Potential for Proterozoic mineralisation in western Tasmania

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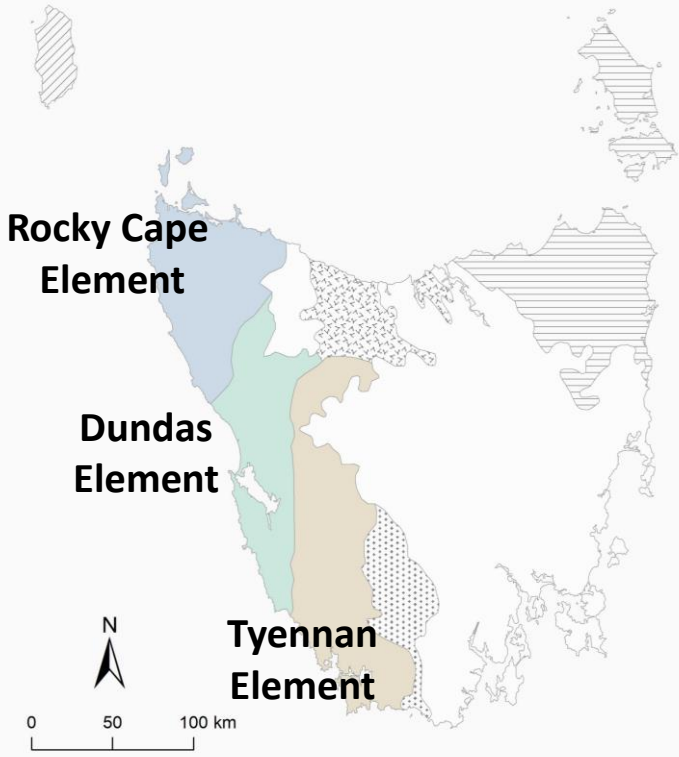
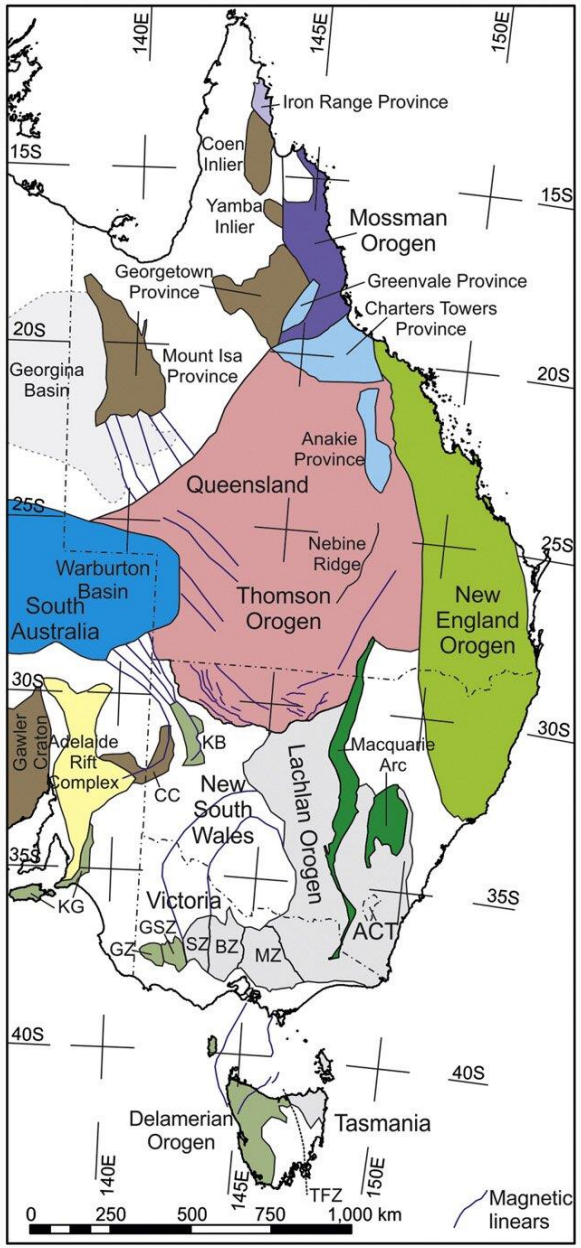
Western Tasmania in the Tasmanides

- Terranes that make up the Tasmanides of mainland eastern Australia are thought to extend into Tasmania, although the exact correlation is contentious
- The Western Tasmania Terrane (WTT) occupies the western half of Tasmania and consists of
  - **Rocky Cape Element** (dominantly Mesoproterozoic to Neoproterozoic siliciclastic rocks)
  - **Dundas Element** (dominantly Cambrian Mount Read Volcanics)
  - **Tyennan Element** (dominantly Mesoproterozoic siliciclastic rocks)
  - All these tectonic elements are intruded by **Devonian granites**





Ferguson and Henderson 2015

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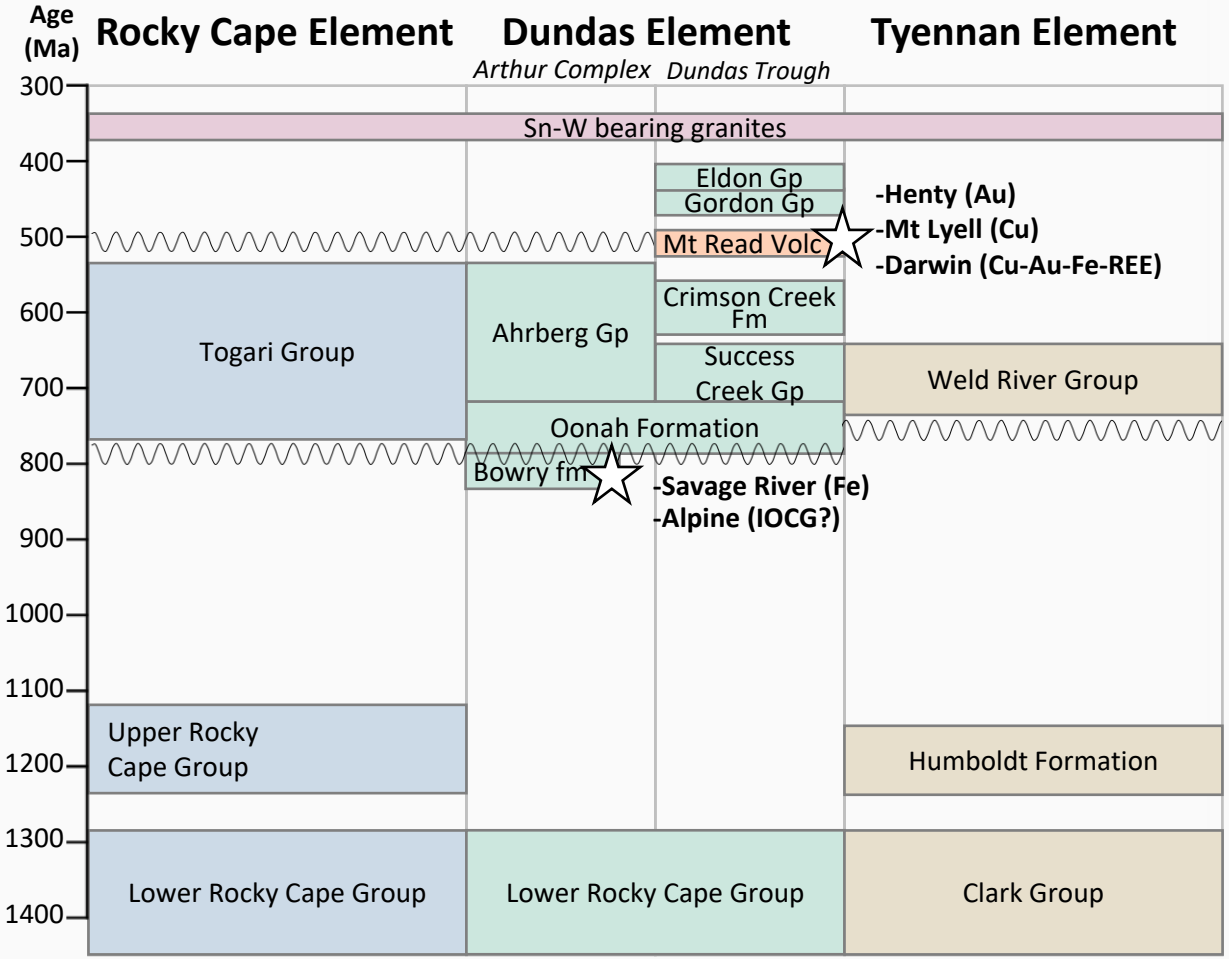
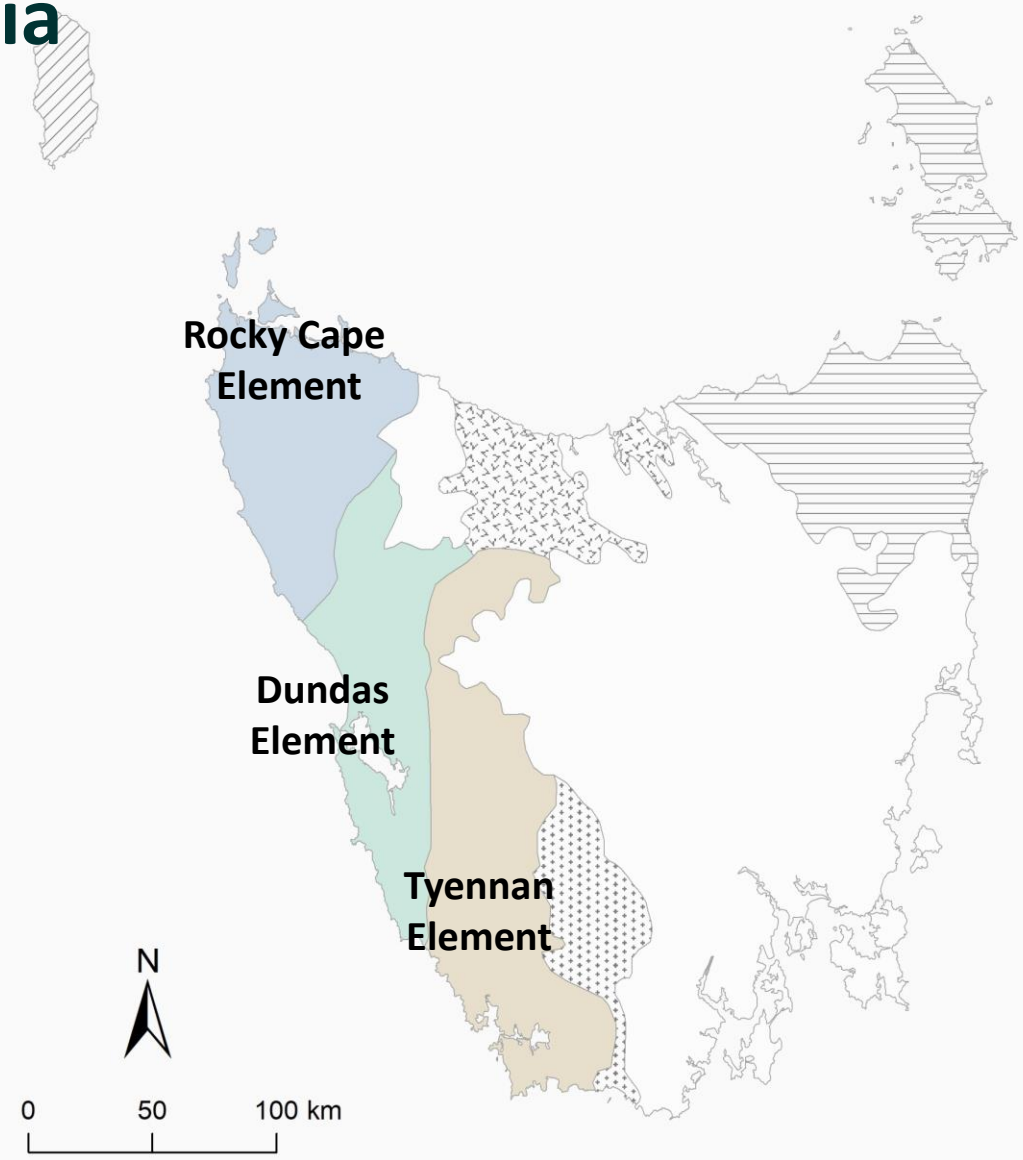
Tectonic elements of western Tasmania





Modified from Mulder et al., 2018 and MRT Time-Space diagram for Tasmania 1998

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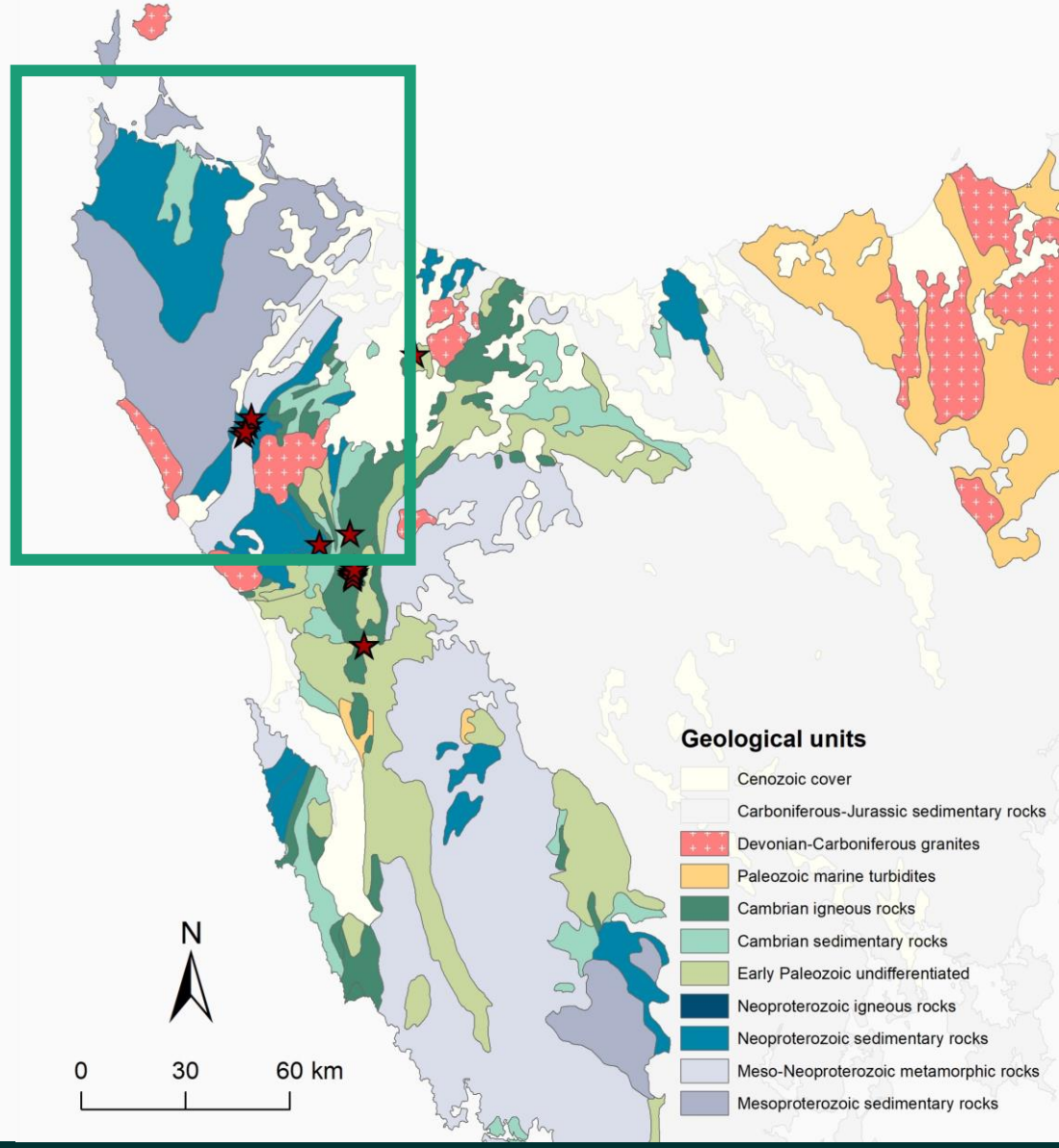
Mineral deposits in western Tasmania

- The majority of large metallogenic deposits are Volcanic-Hosted Massive Sulphide (VHMS) deposits related to the Cambrian Mount Read Volcanics, in the Dundas Element
- Sn-W deposits are associated with Devonian granite intrusions
- Devonian events overprint many of the Cambrian deposits, making it challenging to unravel the timing of mineralisation
- New dating of these Cambrian and Devonian deposits as part of this project has better refined some of the ages here



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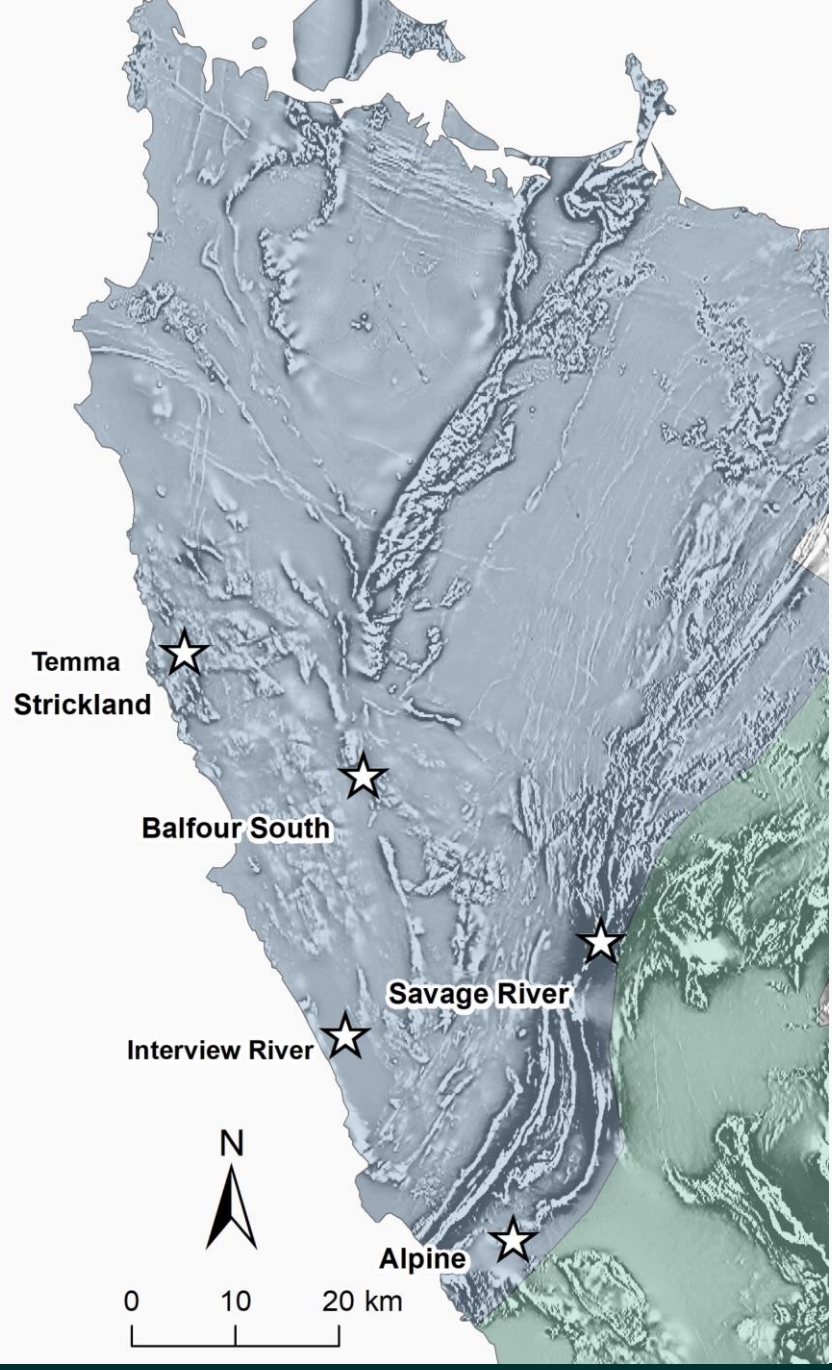
Mineral deposits in northwest Tasmania

- Savage River magnetite deposit (possibly IOCG related), hosted by Neoproterozoic Bowry Formation, but is thought the be Cambrian-aged mineralisation
- Alpine Deposit – along strike from Savage River iron-oxide apatite (IOA) or iron-oxide-copper-gold (IOCG) deposit, hosted by the Neoproterozoic(?) Bowry Formation(?)
- Small, mostly abandoned, Cu-Pb-Zn prospects in the Rocky Cape Group
  - Balfour – sedimentary-hosted Cu, thought to be Devonian aged
  - Interview River Pb-Zn
  - Strickland Pb-Zn



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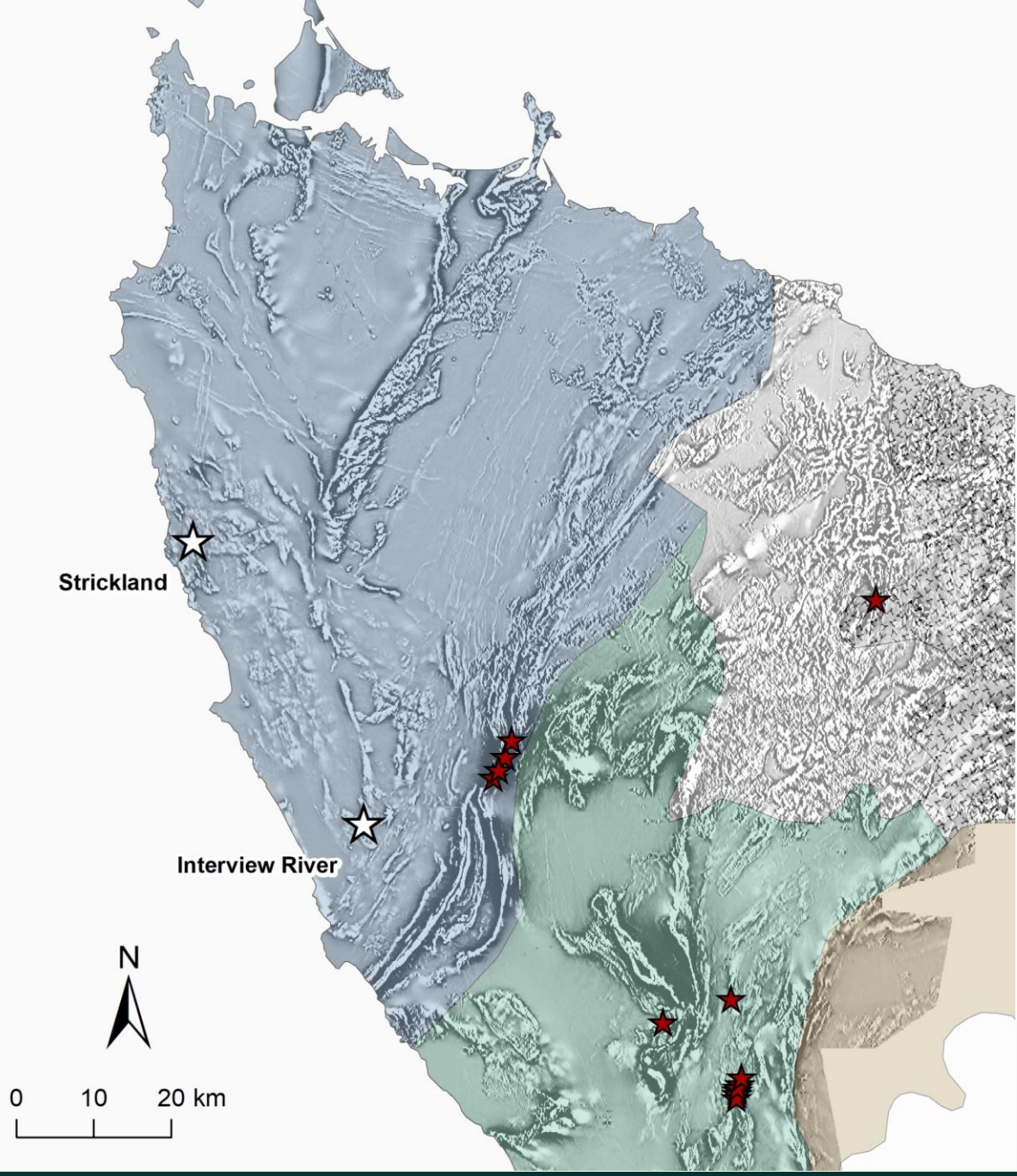
Proterozoic mineralisation in western Tasmania?

- Mesoproterozoic Rocky Cape Group host rocks
- **Interview River** and **Strickland** are two old Pb-Zn-Ag prospects – very small, abandoned prospects

Strickland prospect



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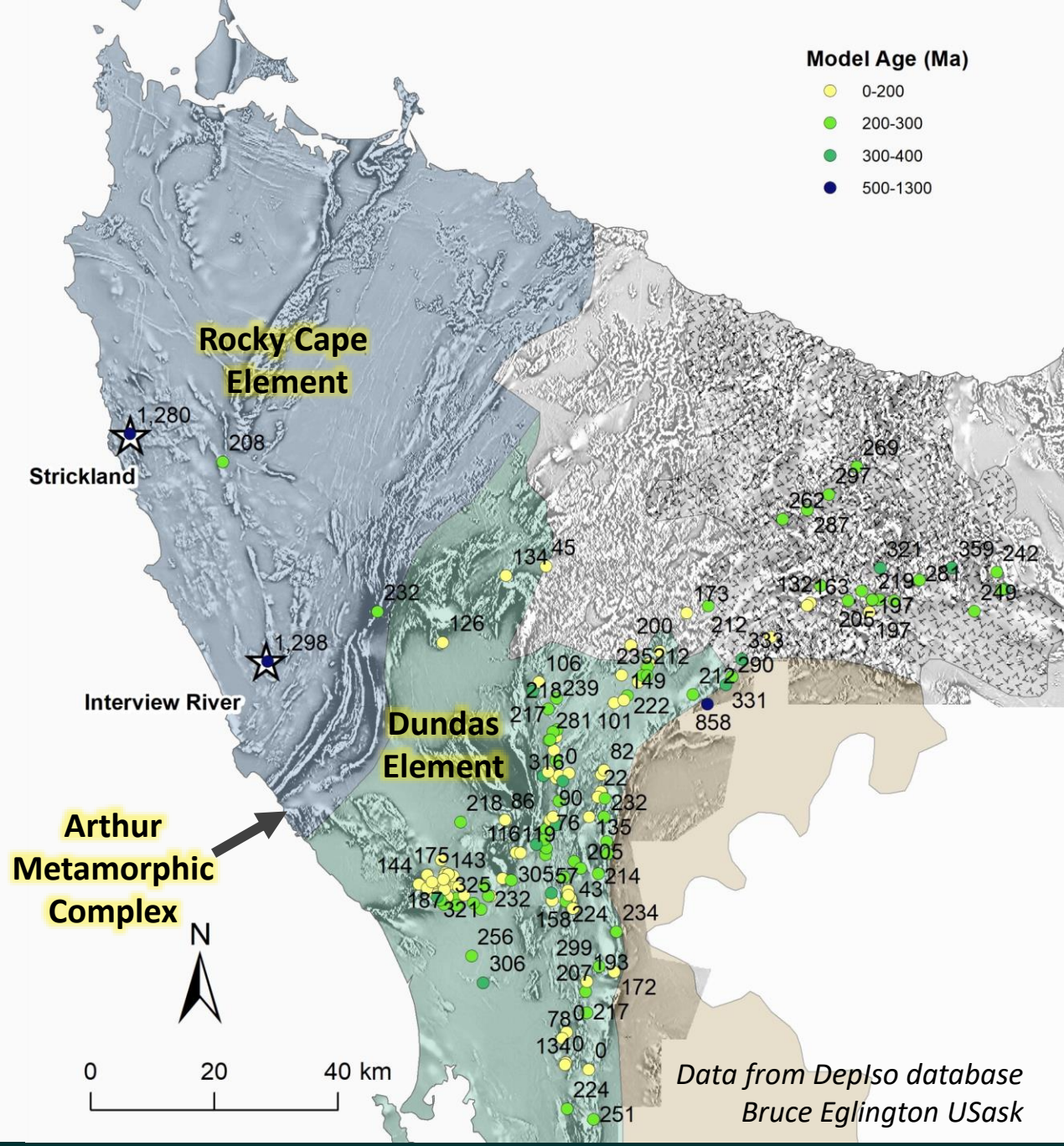
Pb isotopes in Tasmania

- Mount Read Volcanics and associated deposits have been extensively studied and analysed
- Only four Pb isotope analyses from the Rocky Cape Element
- Two of these are Mesoproterozoic and suggest a c. 1290 Ma age for mineralisation
- However, Pb isotopes are not a robust dating method as these ages are heavily dependent on the model used (i.e. Stacey and Kramers 2nd stage model)
- New dating using monazite U-Pb geochronology



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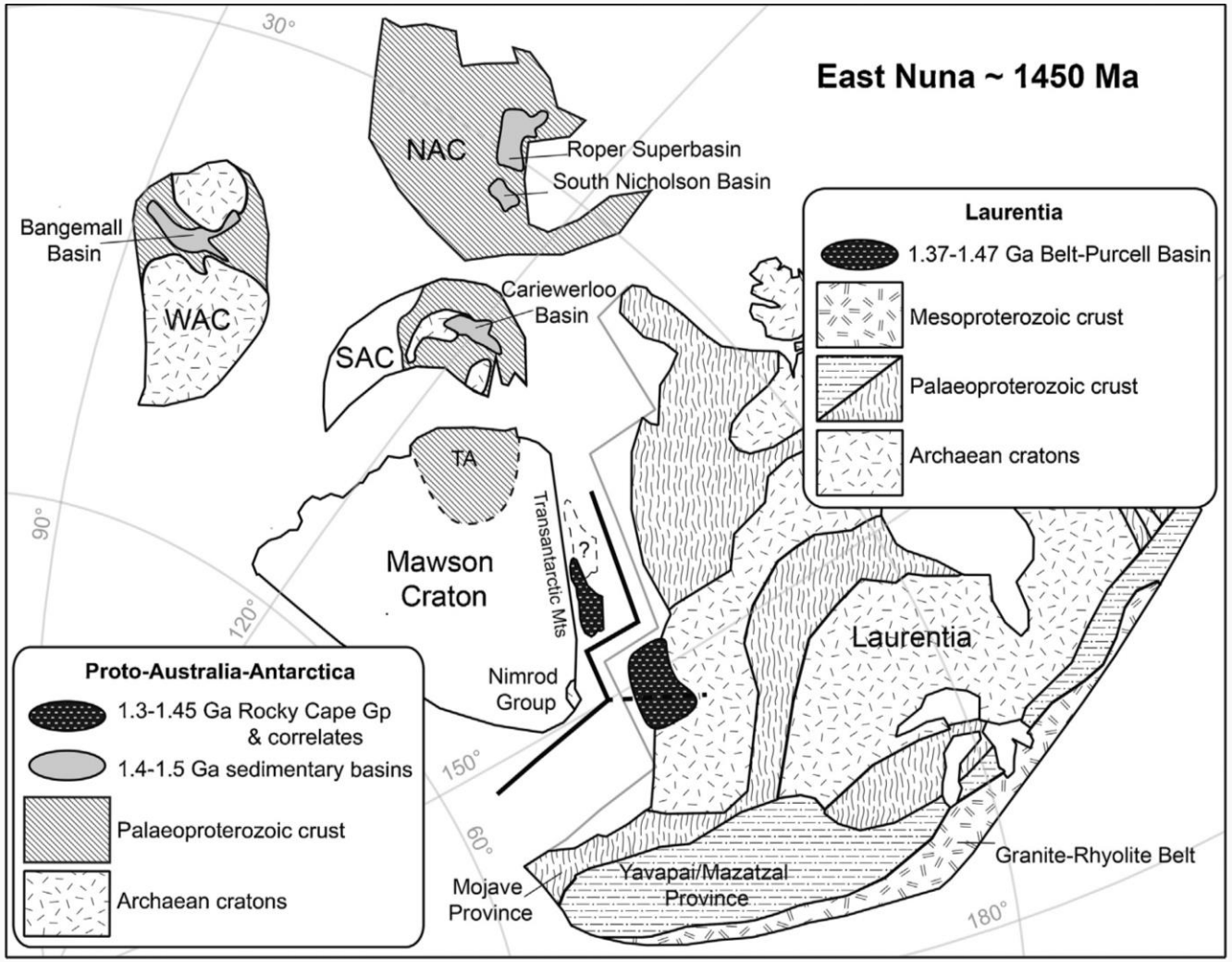
Proterozoic tectonics in Tasmania

- The Rocky Cape Group in NW Tasmania thought to correlate with the Belt-Purcell basin in Laurentia (US and Canada) during the Mesoproterozoic 1450–1300 Ma (Halpin et al., 2014, Mulder et al., 2015)
- This is based on detrital zircon spectra and monazite dating
- Lu-Hf garnet ages of c. 1300 Ma show a connection between the Western Tasmania Terrane and Laurentia (Brown et al., 2022)



Halpin et al., 2014

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Rocky Cape and Belt-Purcell connection

Rocky Cape	Belt-Purcell
1450–1300 Ma detrital zircons	1450–1370 Ma detrital zircons
1300–1100 Ma fluid flow	1300–1100 Ma fluid flow
1400 Ma *Horodyskia* fossils	1400 Ma *Horodyskia* fossils
• No known Proterozoic deposits • Interview River and Strickland, old Cu-Pb-Zn workings – thought to be Devonian • Balfour Cu deposit central Rocky Cape Element – thought to be Devonian	• 3 giant metal producing ore deposits • Sullivan Pb-Zn-Ag SEDEX • Smaller stratabound Cu-Co deposits • Mineralisation ages range from 1400 – 1300 Ma (Aleinikoff et a., 2012)

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Strickland prospect

- Finely laminated siltstone
- Disseminated chalcopyrite, galena, pyrite and sphalerite
- Previously thought to be related to the intrusion of Devonian granites

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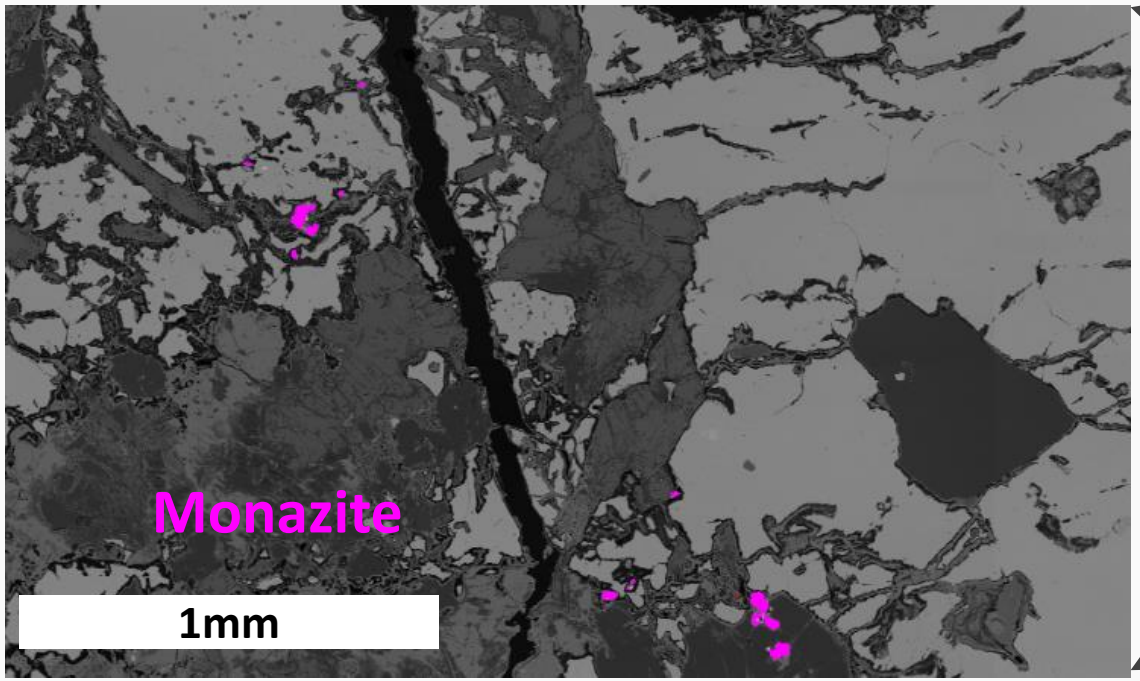
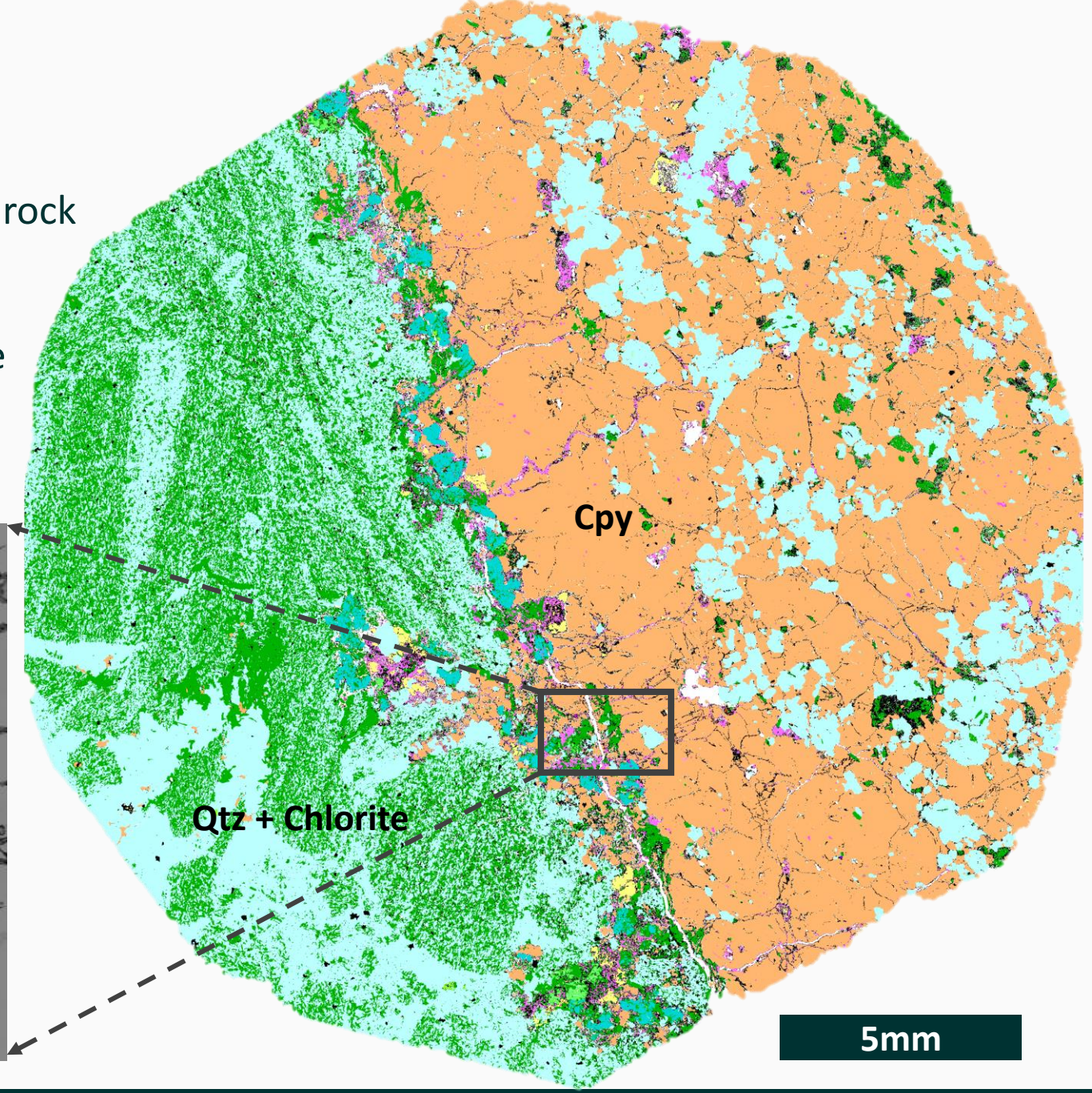
Strickland prospect sample

- Chalcopyrite in a quartz-chlorite sedimentary rock
- Minor amounts of Cobaltite
- Accessory minerals such as monazite, that are texturally/spatially associated with the chalcopyrite, can be dated





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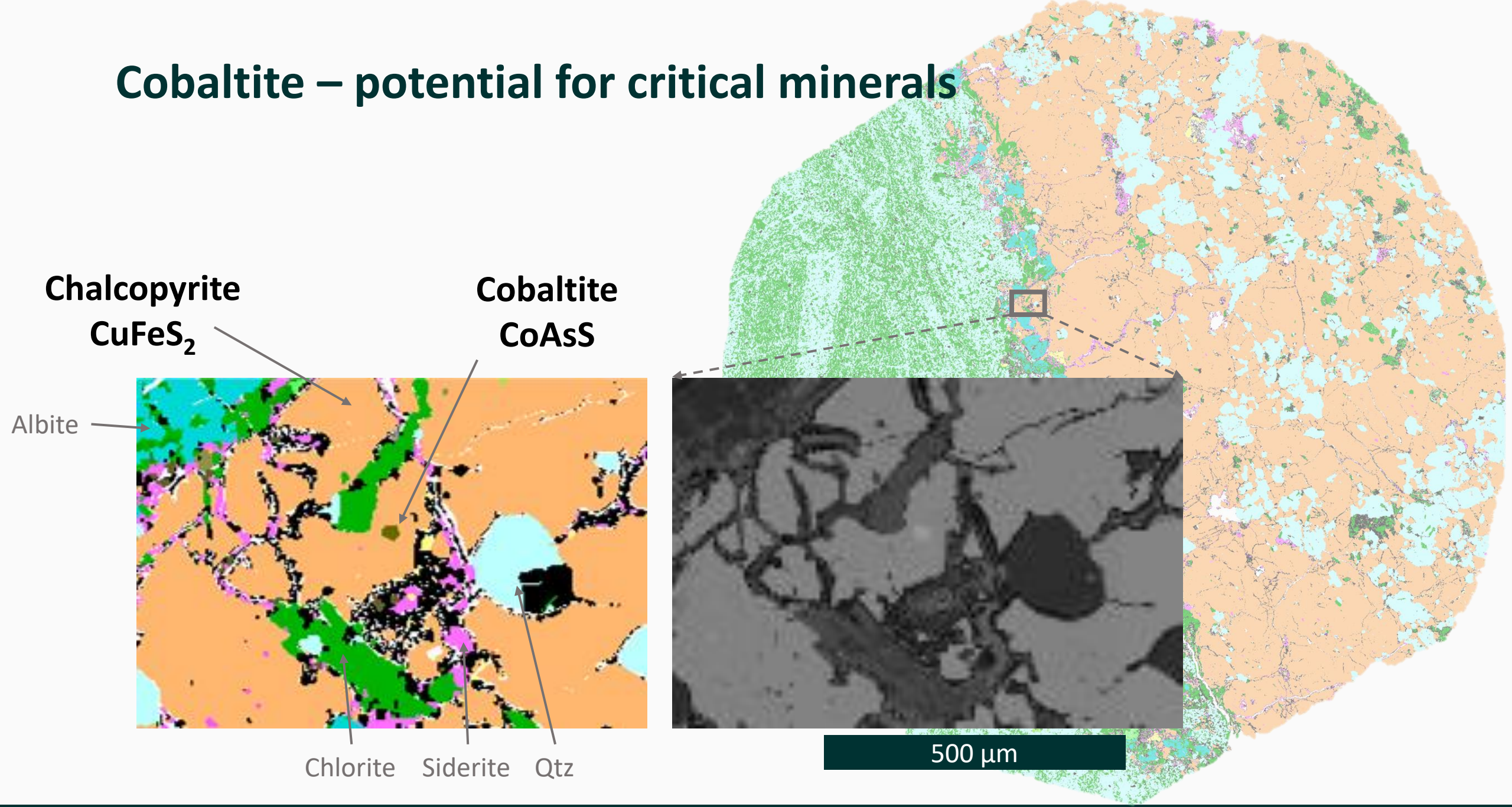
Cobaltite – potential for critical minerals



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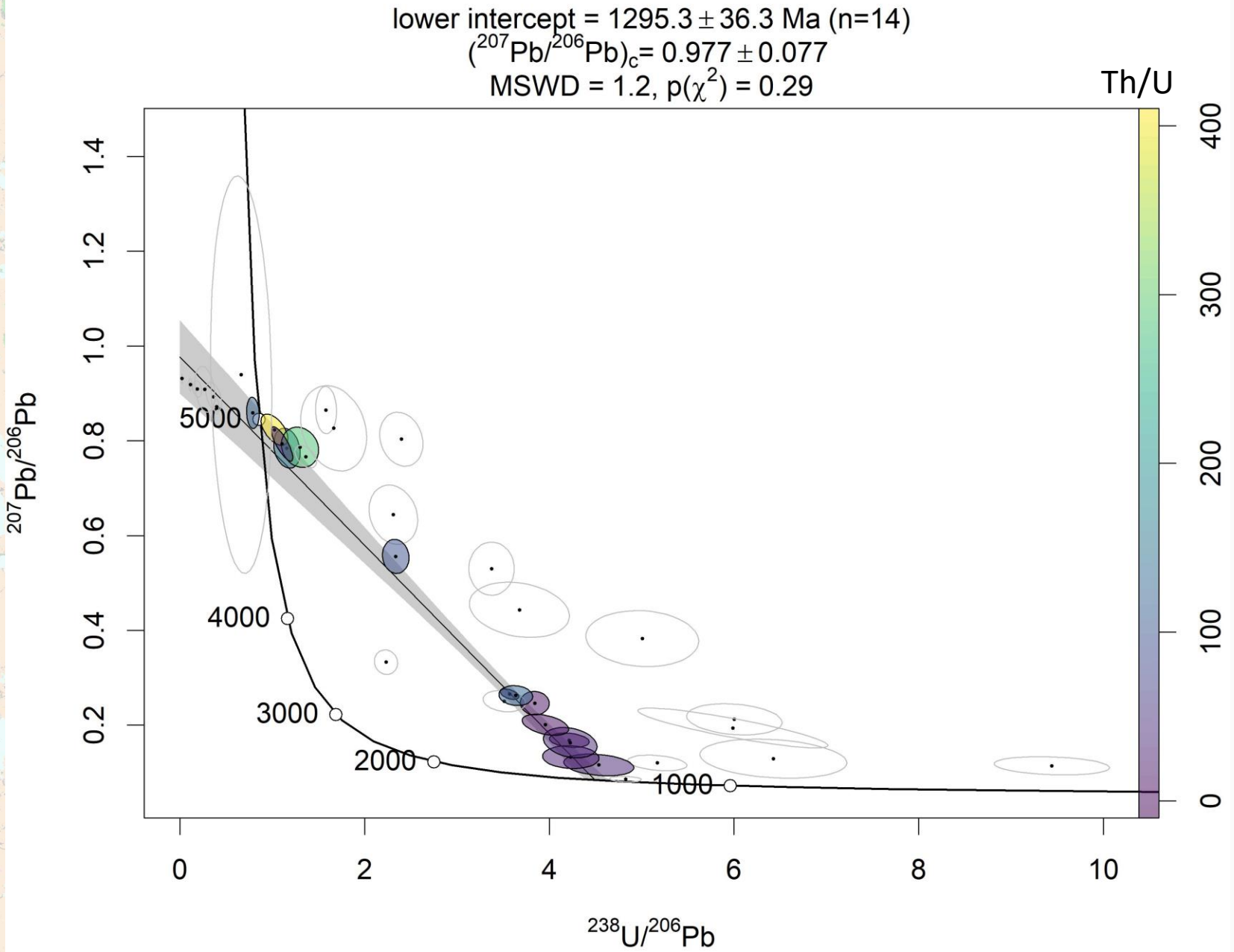
Strickland prospect
Monazite U-Pb data



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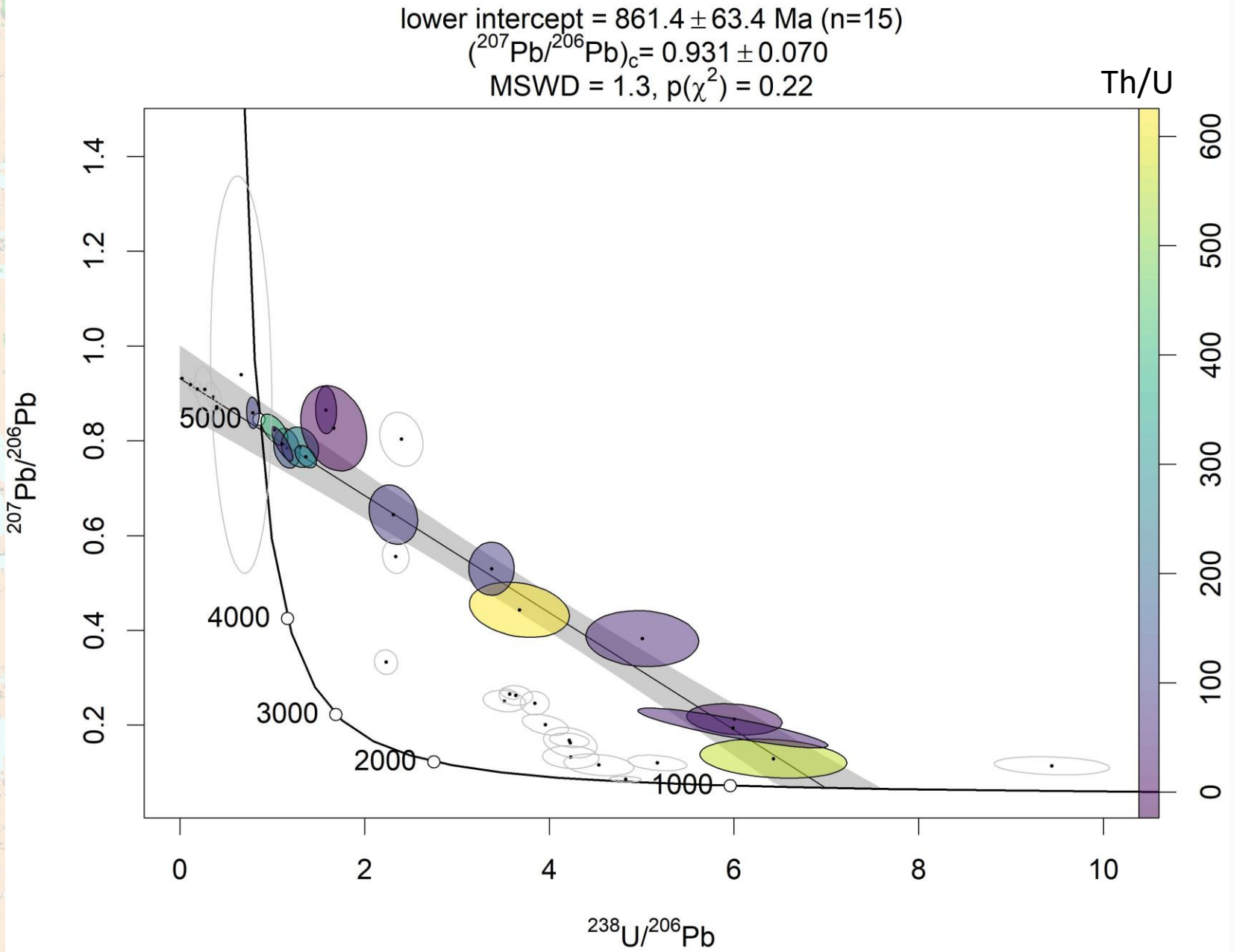
Strickland prospect
Monazite U-Pb data



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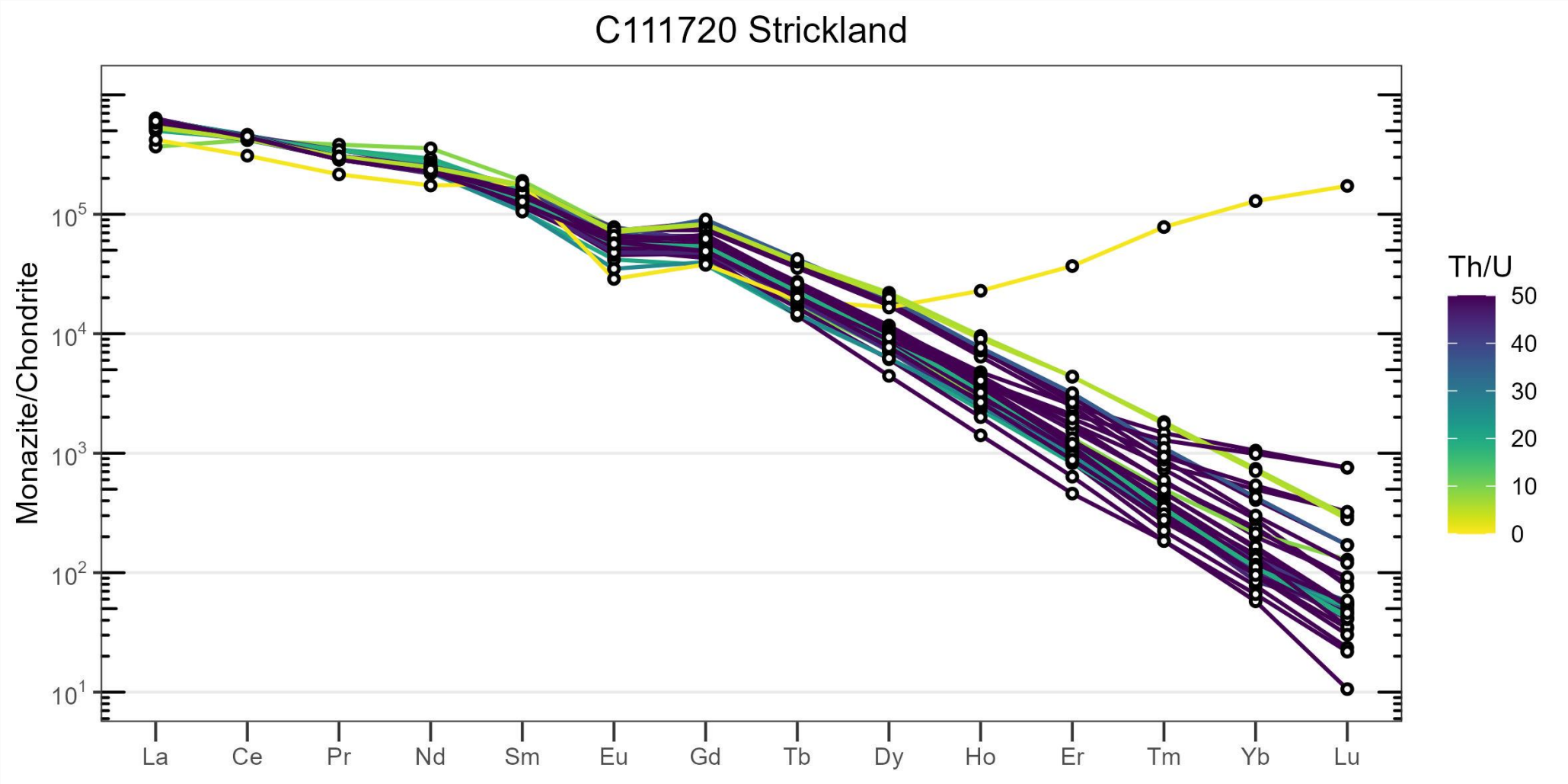
Strickland prospect Monazite trace elements



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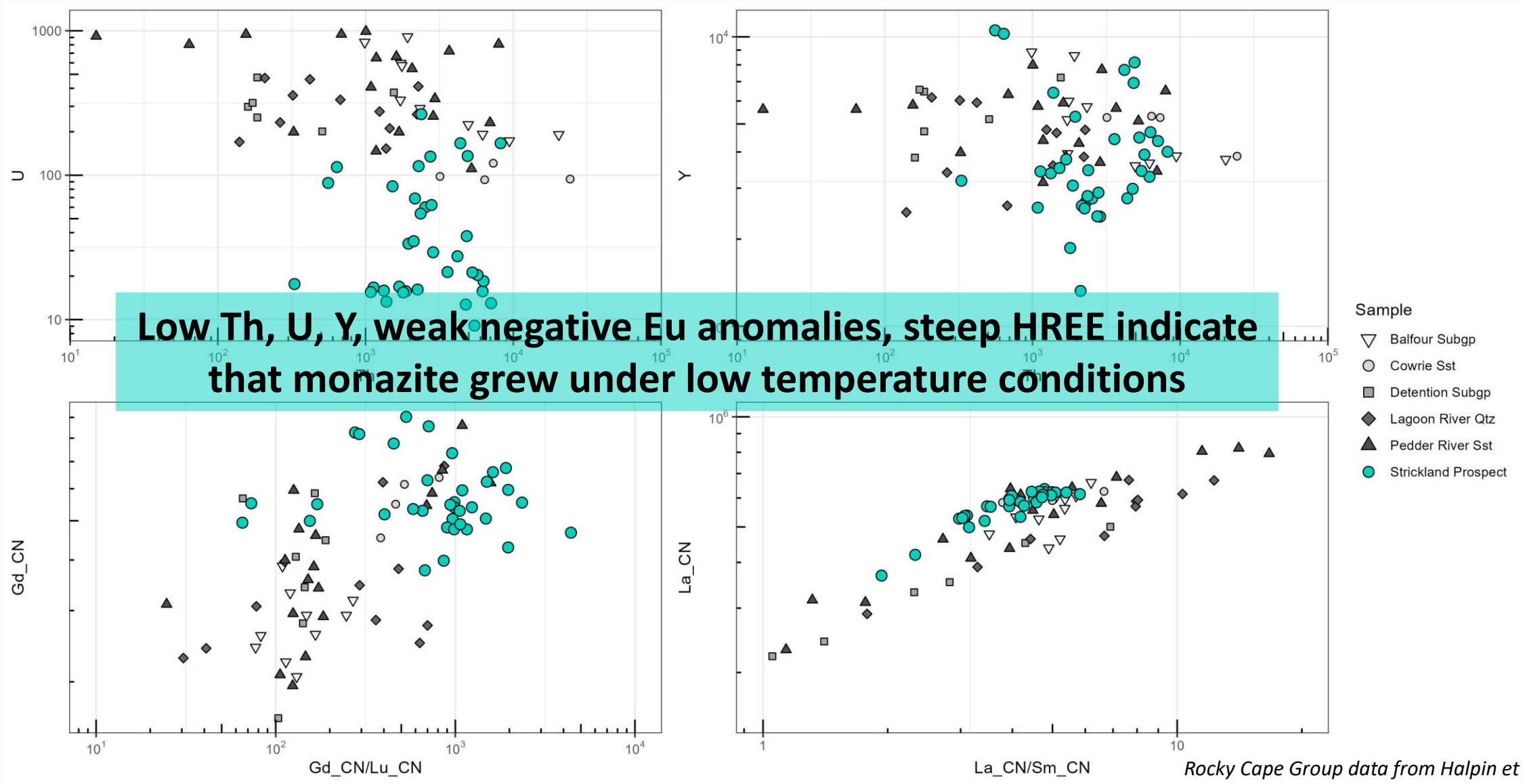
Monazite trace element geochemistry Rocky Cape Group



Low Th, U, Y, weak negative Eu anomalies, steep HREE indicate that monazite grew under low temperature conditions

Rocky Cape Group data from Halpin et al., 2014

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Rocky Cape and Belt-Purcell connection

Rocky Cape	Belt-Purcell
1450–1300 Ma detrital zircons	1450–1370 Ma detrital zircons
1300–1100 Ma fluid flow	1300–1100 Ma fluid flow
1400 Ma *Horodyskia* fossils	1400 Ma *Horodyskia* fossils
~~• No known Proterozoic deposits~~ • **1295 Ma Cu, Pb, Zn ± Co mineralisation in the Strickland Prospect** • Monazite U-Pb dating planned for Interview River prospect using SHRIMP at Geoscience Australia	• 3 giant metal producing ore deposits • Sullivan Pb-Zn-Ag SEDEX • Smaller stratabound Cu-Co deposits • Mineralisation ages range from 1400 – **1300 Ma** (Aleinikoff et a., 2012)

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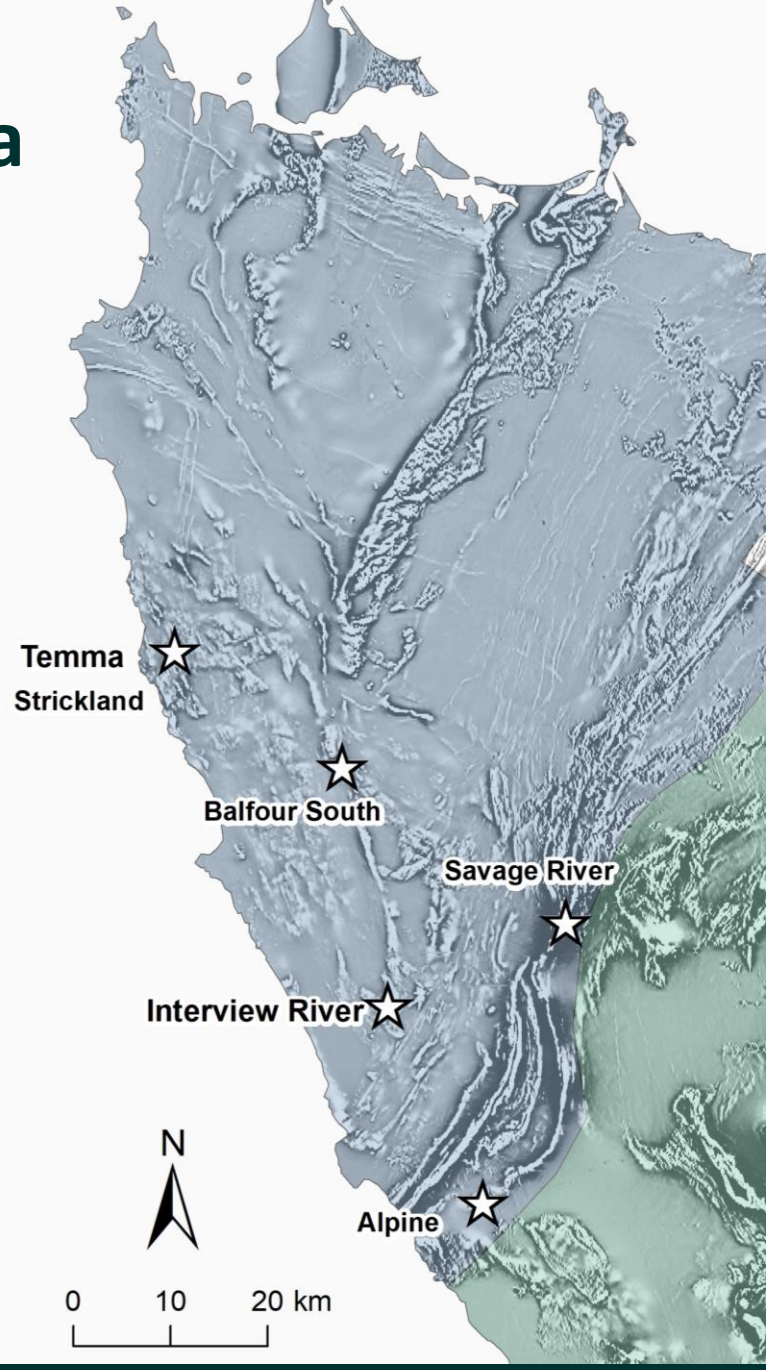
Other Proterozoic events in western Tasmania

- Andalusite schist near Temma c. 1090 Ma
- Alpine apatite ages c. 1000 Ma
- Balfour monazite and apatite from Cu lode c. 826 Ma



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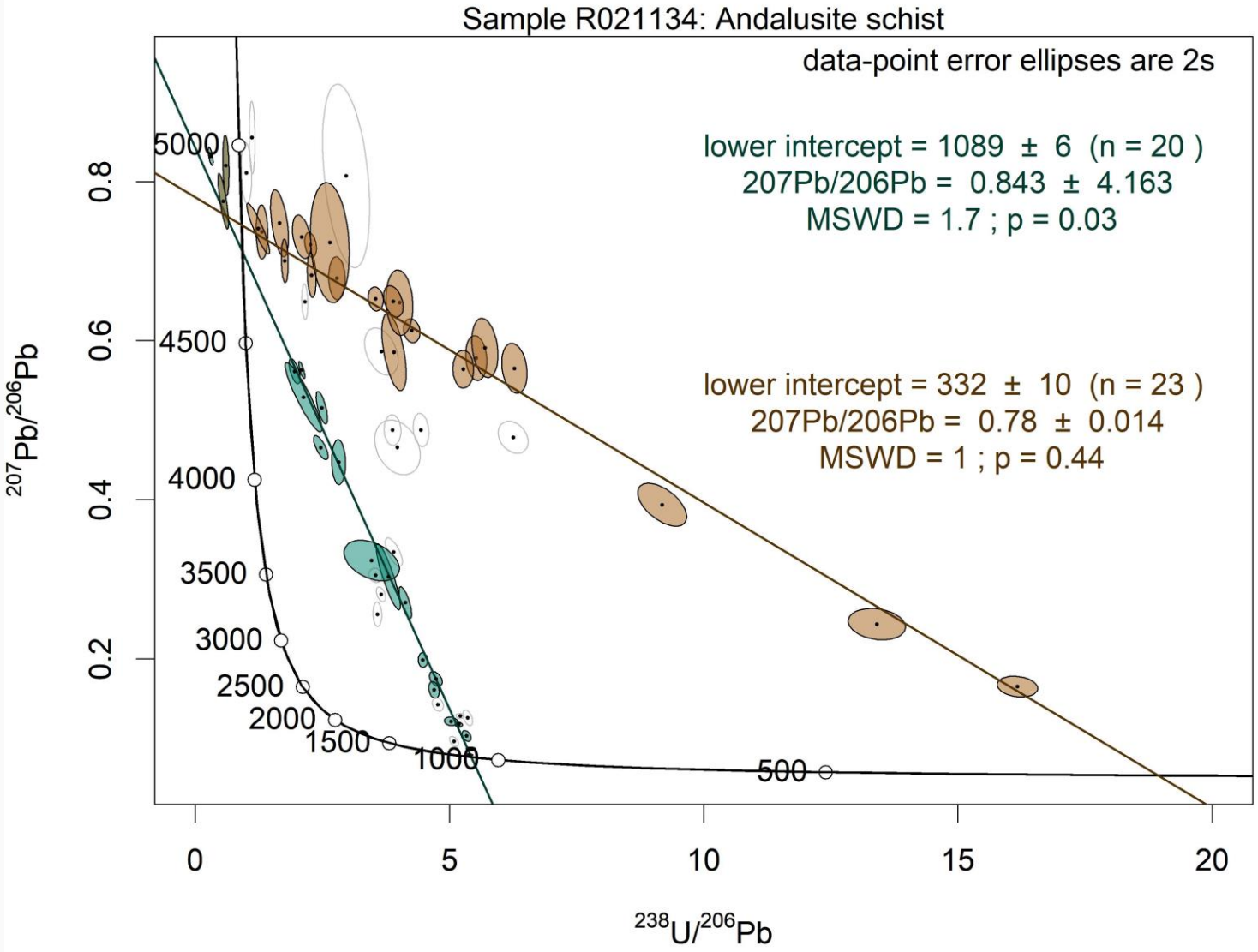
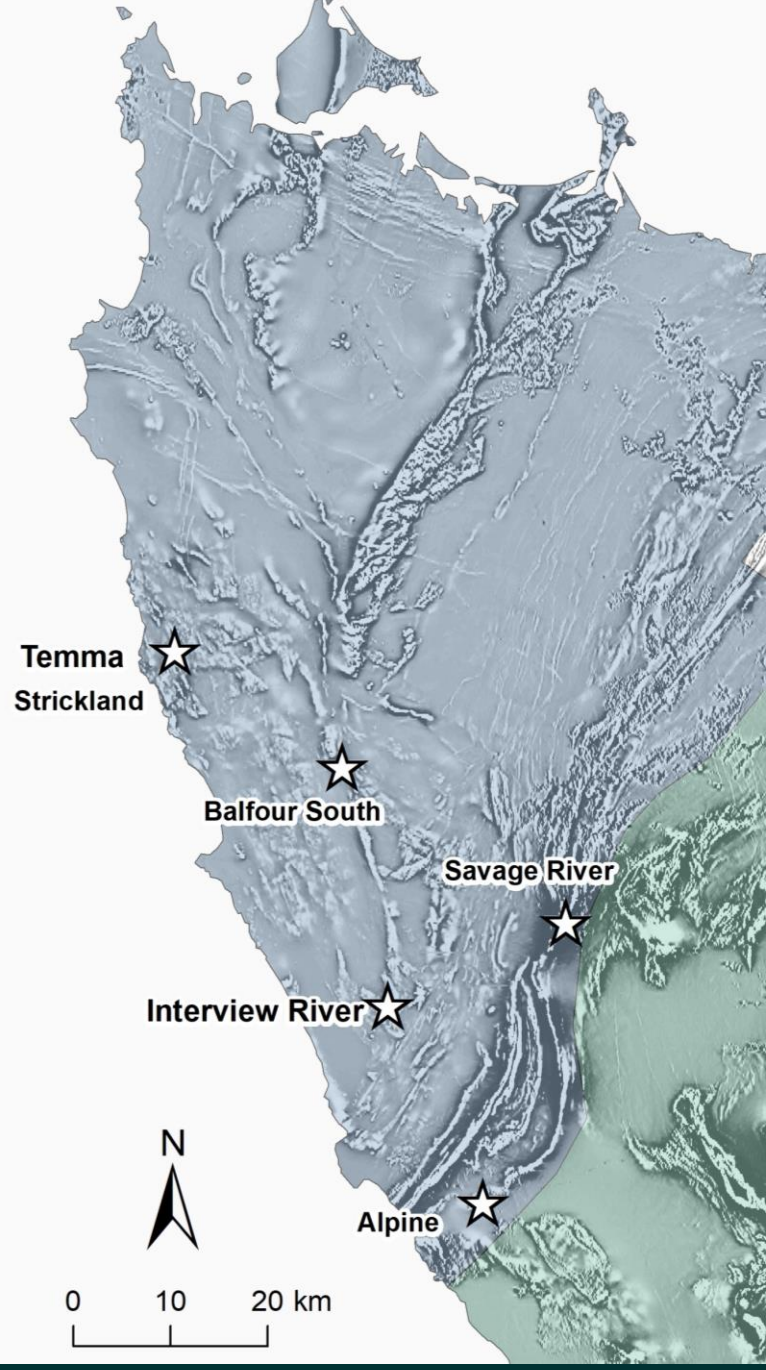
Andalusite schist Temma





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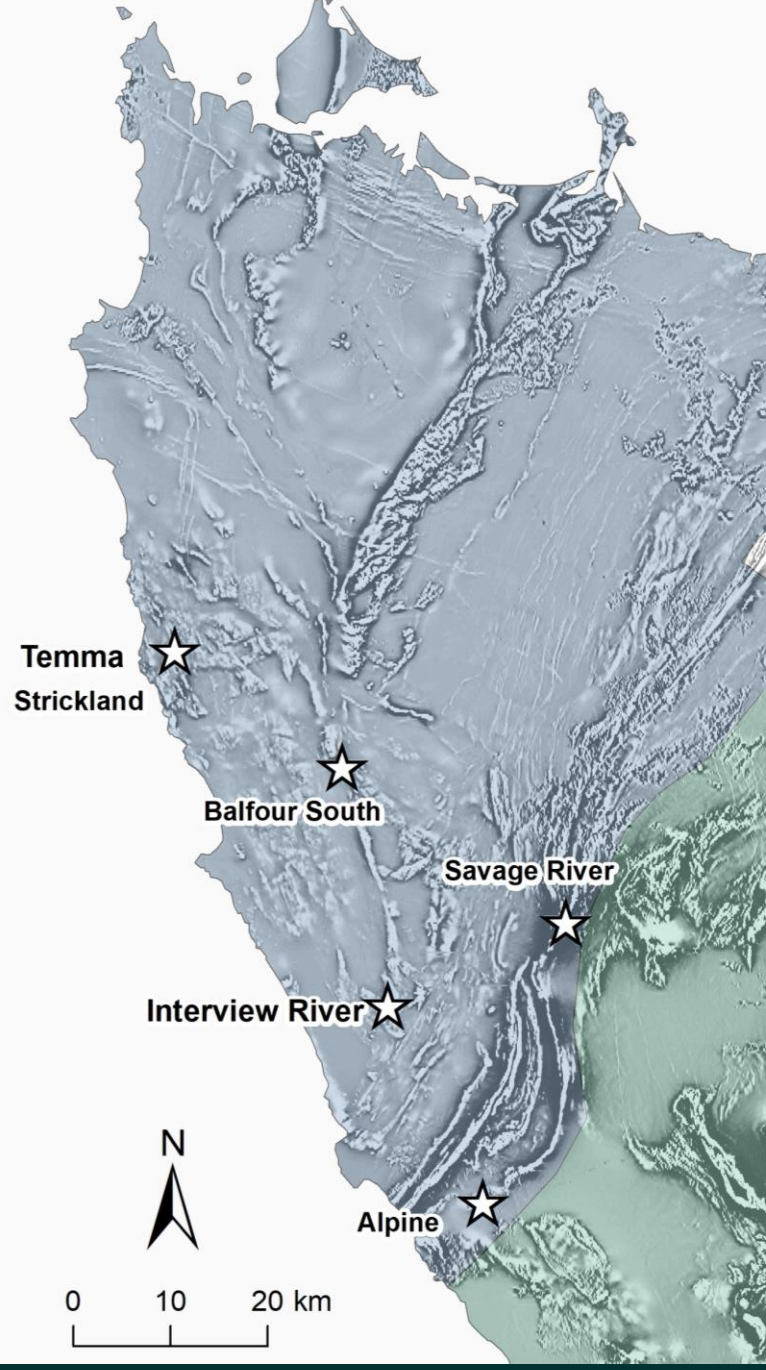
Alpine Deposit

- Iron-oxide apatite (IOA) or iron-oxide-copper-gold (IOCG) deposit, along strike from and possibly related to Savage River
- New apatite U-Pb ages of c. 1000 Ma
- Textural relationships unclear – could be hydrothermal or could be detrital
- New rutile U–Pb ages ranging c. 500 – 350 Ma
- Follow up work underway:
  - Detrital zircon and apatite dating, to be able to compare to in-situ apatite dates
  - Calcite U-Pb dating



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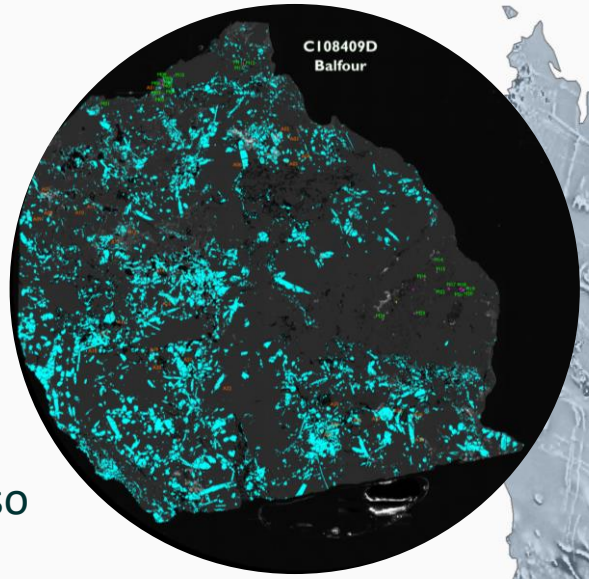
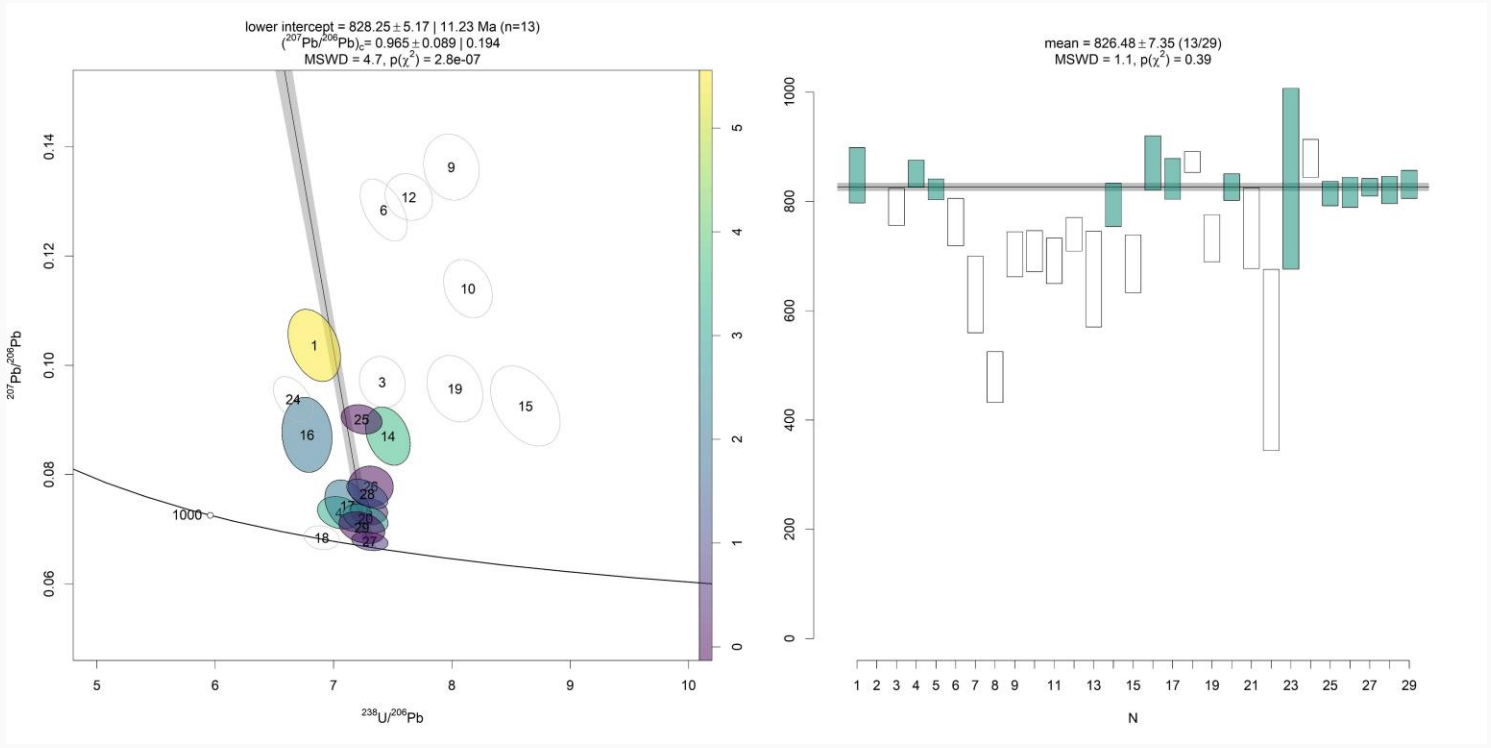
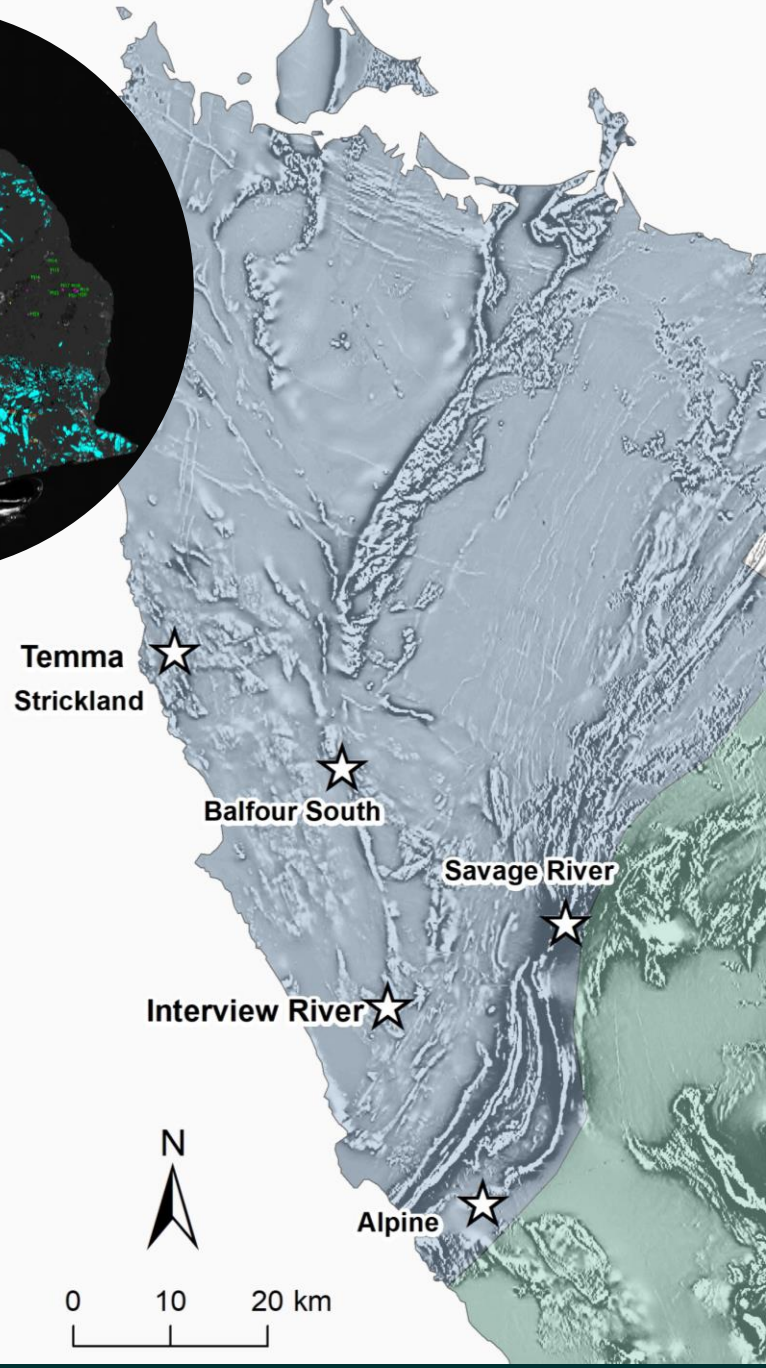
Balfour Cu deposit

- Large apatite crystals with small monazite from Cu lode
- Monazite U-Pb age 826 ± 7 Ma
- Apatite data broadly consistent with this age
- Age consistent with Gairdner Dyke Swarm in South Australia, so further dating on mafic dykes in NW Tas could be useful







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Monazite U-Pb data confirm Mesoproterozoic mineralisation

- The monazite dating indicate that the Cu-Pb-Zn (± Co) mineralisation occurred at c. 1295 Ma, consistent with deposit style and ages found in the Belt-Purcell Supergroup in Canada and the US
- Some evidence for Neoproterozoic (c. 850 Ma) overprint at the Strickland Prospect
- c. 1090 Ma age for monazite from an andalusite schist at Temma and c. 1000 Ma apatite from Alpine Deposit suggest a late Mesoproterozoic–early Neoproterozoic event in NW Tasmania
- c. 826 Ma age for Balfour Cu lode suggest Neoproterozoic age for mineralisation or fluid flow

- Overall these new data suggest a protracted and complicated history of hydrothermal activity in NW Tasmania
- The new data suggest there is potential for Proterozoic sediment-hosted metal deposits (SEDEX, Sedimentary Cu) in NW Tasmania, which requires further investigation

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