



Exploring Australia for sediment-hosted copper

Insights from Northern Territory basins

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Objective and scope of this presentation

How to generate and advance sediment-hosted copper exploration projects in areas with different data density and quality?

Build a narrative supported by observations, collect new data to address specific knowledge gaps, and drill to test your hypotheses.

... and don't forget to thank people who collect pre-competitive datasets.



Outline

Who are we and what are we looking for?

The Northern Territory: A land of opportunity

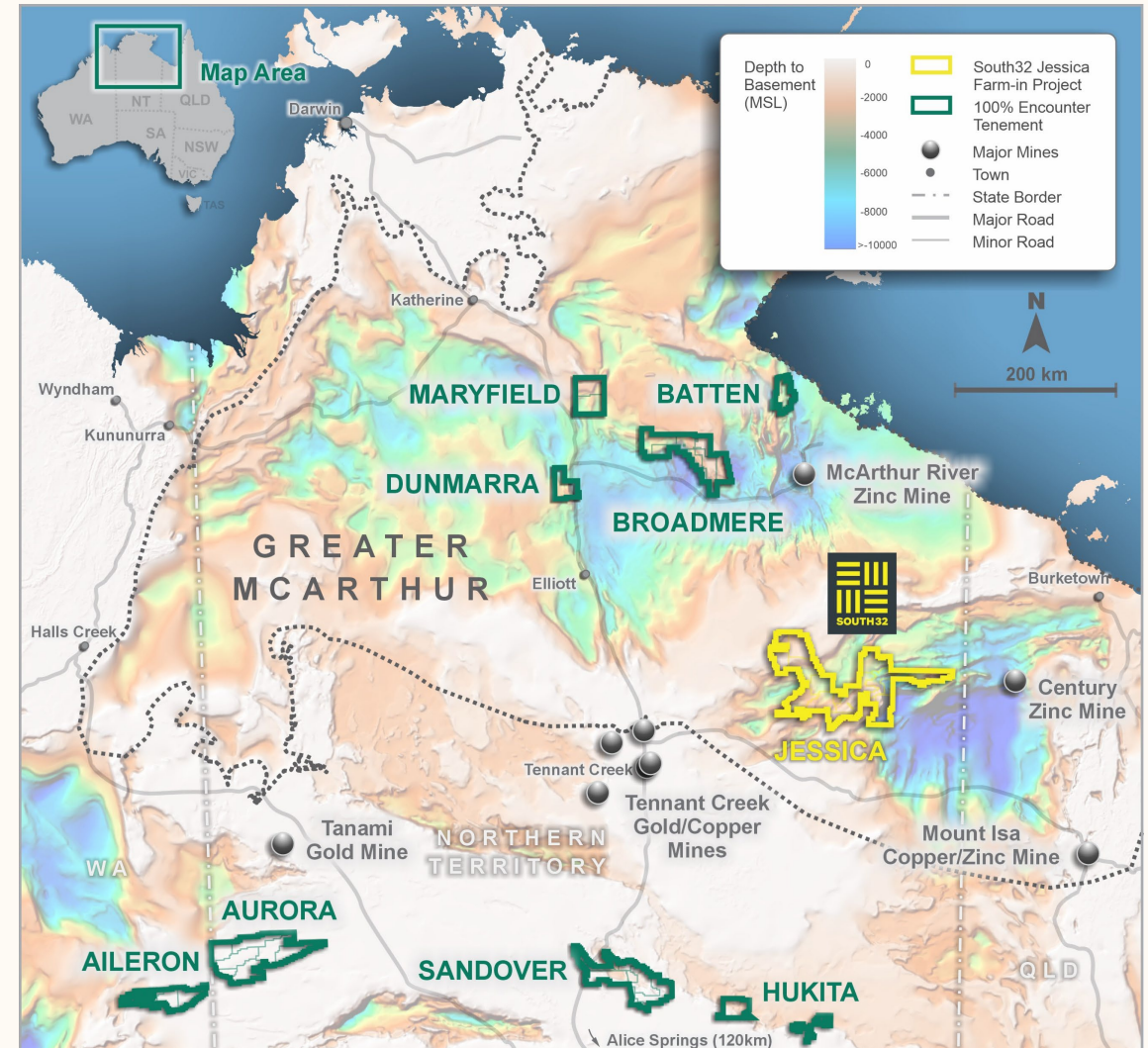
Developing and applying a mineral systems approach

How to advance exploration for sediment-hosted Cu systems?



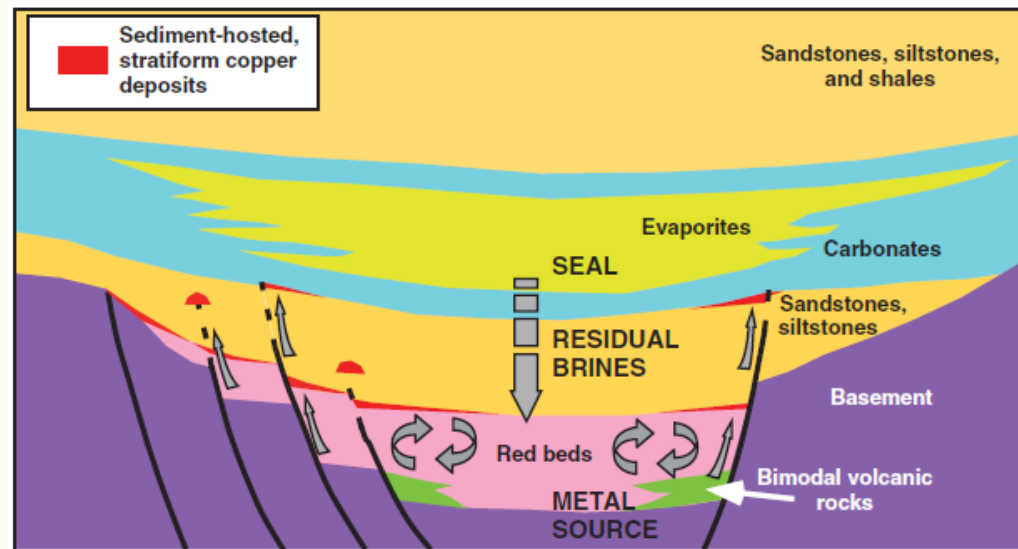
Encounter Resources NT project portfolio

- **Global decline** in mined copper grades and discoveries.
- **Sediment-hosted copper** emerging as an **important deposit style** – proliferation in Zambia and growth in the DRC.
- Northern Territory (NT) holds the Greater McArthur and Georgina basins known to host **world-class sedimentary-hosted mineral systems** (Mt Isa, McArthur River and Century).
- Highly prospective, **vastly underexplored** regions under shallow cover.
- **Historical difficulties** exploring in NT – sediment-hosted systems have limited direct exploration techniques and basins are largely undercover.



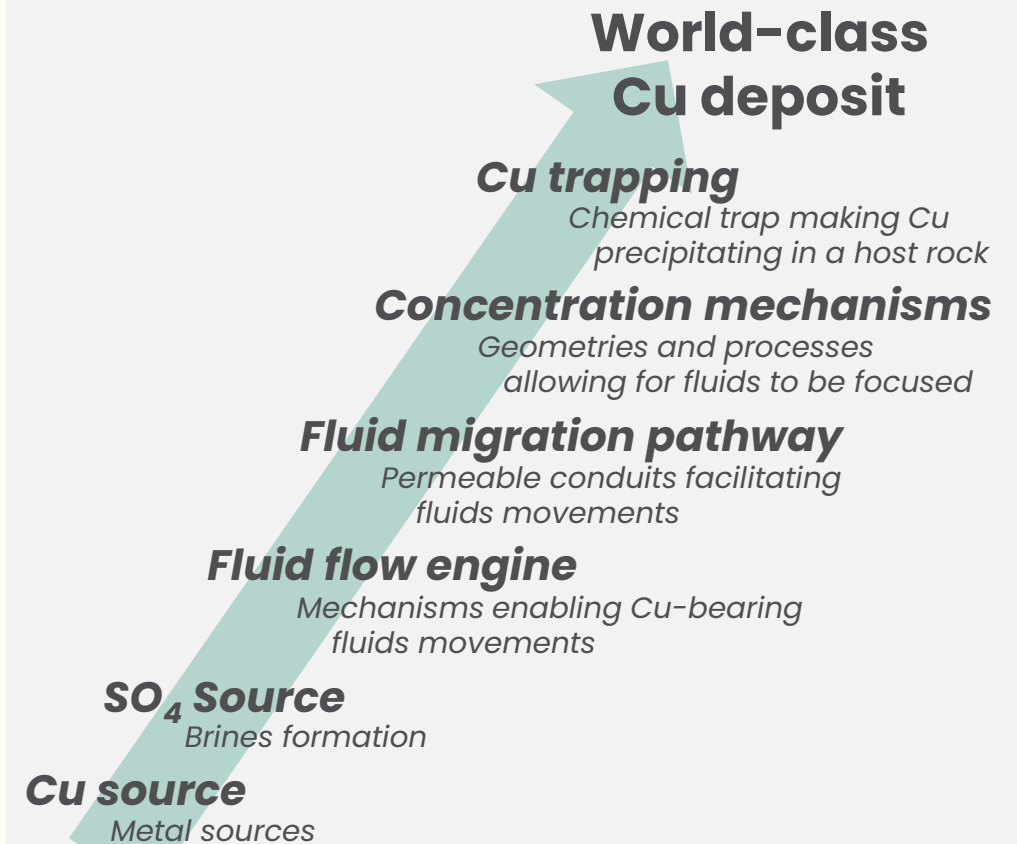
A mineral systems approach

- New precompetitive datasets have provided crucial early insights into areas prospective for **sedimentary hosted copper** deposits.
- Encounter has built on these datasets and is using a **mineral system framework** to focus its exploration and define drill targets.



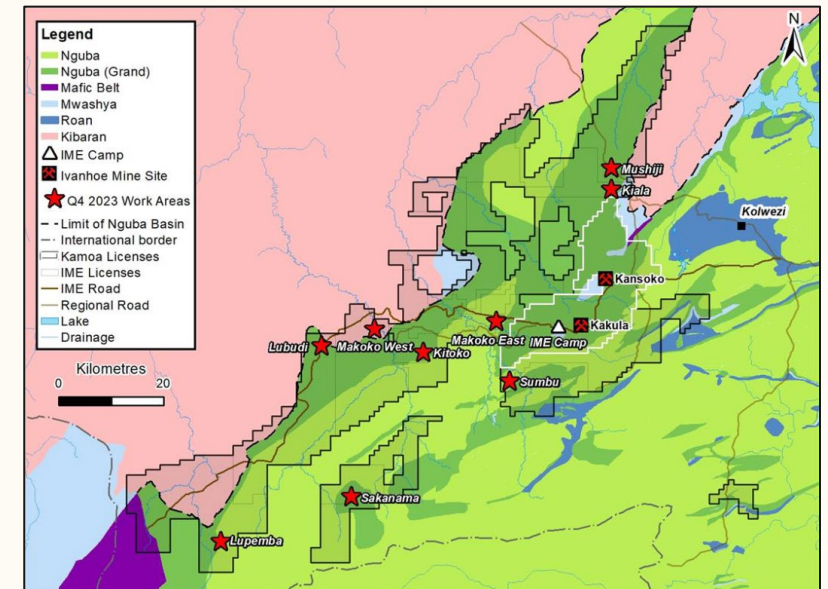
Hitzmann et al. (2010)

Encounter's approach to Sediment-hosted Copper deposit exploration

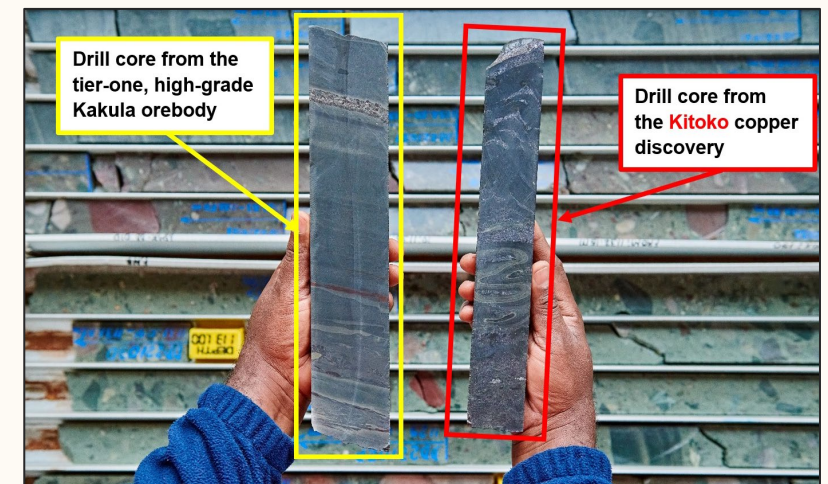


An example: the African copper belt

- Sediment-hosted copper systems are believed to contain more than **250 Mt of Cu metal**¹.
- Deposits example include the **Kamoa deposit**:
 - **759Mt @2.57% Cu**,
 - Hosted in Neoproterozoic Grand Conglomérat,
 - Inverted rift system,
 - Redox boundary at the base of the Grand Conglomérat,
 - Cu-rich fluids mobilized through inverted faults and permeable sedimentary layers.
- These deposits are **high-grade** (>1.5% Cu) with copper sulphides (e.g. Chalcopyrite, Bornite).



Ivanhoe mines' Western Foreland project - 2024



Ivanhoe mines' Western Foreland project - 2024

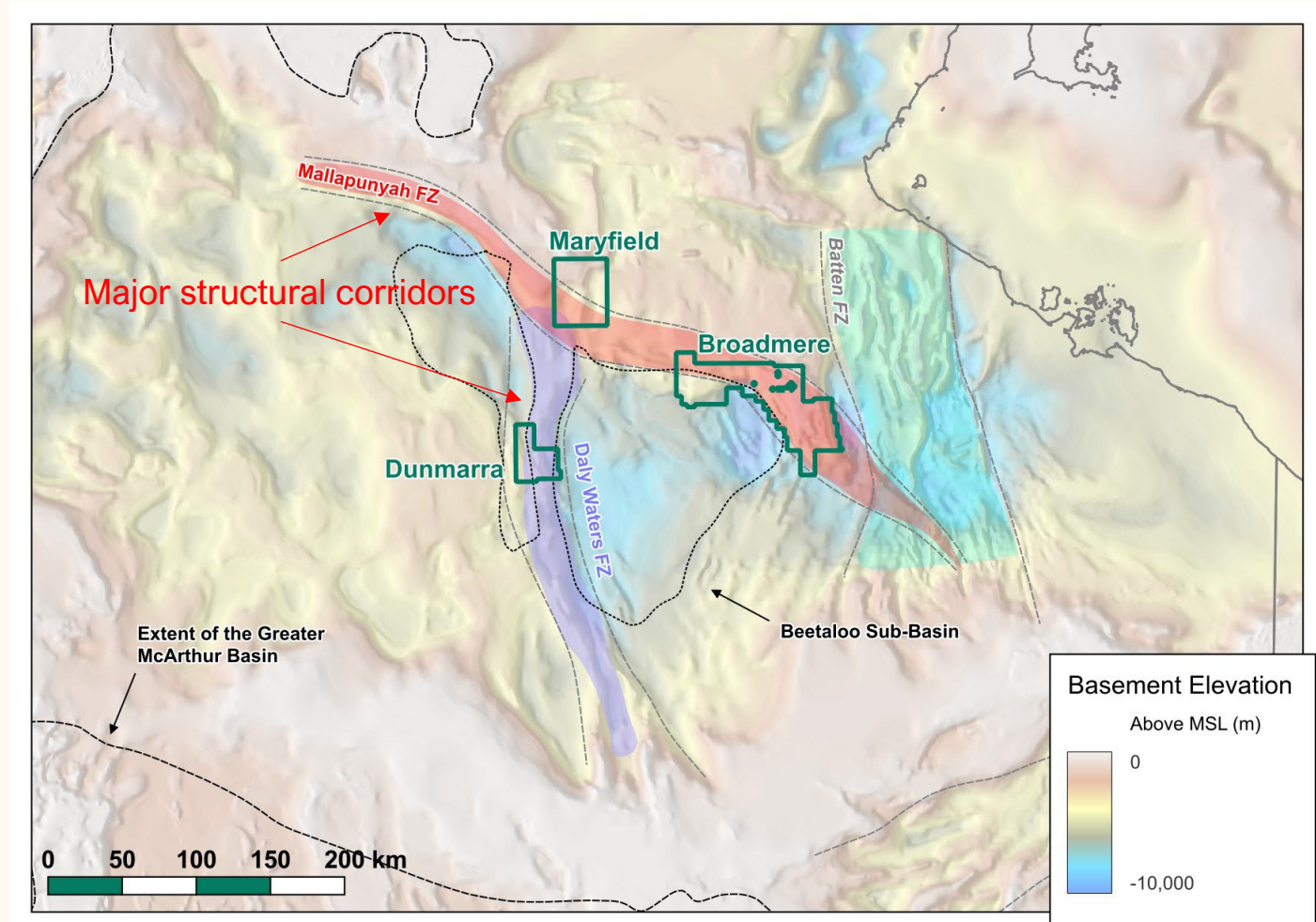
Available datasets

- Both **data availability and relevance** are paramount to progress exploration projects **from good concepts to great drill targets**.
- **High quality data are useless without context.**
- Encounter's NT projects present various data availability, quality and coverage:
 - From Maryfield, with great potential field data, geological mapping, and sparse drilling data,
 - Through Dunmarra, with a great 2D Seismic data but no drilling data on the project,
 - To Sandover, with proof of process but no direct imaging tools.



The Greater McArthur Basin

- The Proterozoic Greater McArthur basin was **deposited on the Northern Australian Craton.**
- The main, **long-lived, structures** observable today in the basin are **inherited from Archean sutures in the basement.**
- **Encounter's projects are located on these major structures:** the Daly Waters FZ and the Mallapunyah FZ.
- All the projects are located on the **margin of the Beetaloo Sub-basin**, a confined Mesoproterozoic depocenter.

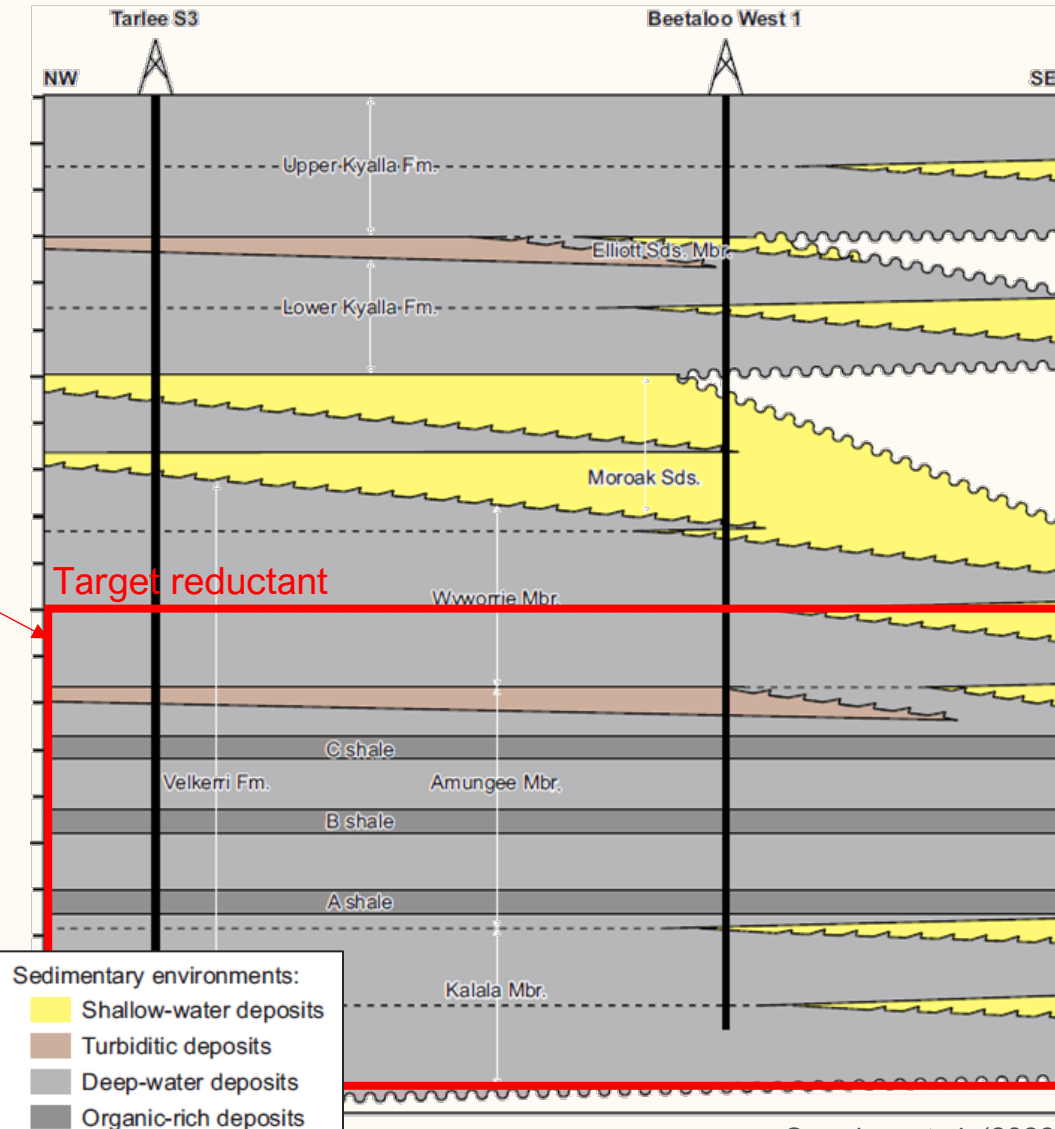


Background from OzSeebase

The Beetaloo Sub-basin and the Velkerri Formation

- The Beetaloo Sub-basin contains sediments spanning from the **Paleoproterozoic Redbank package**, to the **Mesoproterozoic Wilton package**.
- The Mesoproterozoic series are known to host the **Velkerri Formation**, a **black shale** with **proven hydrocarbon generation potential**.
- Recent work on the Velkerri Formation prove the **regional extent of this thick blanket of reductant**.
- **Prospective area** for a large Cu-system are interpreted in zone of **structural complexity**, on the edges of the sub-basin.

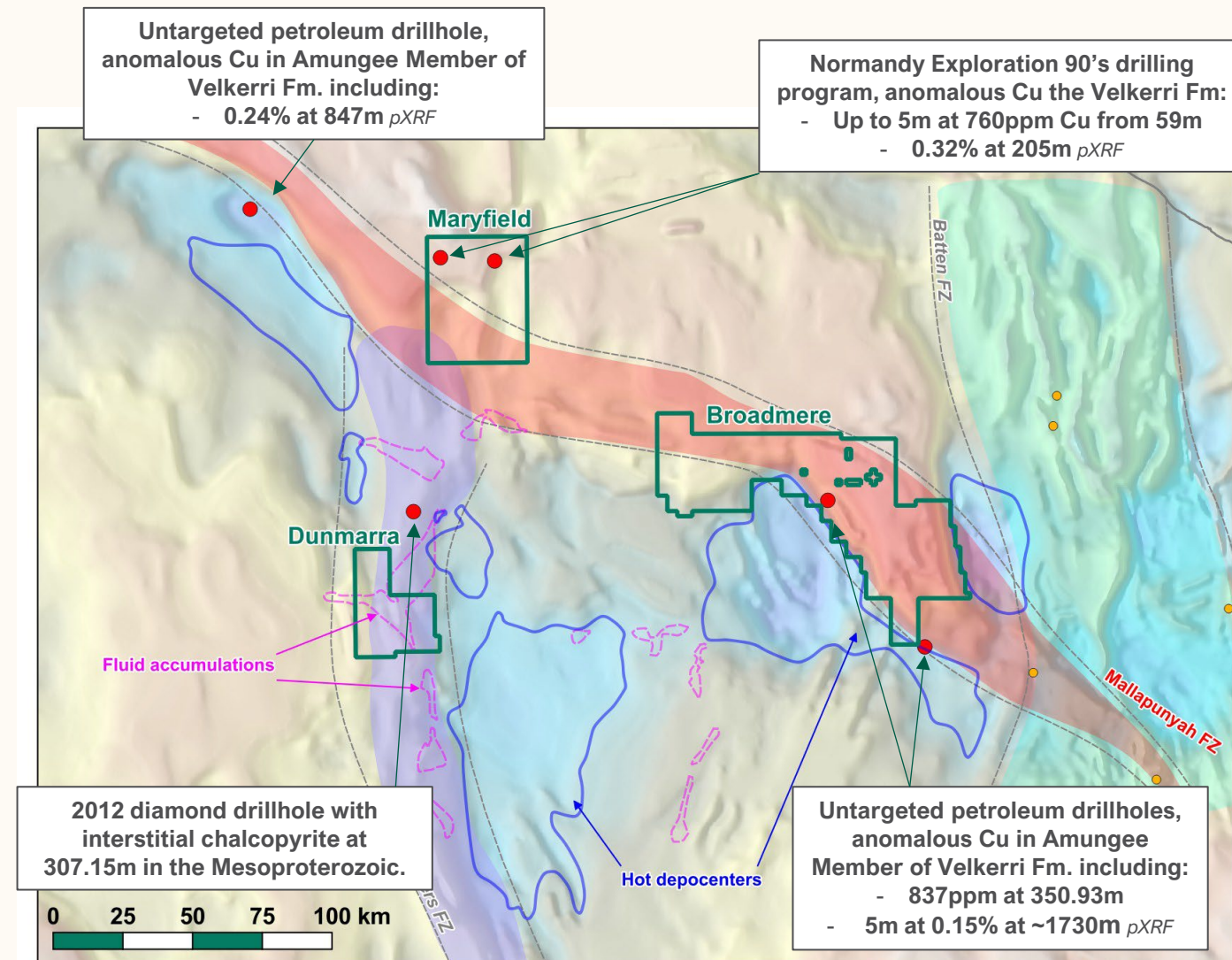
Tarlee S3



Crombez et al. (2023)

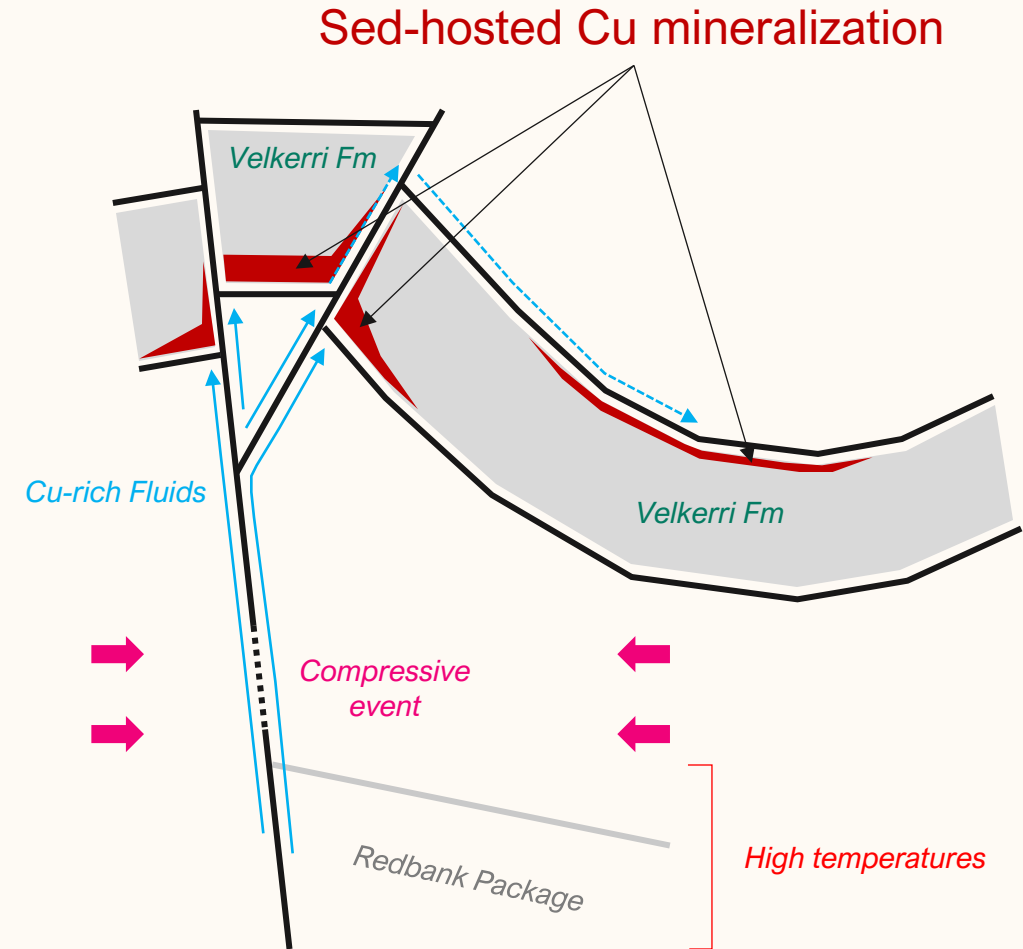
Understanding the distribution of Cu anomalies

- To support a conceptual targeting model for a Cu system on the edges of the Beetaloo, Encounter undertook a **systematic review of historical drillhole data**.
- **Multiple Cu anomalies were identified** in Mesoproterozoic sediments along the Malapunyah and Daly Waters FZ.
- Furthermore, petroleum system **modelling approaches enabled the simulation of the thermal evolution** at the base of the Sub-basin.
- This approach showcased **high (>300°C) temperatures under multiple depocenters** which can enable a SO_4 -rich fluid to leach Cu from source rocks.

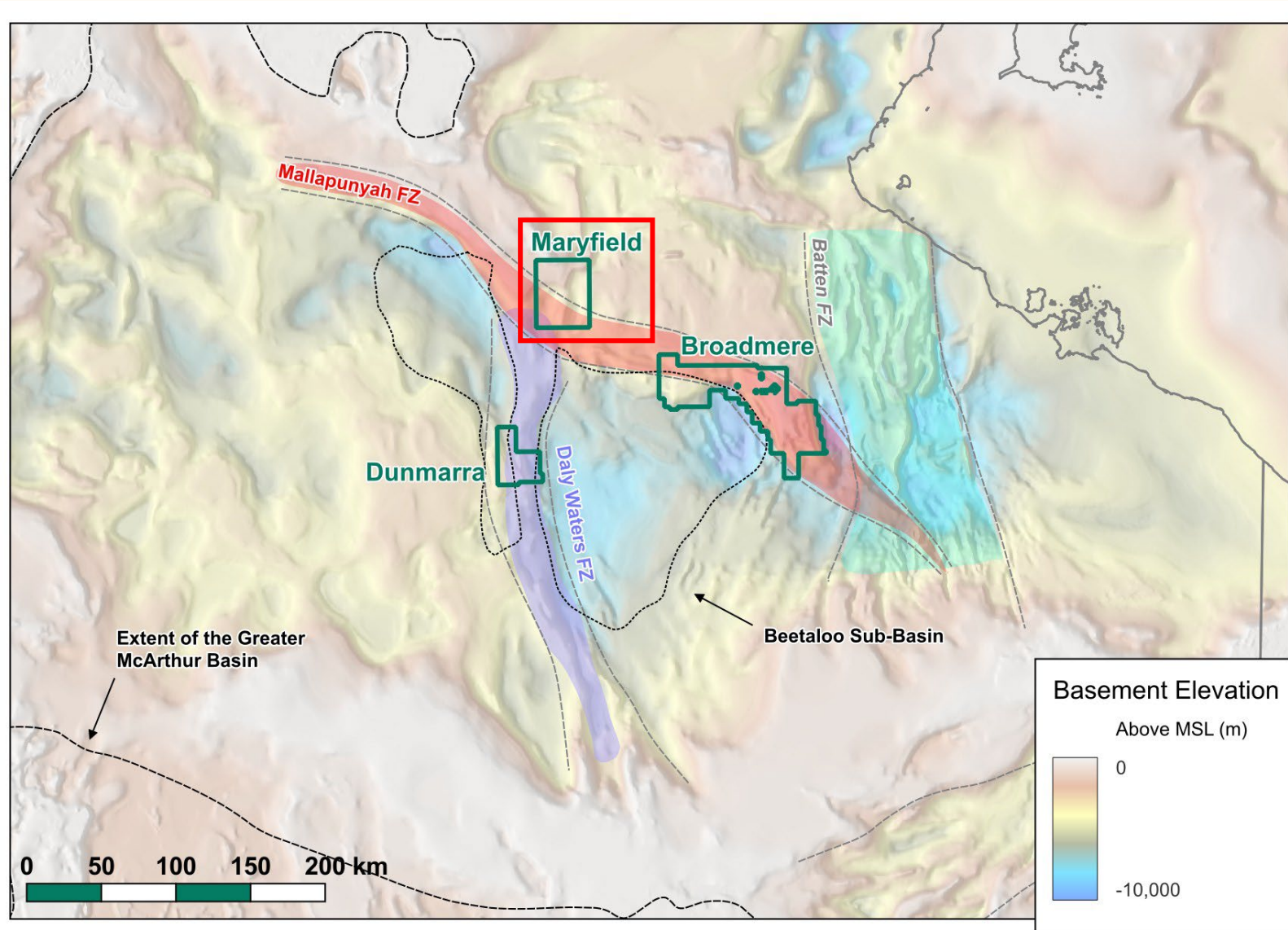


Mineral system framework for the McArthur projects

- **Long-lived structures** inherited from Paleoproterozoic and Archean basement architecture **create a deep plumbing system**.
- **Hot aquifers, located in deep compartmentalized depocenters** of the Beetaloo Sub-basin, are **capable of leaching Cu** from Paleoproterozoic rocks.
- O&G and historical exploration have demonstrated **the regional extent of a thick reductant** across the Beetaloo Sub-basin.
- **Multiple copper anomalies** are documented along the Mallapunyah fault zone and **attest the occurrence of Cu-rich fluids movement** during one of the multiple inversion event documented in the area.



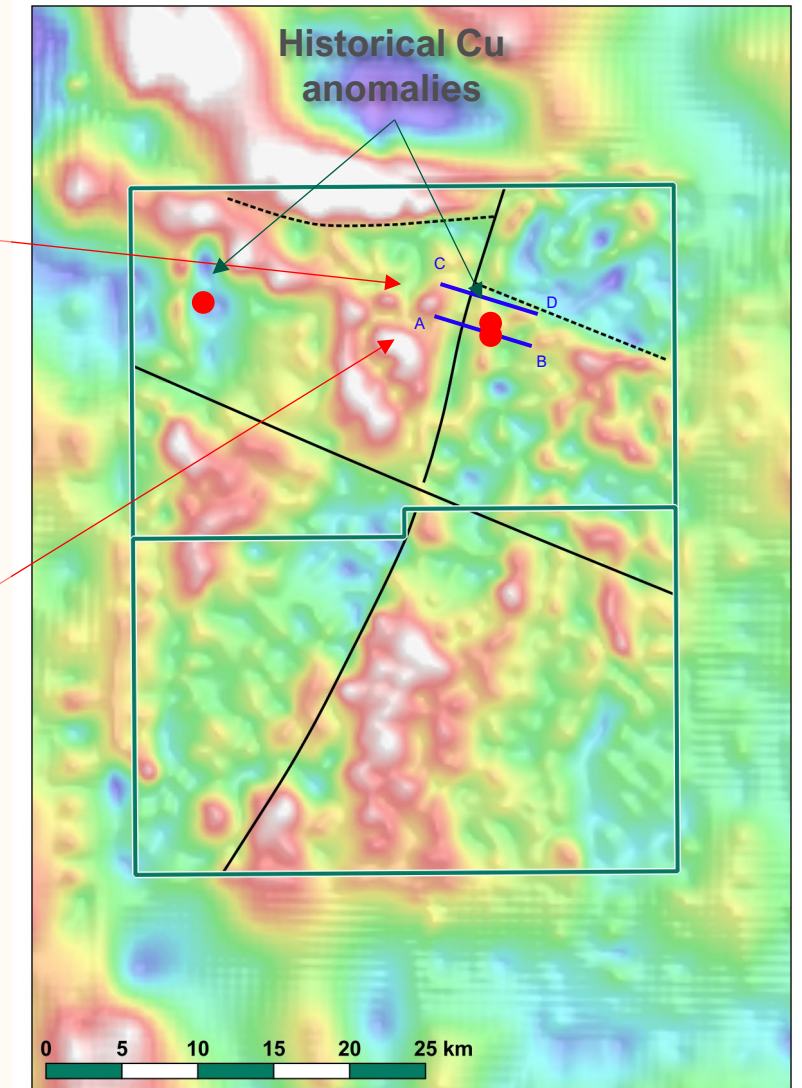
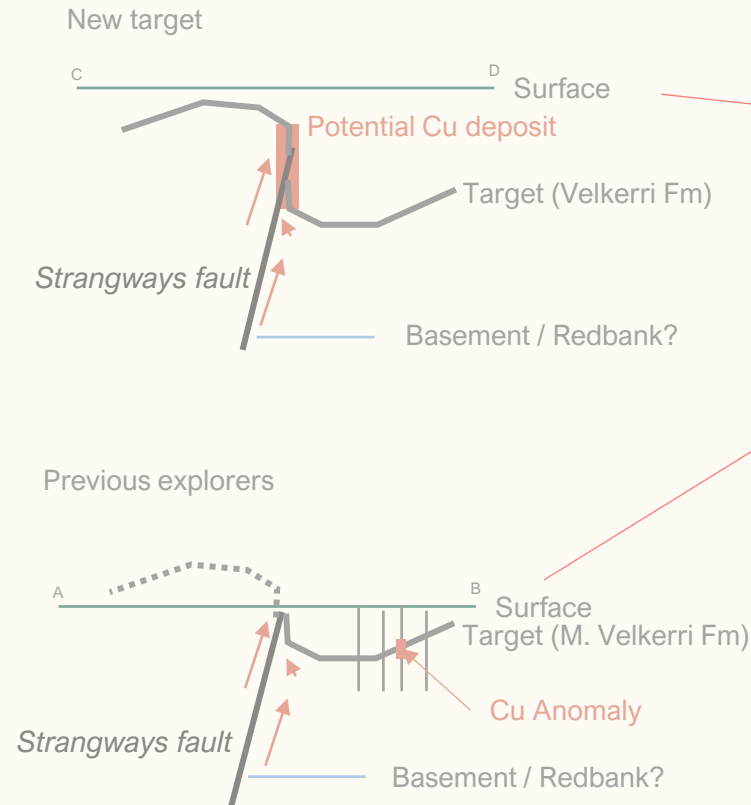
Encounter Resources Greater McArthur project portfolio



Background from OzSeebase

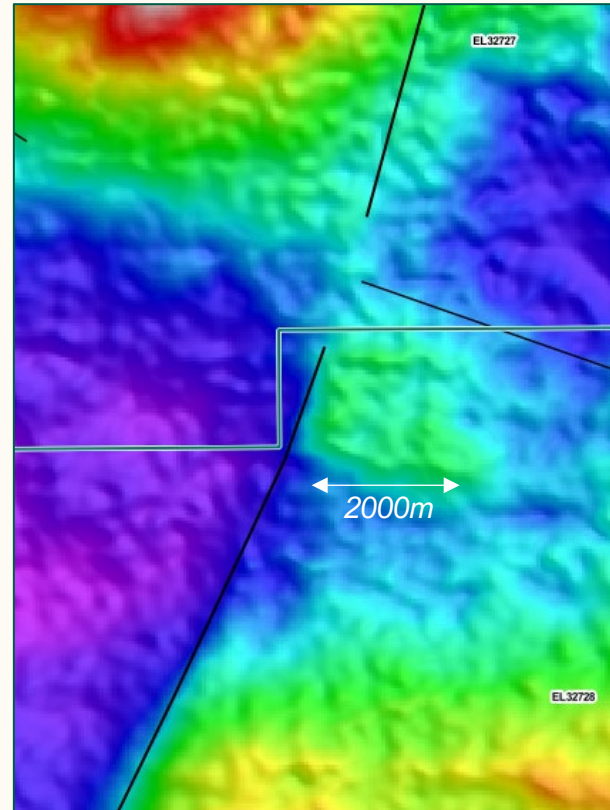
Building on previous exploration

- Ground gravity infill resulted in a great uplift in data quality.
- Previous explorers drilling results returned multiple intervals >450ppm Cu 3km East of the Strangways fault.
- Gravity infill interpretation suggests the occurrence of a structural intersection to the North of historical drilling.
- This network of faults will focus mineralizing fluids migrating from deep aquifers into the target reductant.

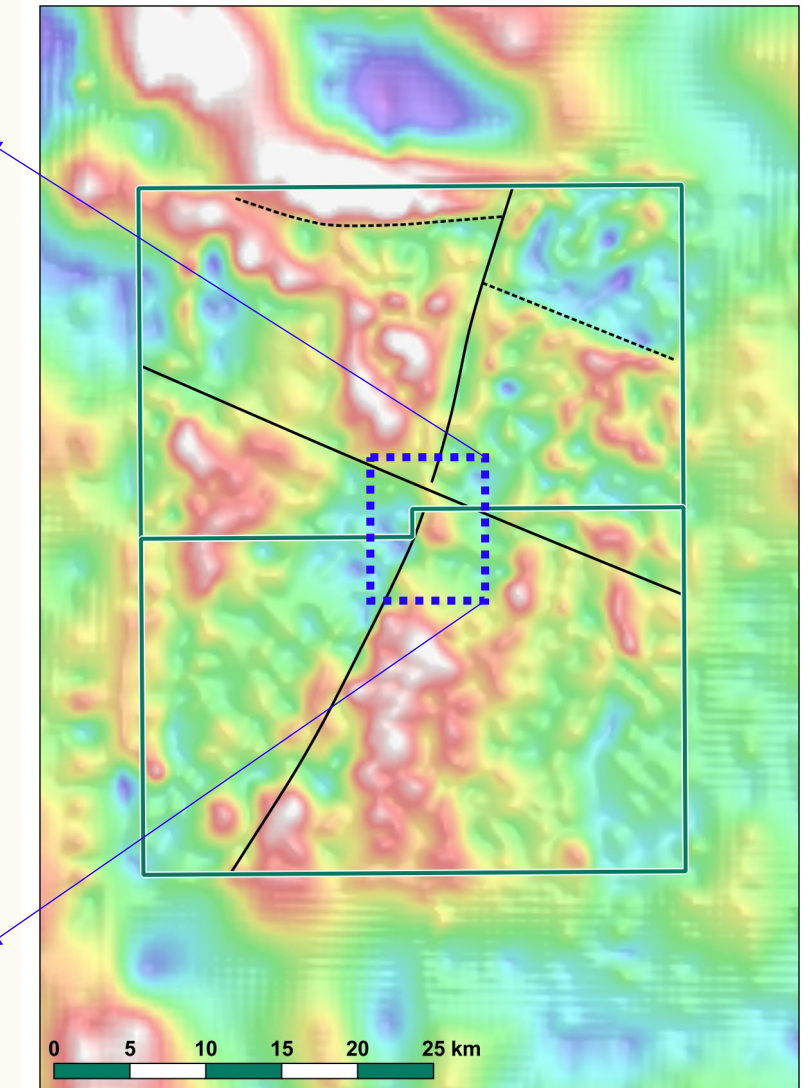


At the intersection of two continental-scale structures

- **Infilled gravity data interpretation highlighted an anomaly** at the intersection of the Strangways Fault and Malapunyah FZ.
- Also present on the Larrimah AGG survey acquired in 2003 to explore for diamonds in Kimberlites.
- Gravity inversion suggest a **shallow anomaly** (<500m) along the Strangways fault.
- Dense bodies are **interpreted as mineralized sediments** against continental structural elements.

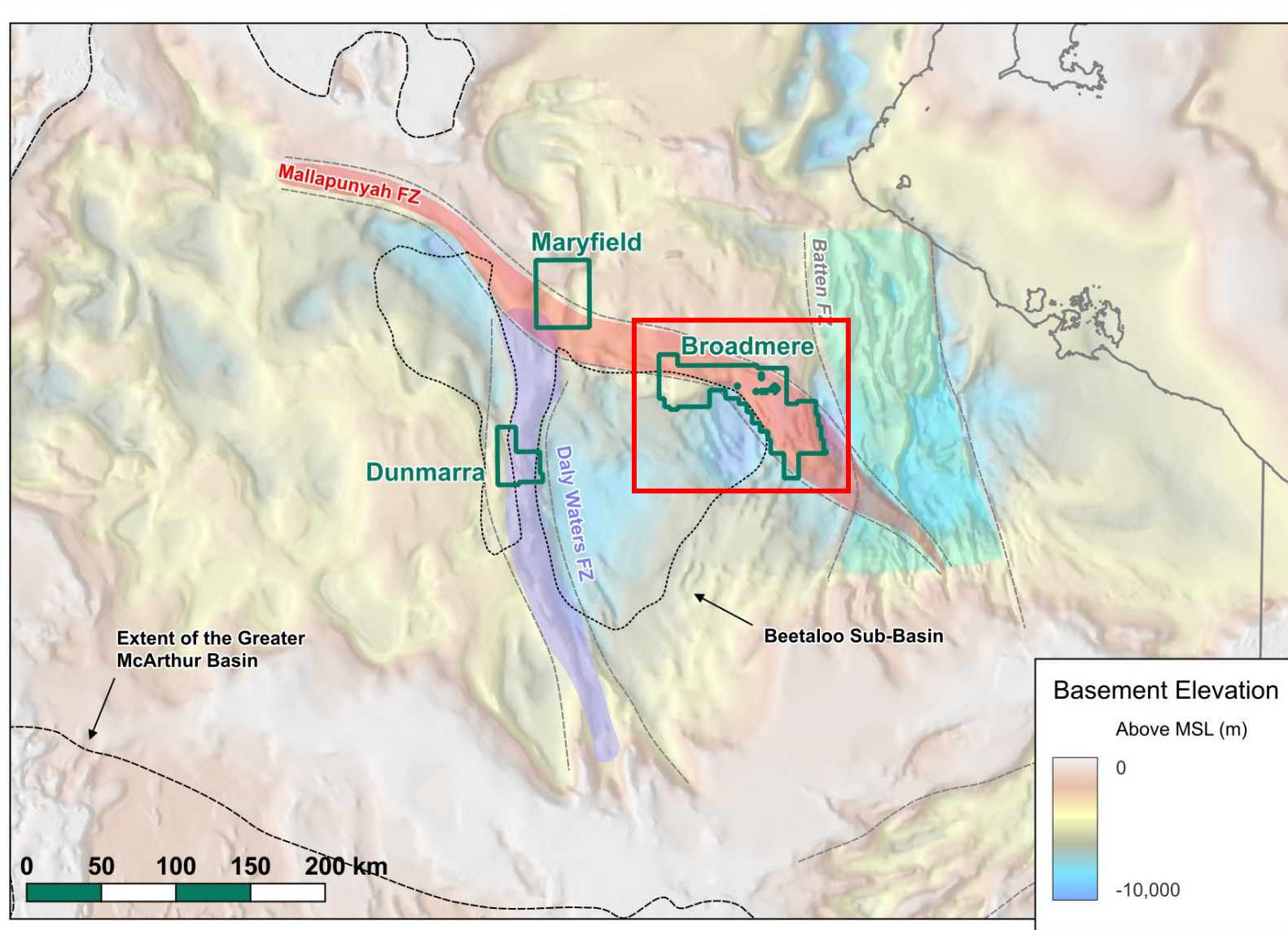


2003 AGG



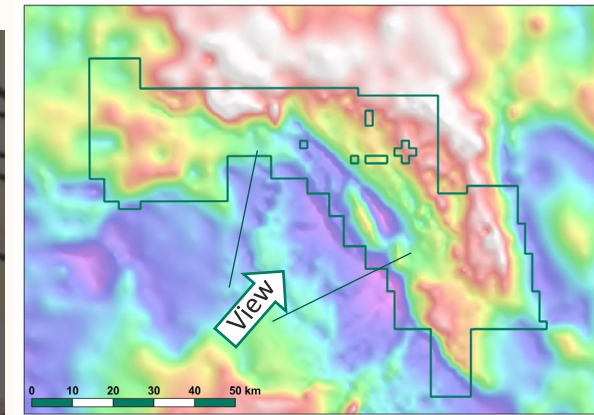
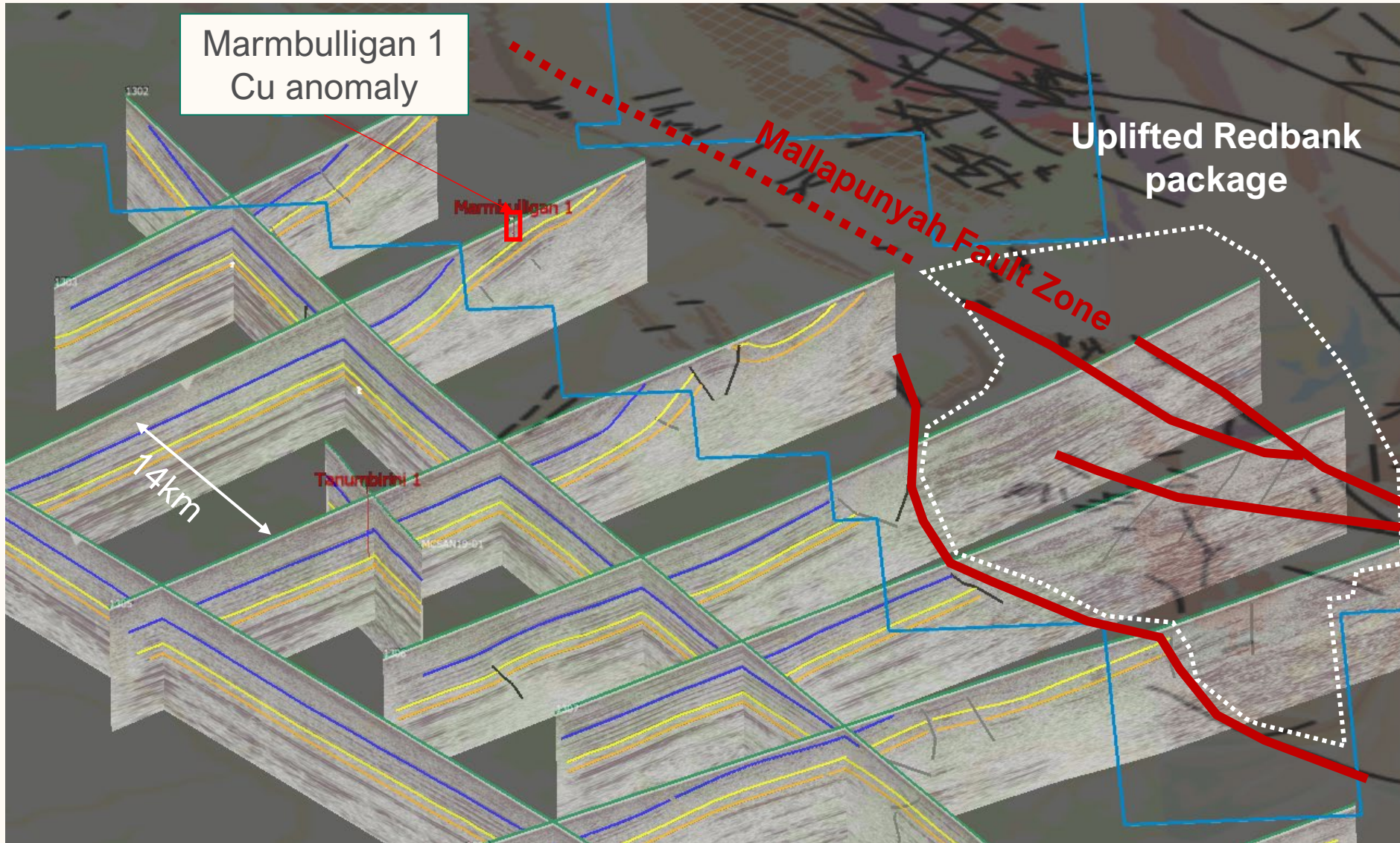
BA 1km residual

Encounter Resources Greater McArthur project portfolio



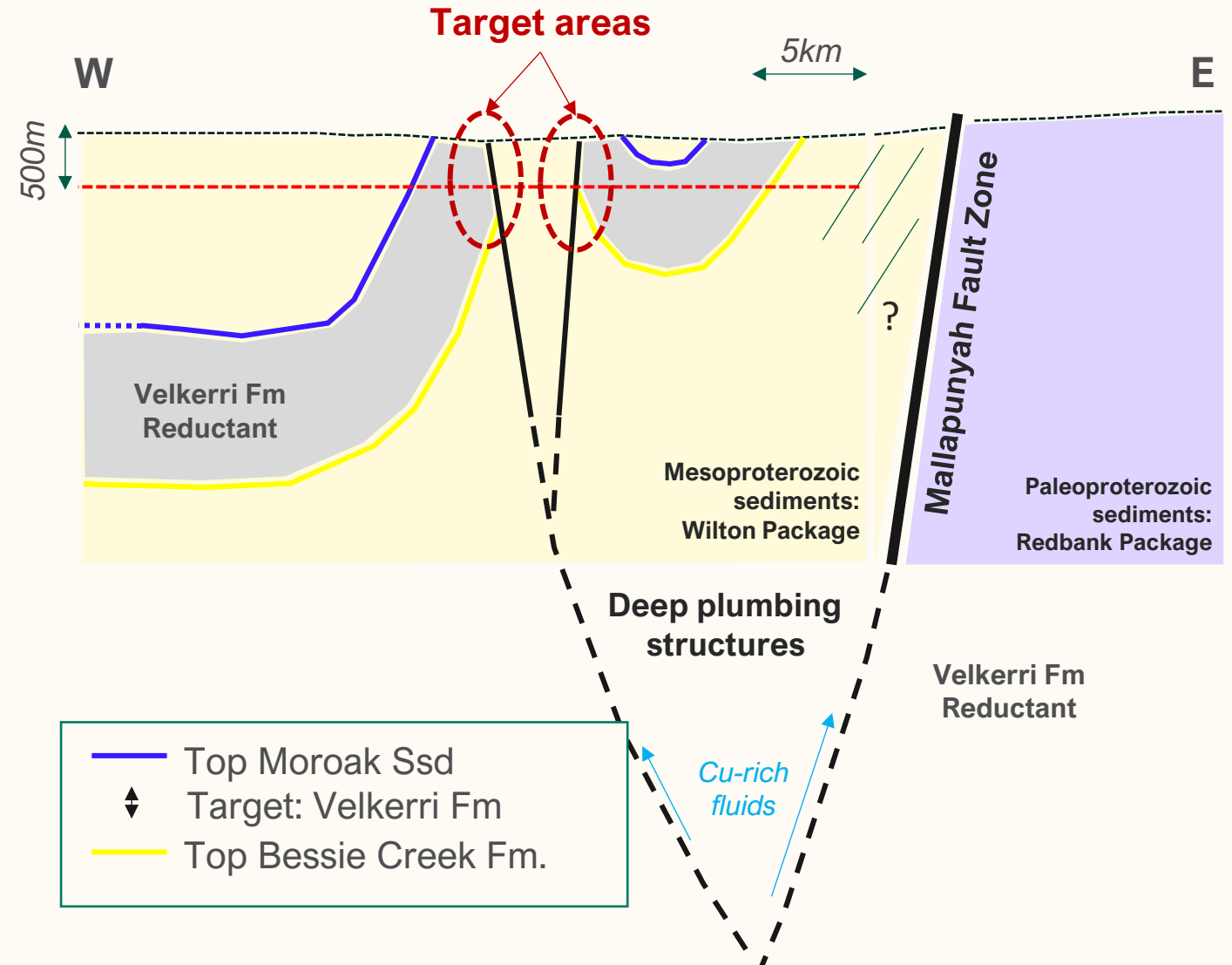
Background from OzSeebase

Imaging the relation between the reductant and a structure

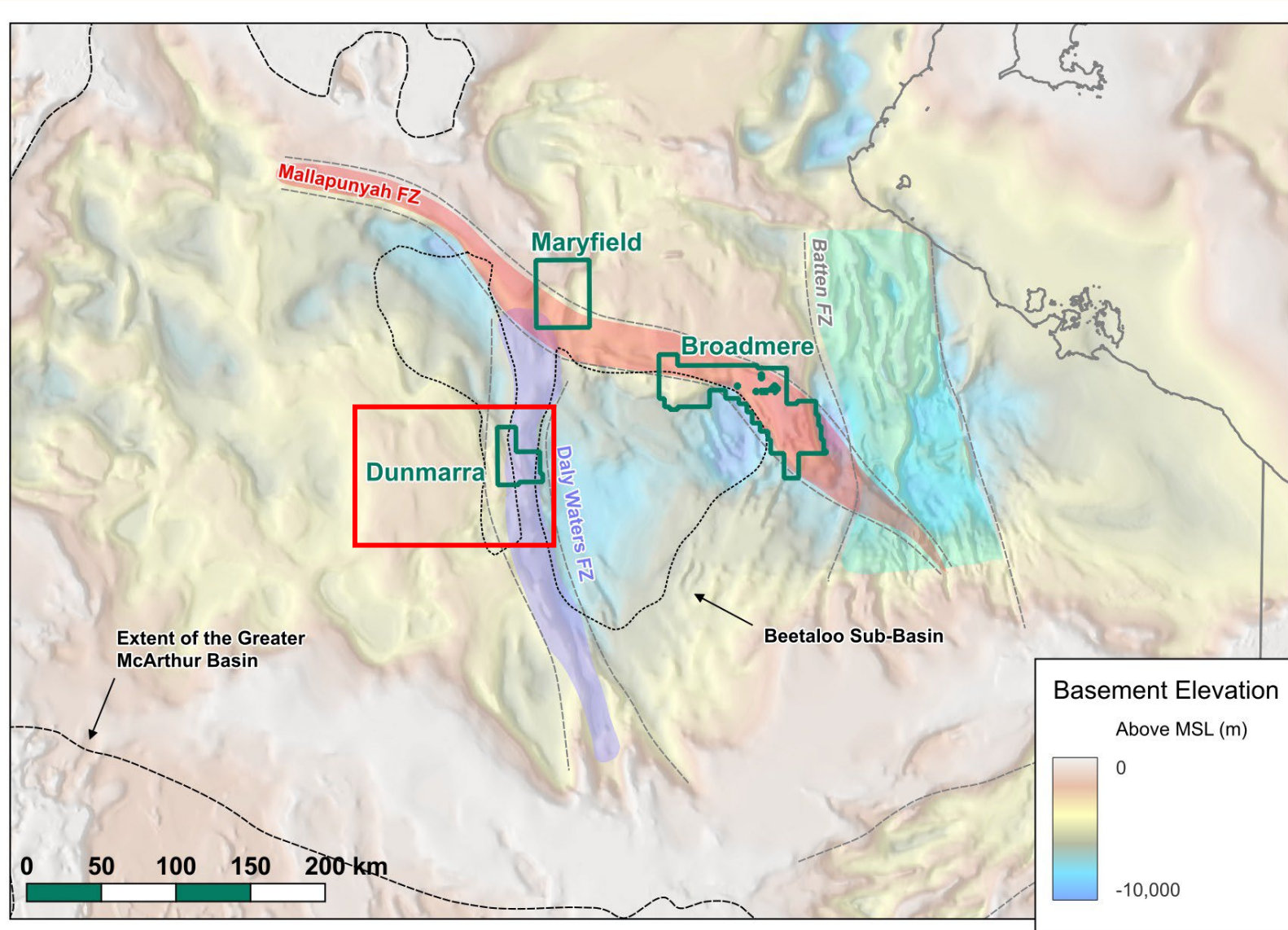


Leveraging observation on seismic data

- Seismic observation highlighted **compartmentalized mini-basin** adjacent to an uplifted Redbank package.
- **Velkerri Fm intersected by faults** that are **connected to the major structural elements**.
- The occurrence of **deep plumbing structures** along the Redbank inlier are interpreted as **pathways for mineralizing fluids** to migrate from deep and hot aquifers into the target reductant.
- **Drill targets can be defined on either side of a faulted anticline** connected to the Mallapunyah fault.



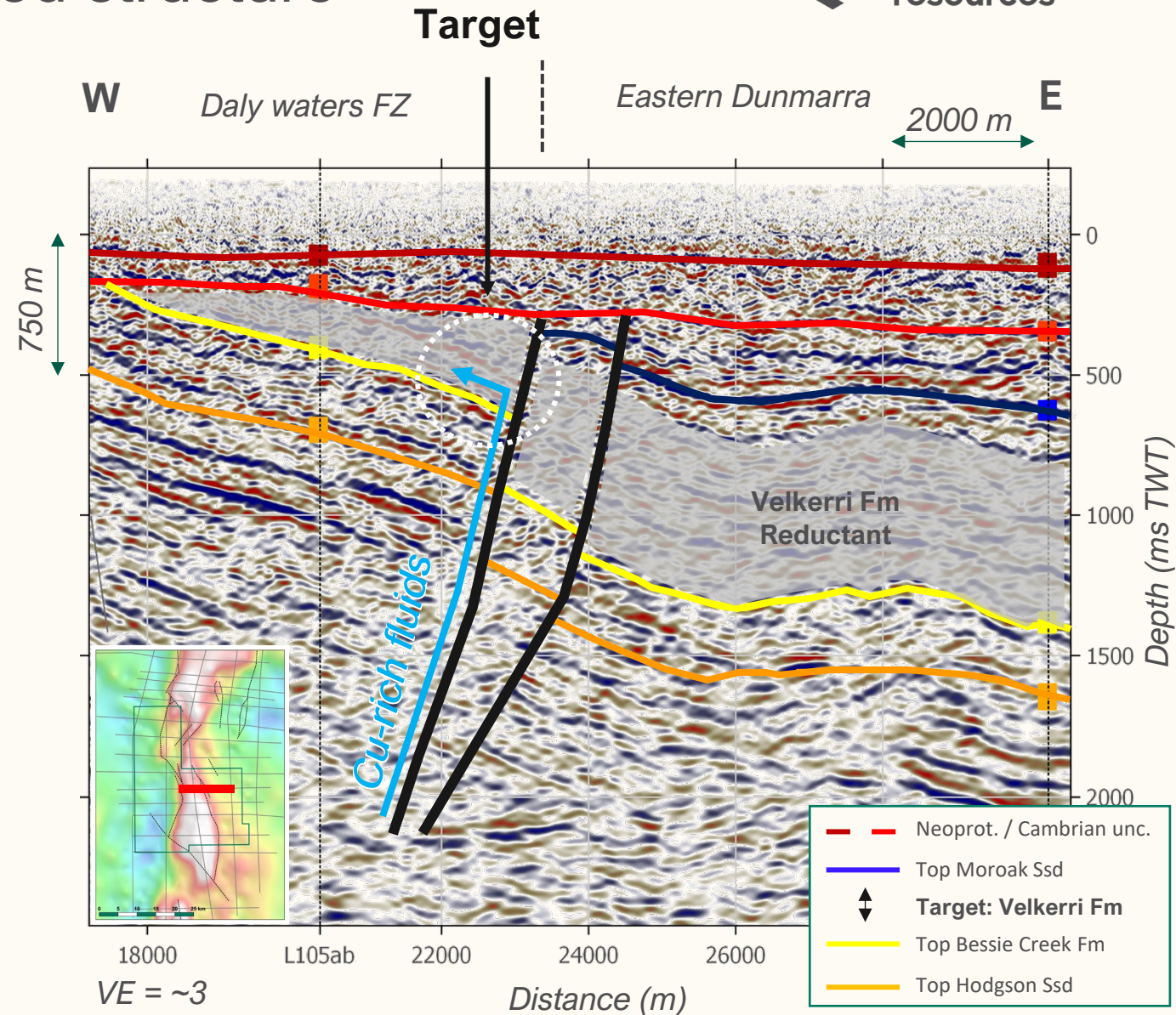
Encounter Resources Greater McArthur project portfolio



Background from OzSeebase

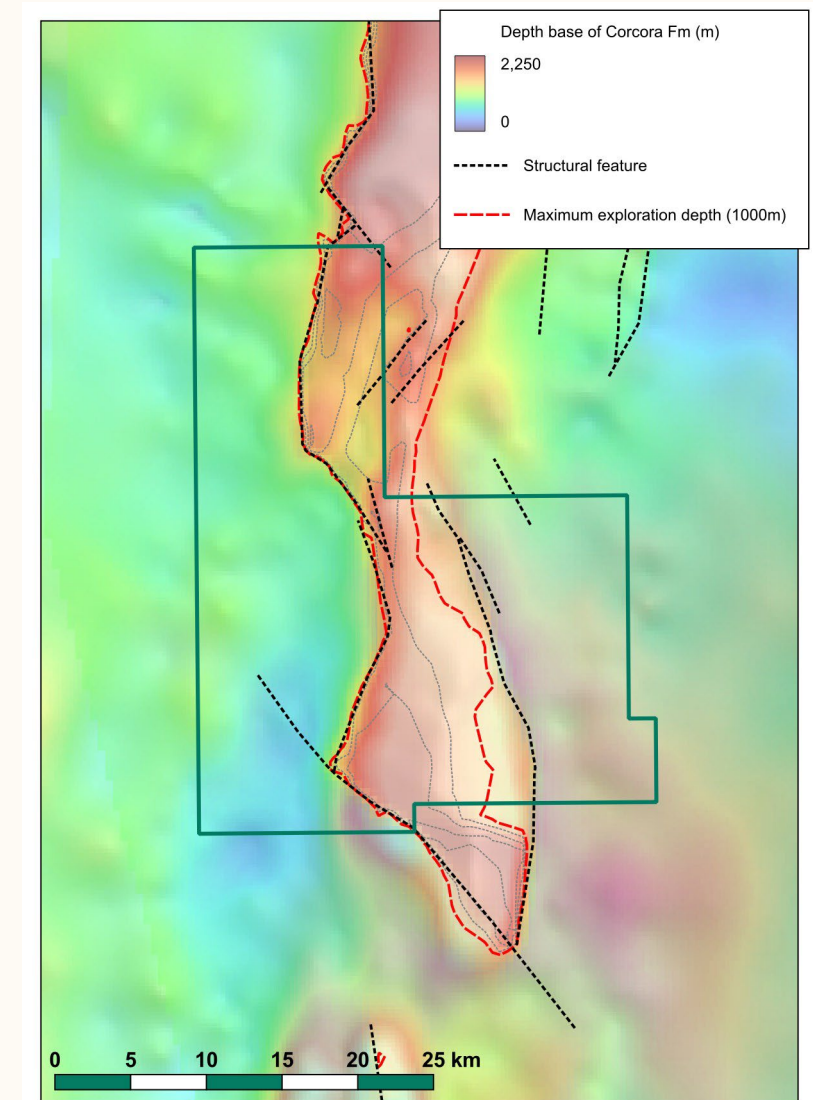
A reductant blanket on an inverted structure

- On each side of the Daly Waters FZ, the **Velkerri Fm** is intersected by inverted normal faults.
- The **offset** of these faults is greater than **250m**.
- These structures are interpreted as **fluids conduits**.
- It is likely these faults were inverted post-deposition of the Velkerri Fm and that **at the time of inversion and fluid migration, the Velkerri Fm was still continuously draping the Daly Waters FZ**.
- This further enhanced focusing the **Cu-rich fluids** in the reductant.



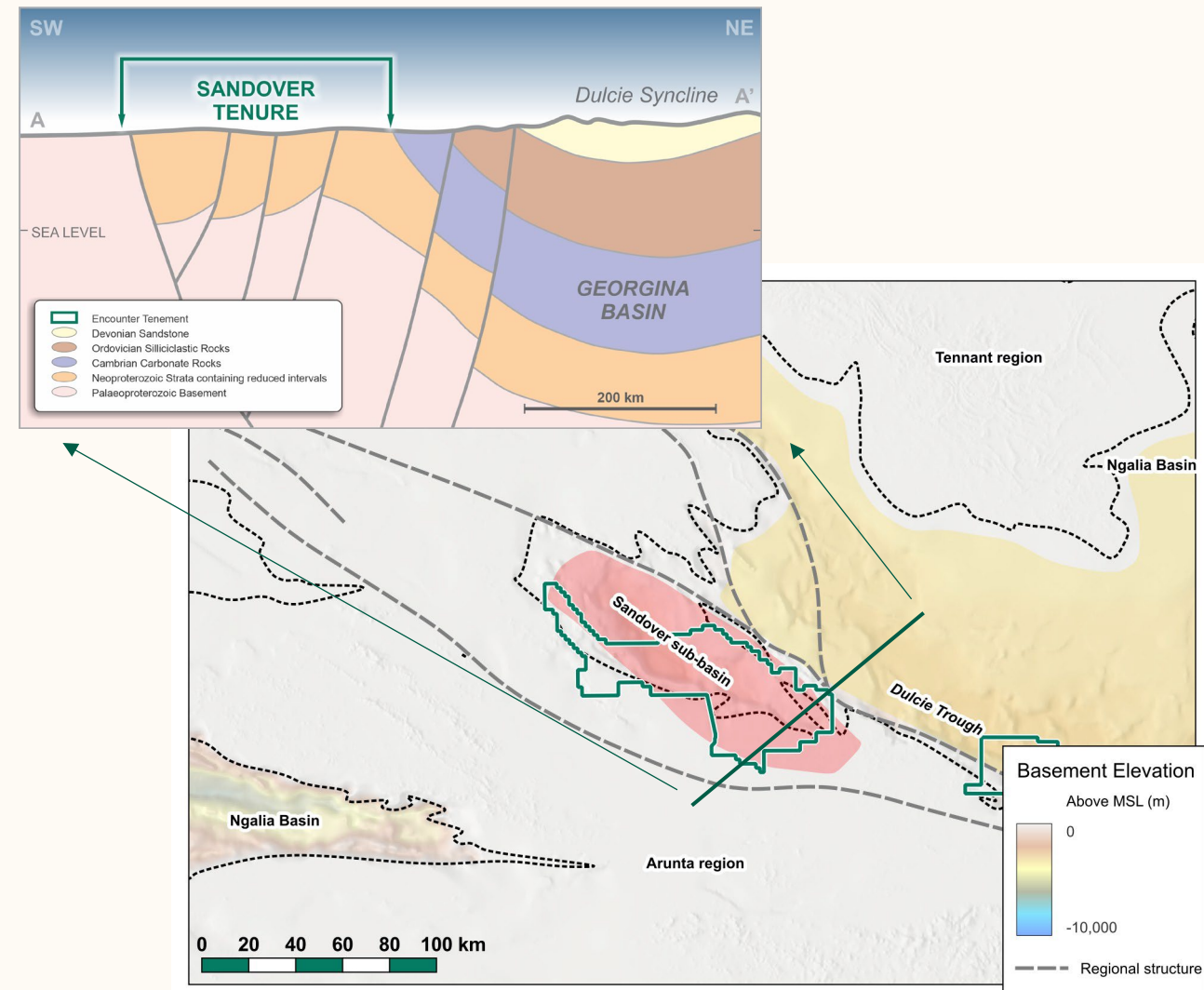
Establishing relation between gravity and seismic data

- Comparison of the 5km residual of the BA with the depth to the base of the Mesoproterozoic reflector show a **perfect correlation between the seismic interpretation and the gravity signal**.
- The spacing between the seismic lines does not allow to resolve the **detailed structural architecture** over the project, which increase the uncertainties when targeting structural intersections.
- Learning from this, infilling gravity data to 1km would **enable to further de-risk** the targeting and allow **to drill** off the seismic lines in **the best structural position**.



Sandover: A partially exposed Neoproterozoic sub-basin

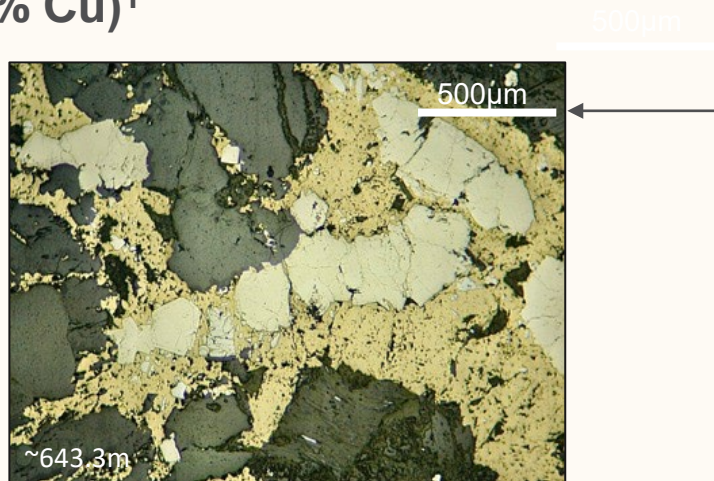
- **Major structural corridor** on the southern margin of the Georgina Basin against the Arunta Block.
- **Neoproterozoic depocenter** where the rift phase sediments of the Sandover basin are juxtaposed against crystalline basement (Arunta block).
- Large areas of the sub-basin are overlain by extensive Phanerozoic.
- **Major elements of a sediment-hosted copper system are present.**
 - Recorded presence of **evaporites, reduced stratigraphic units, and red-bed sequence** within the Sandover sub-Basin.



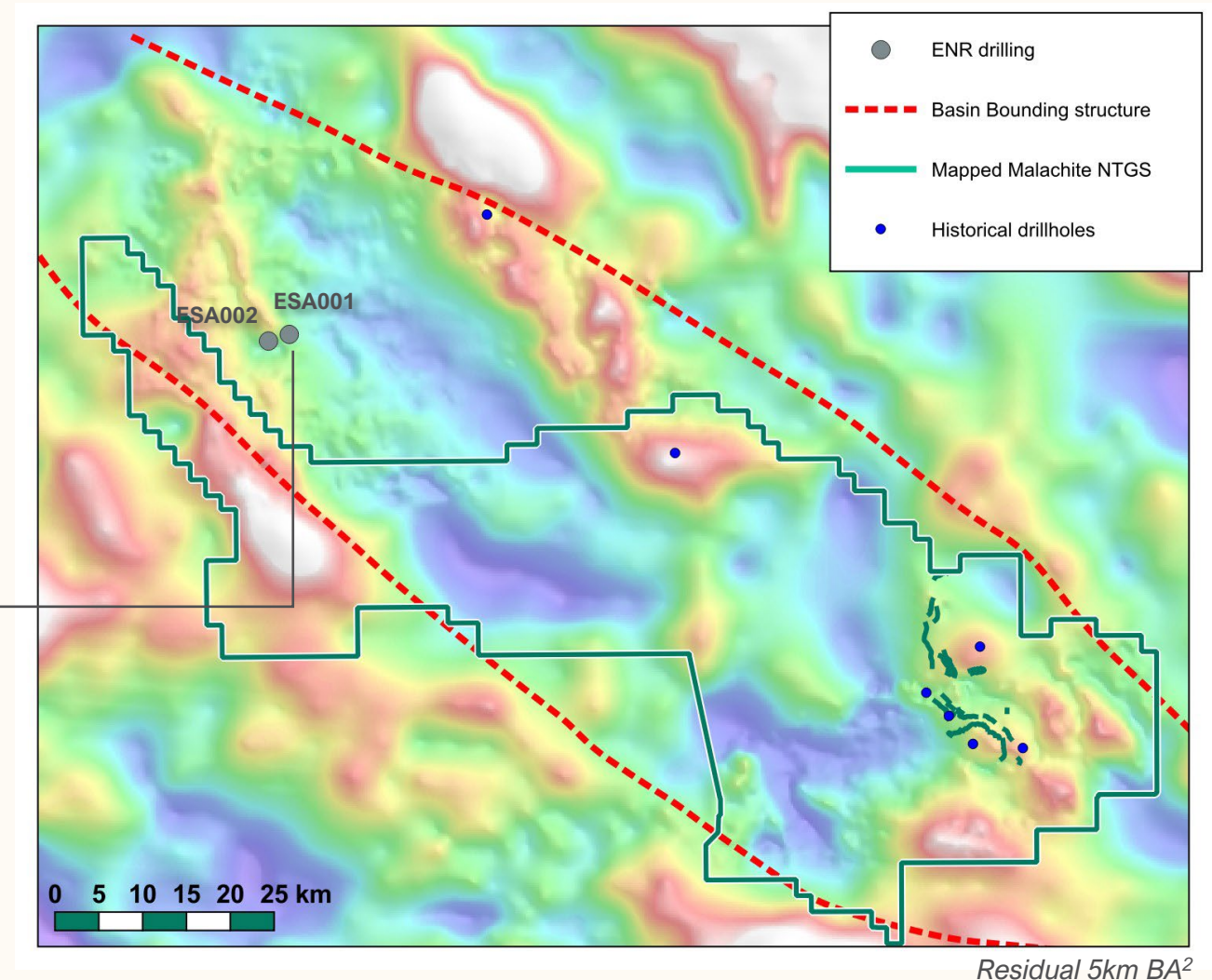
Sandover Project

Neoproterozoic strata and copper mineralisation confirmed by drilling

- Encounter completed **two targeted stratigraphic diamond holes** in the NW of the project 2023/2024
- **ESA001** - designed to test for a first reductant unit within the basin sequence at a key structural location.
 - ➔ returned high grade copper sulphide at the basin-basement interface (**0.3m at 2.12% Cu**)¹



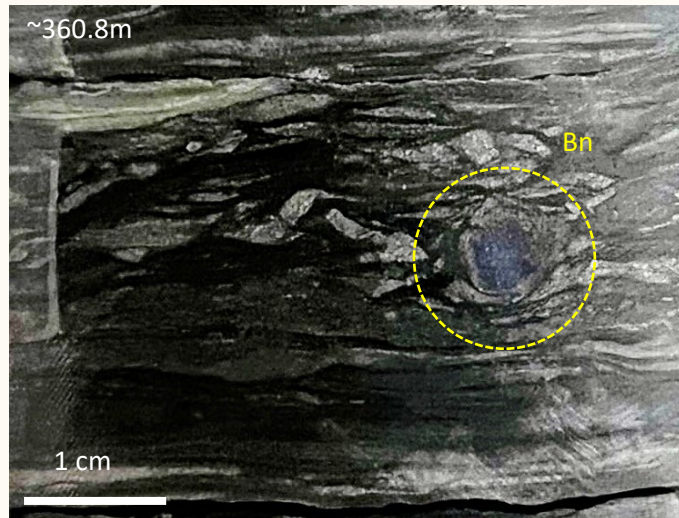
Interstitial sulphides into altered granite, showing residual quartz, chalcopyrite (yellow) replacing earlier pyrite.



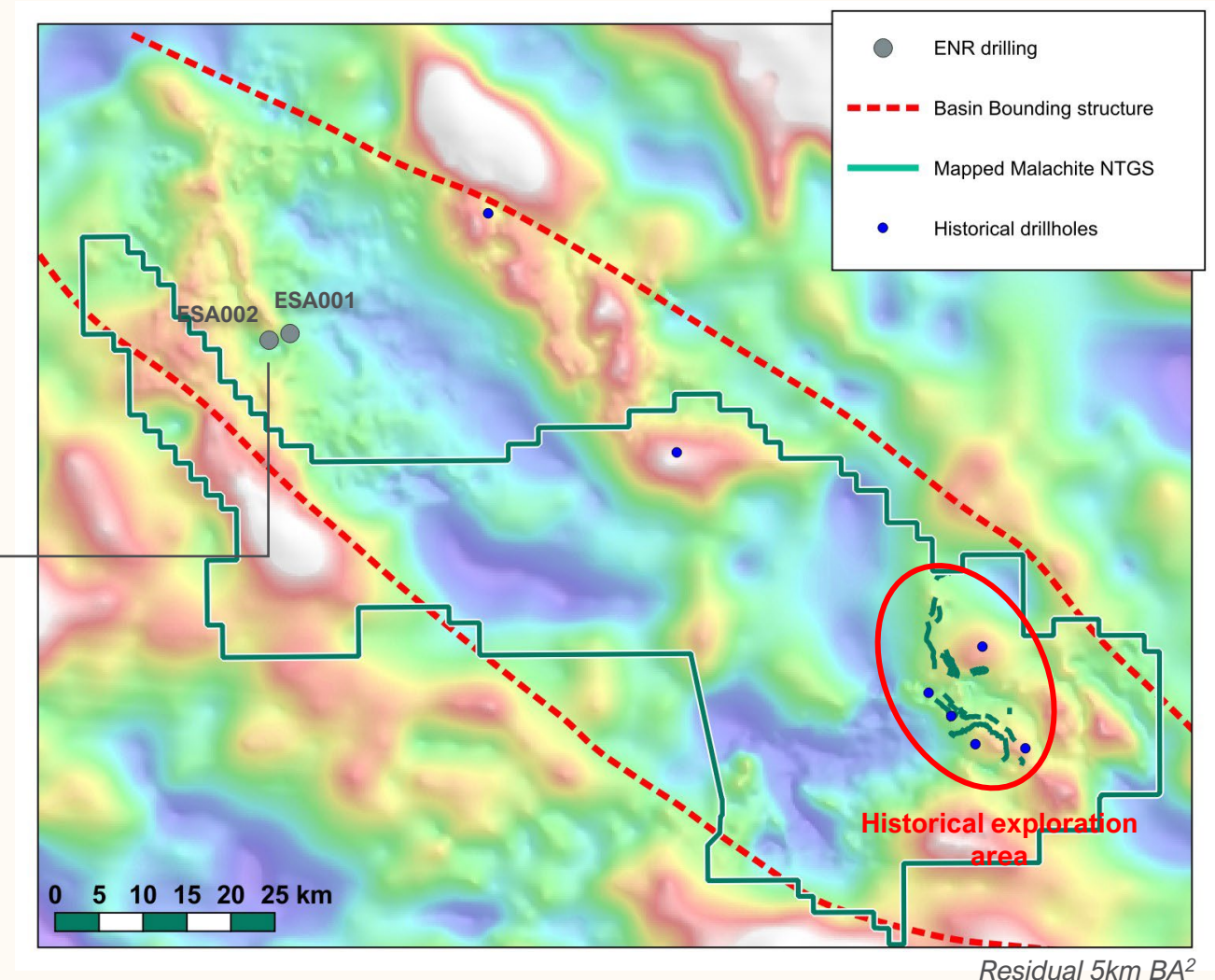
Sandover Project

Neoproterozoic strata and copper mineralisation confirmed by drilling

- **ESA002** - designed to test a discrete modelled magnetic anomaly adjacent to ESA001
 - ➔ returned multiple Cu-rich in grey shale units¹
- Both drillholes **extended copper occurrences** in the basin - 100km from historical anomalism



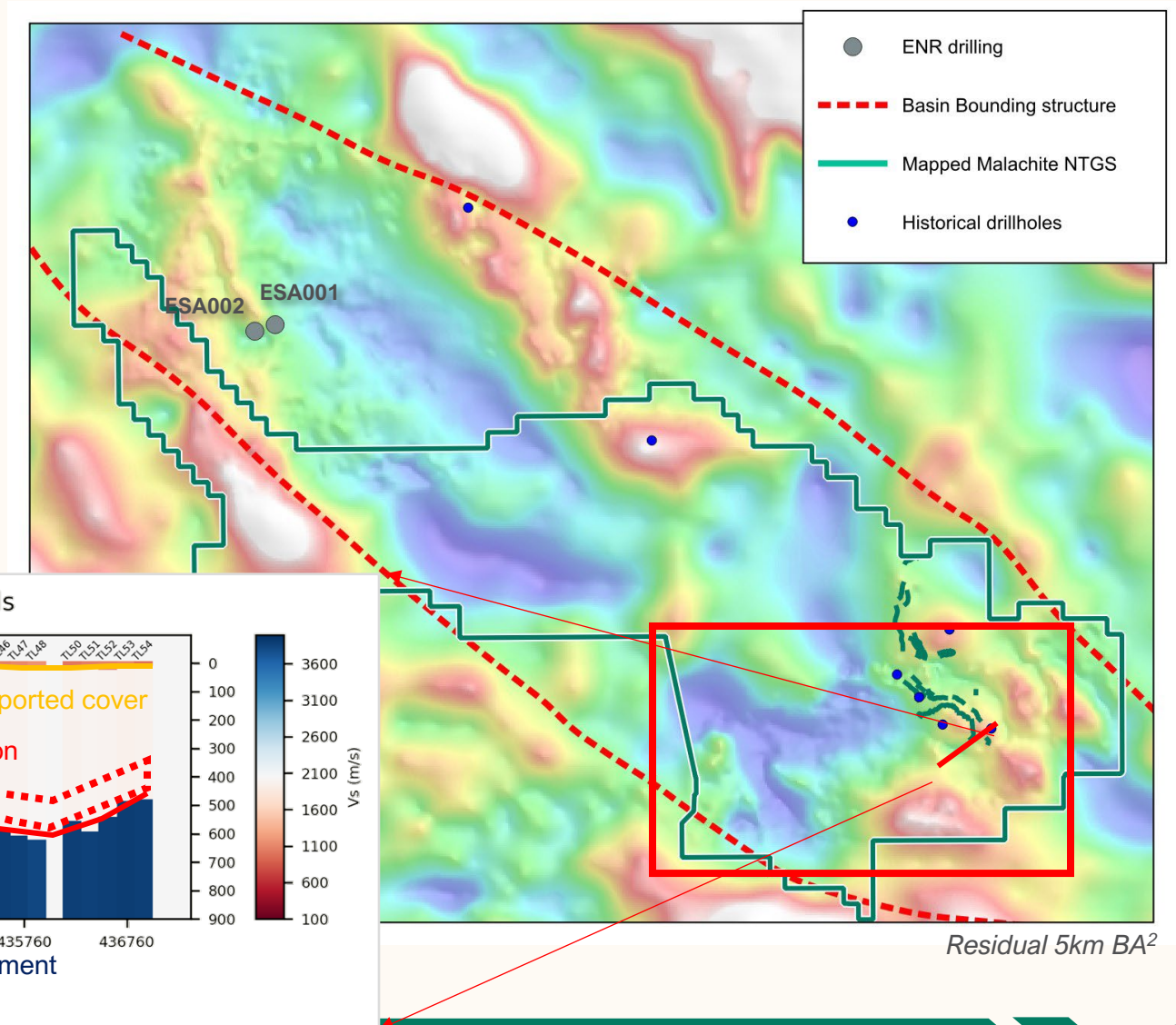
Bornite nodule in grey siltstone and sandstones



Sandover Project

Using cutting edge technologies to generate new drill targets

- Integration of new and historical data highlighted an **untested area under shallow cover**.
- **R&D project with the CSIRO** on new tools to explore for sed-hosted systems.
- Recently completed test phase of a **passive seismic survey** to map **depth to target horizon** and conceptual targets.



Conclusion

Build a narrative supported by observations

- Integration of large-scale geophysical datasets with historical drilling results enabled to identify and understand copper anomalies and focus exploration efforts.

Collect new data to address specific knowledge gaps

- Infilling geophysical datasets enabled to understand historical drilling results and define new targets area.
- Leveraging oil and gas technologies decreased risk associated with part of the mineral systems.

Drill to test your hypotheses

- Drill targets identified on multiple projects, currently securing land access to test our hypotheses in the next 18 months.



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Thank you

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