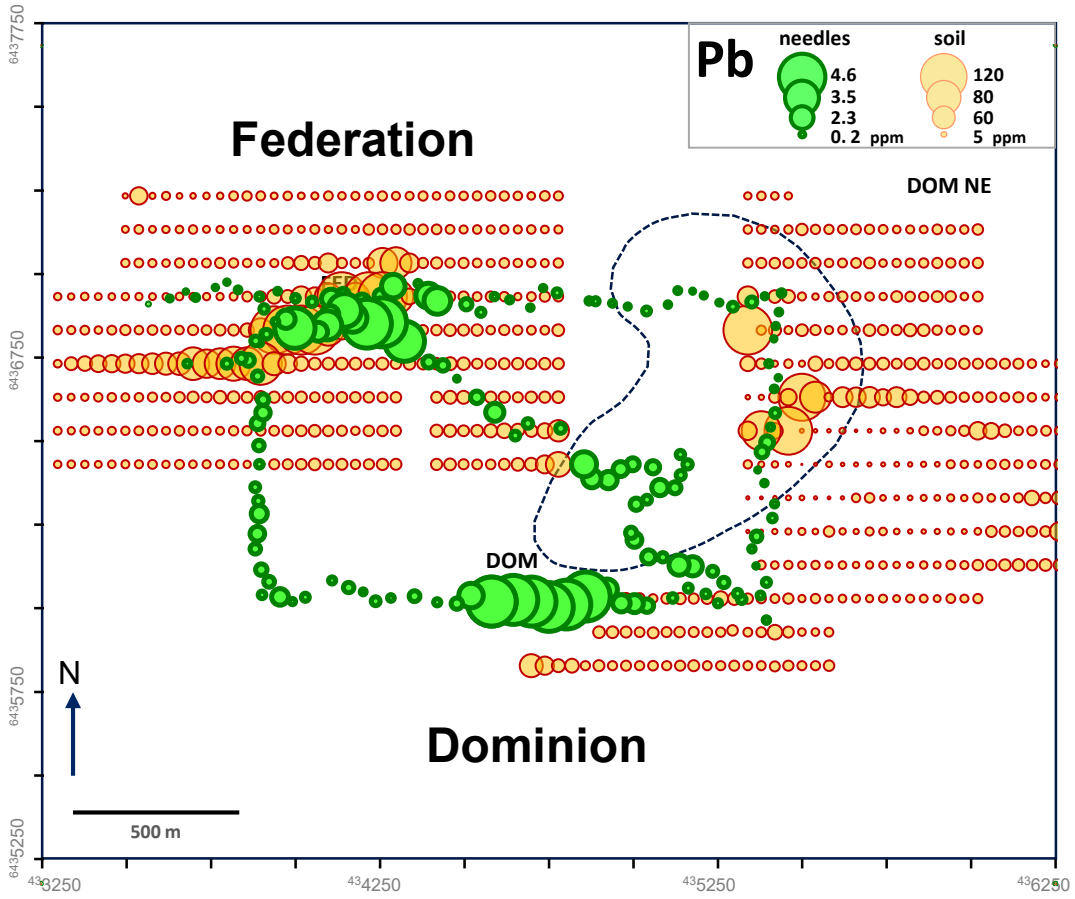
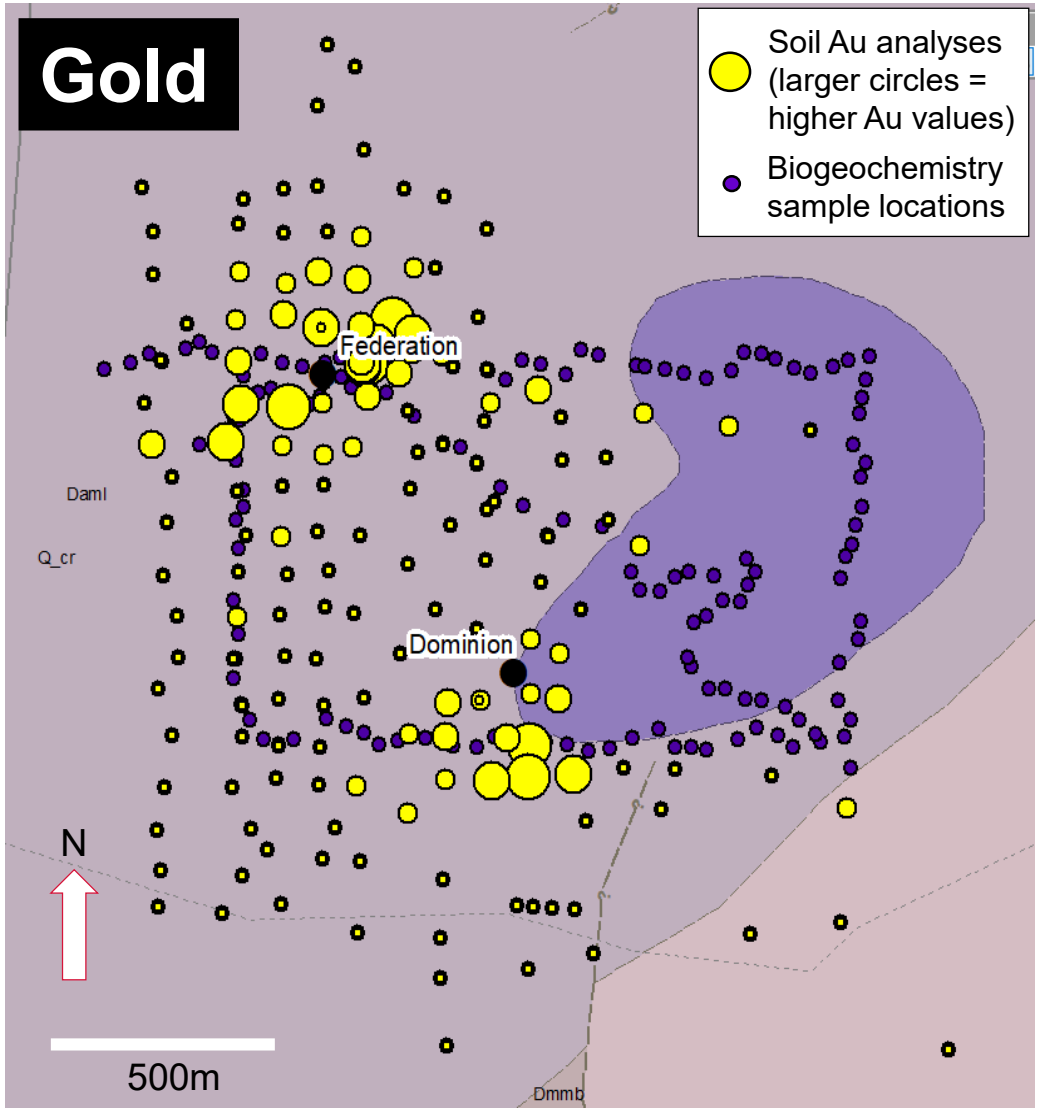


Image courtesy of Joe Schifano, UNSW.

Cobar Ultrafine+ soil geochemistry

- CSIRO-led collaborative project
- Technique has the ability to ‘see’ anomalies that are not apparent in standard surface geochemistry datasets
- 270 soil samples from Wagga Tank - Southern Nights and 163 Federation/Dominion soil samples submitted to compare with biogeochemistry



NSW GOVERNMENT

LABWEST

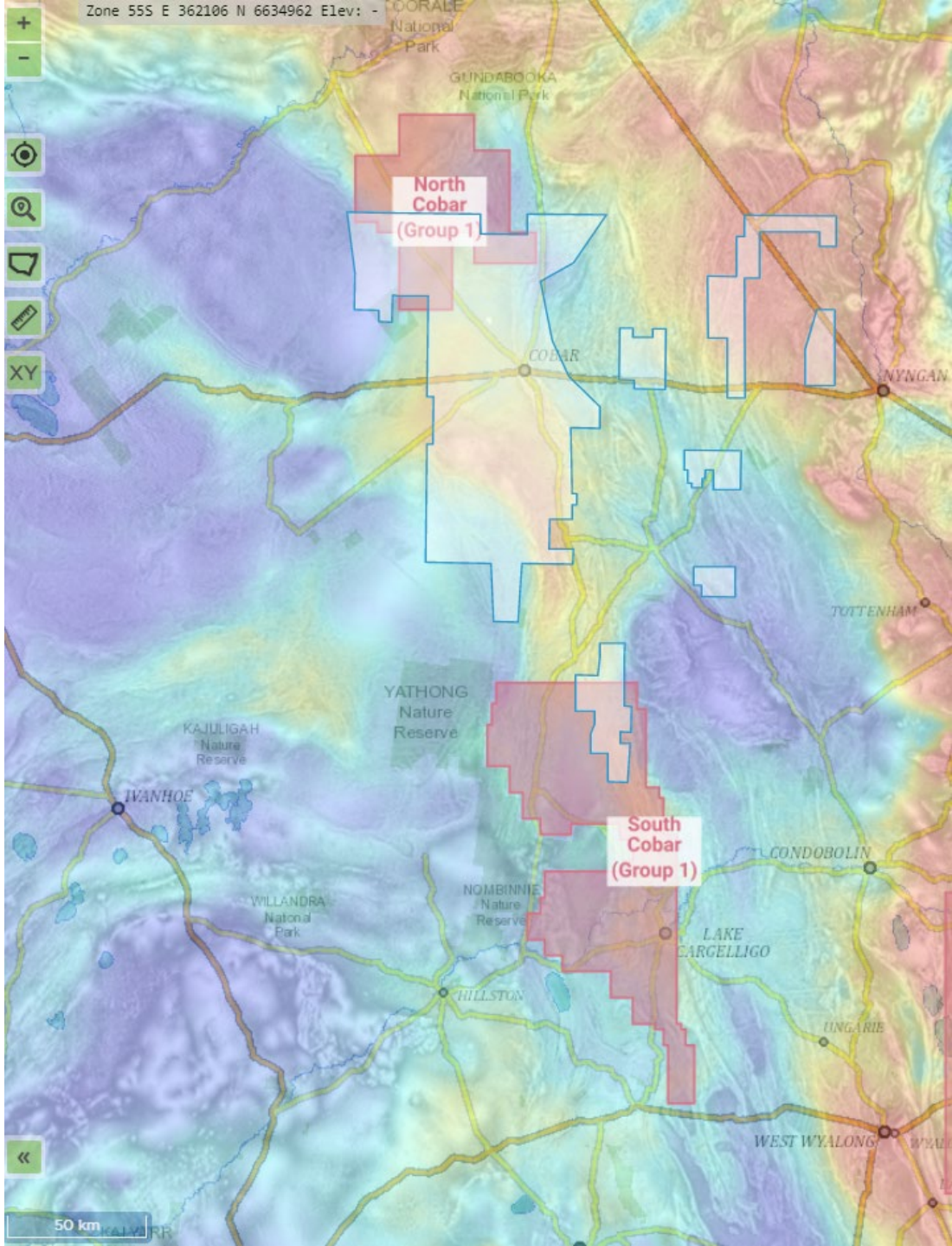
CSIRO

Future work

NSW GOVERNMENT

Cobar Airborne Mag–Rad (AMR) survey

- Will be acquired May–July 2021
- Infilling gaps and improving (old) data
- EOI for company infill occurred – closed 19/3/21. Four submissions being assessed
- Data available late 2021:
  - MinView (https://minview.geoscience.nsw.gov.au/)
  - Geoscience Australia Portal (portal.ga.gov.au).



Future work

- Characterisation of cover sequences, basement rocks and key interfaces:
  - spectral scanning (HyLogger™) of legacy drillholes and rock units from key sections
  - geochemistry, geochronology, palynology, petrophysics
  - also various university researchers and student projects.
- Further integration of data into a 3D workspace (e.g. AEM interpretation, drillholes, waterbores, HyLogger™, geology, faults)
- NDI drillhole site selection (and prioritisation), then drilling starting in 2022 (North Cobar)

MinEx CRC 3D DRILLING

NSW GOVERNMENT

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