Multiscale exploration vectoring in the Tennant Creek Au-Bi-Cu province: Insights from chlorite chemistry

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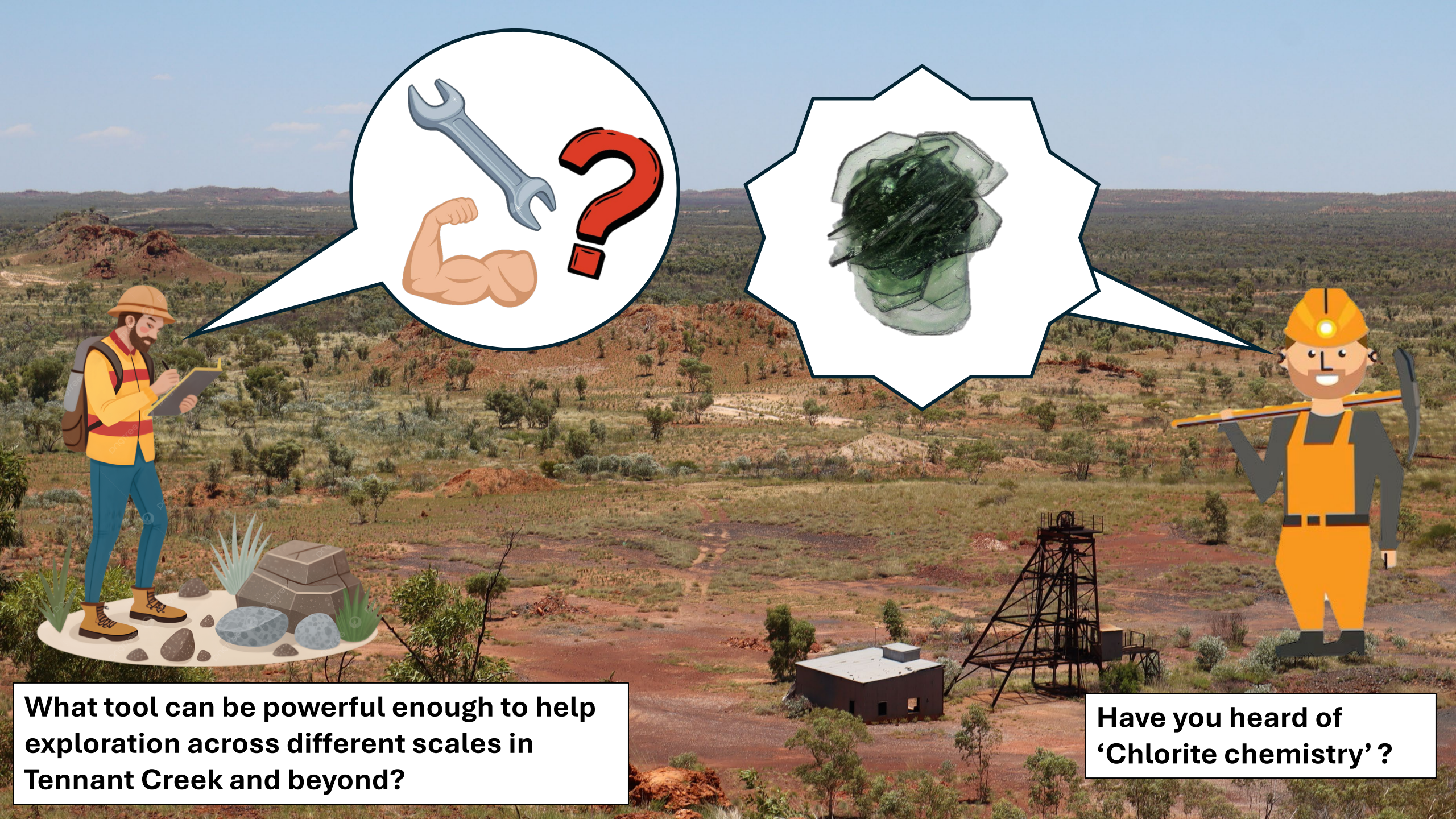
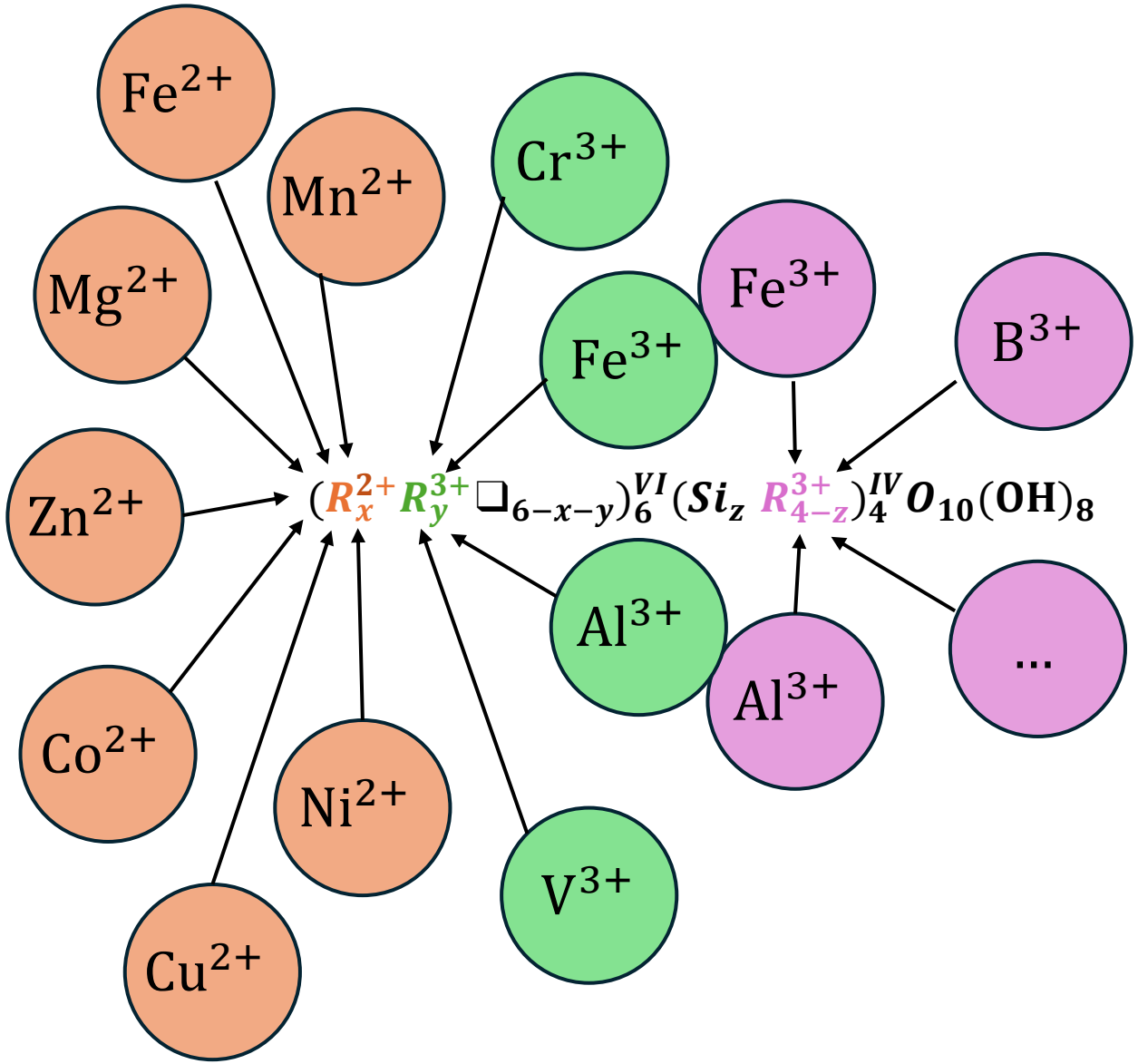
AGES Alice Springs 15th April 2026

Subtitles: How to explore for new deposits in the historical Tennant Creek province ?

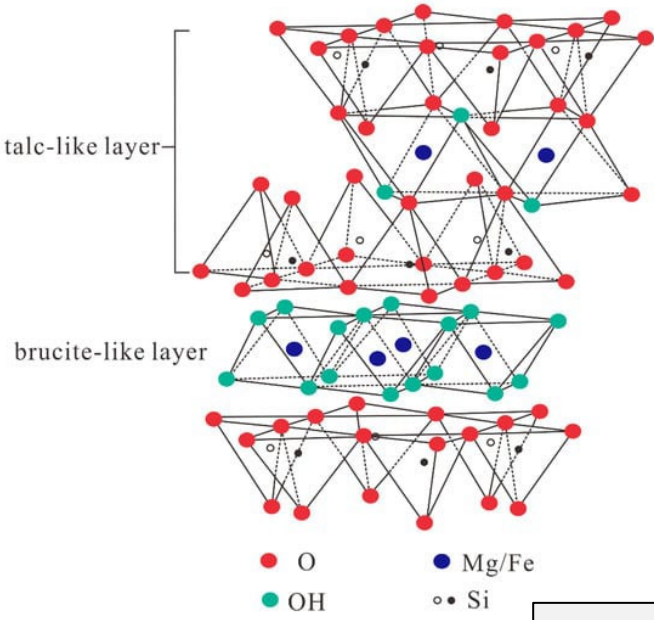
That’s a good question! Let’s use new tools to have new insights on this province.


What tool can be powerful enough to help exploration across different scales in Tennant Creek and beyond?
Have you heard of ‘Chlorite chemistry’ ?

Chlorite chemistry



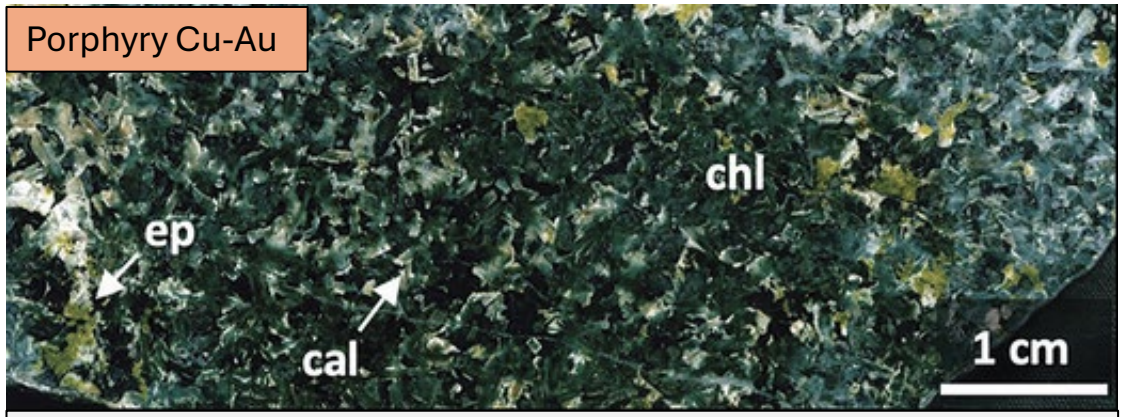
Chlorite – Kayes, Mali - Mindat



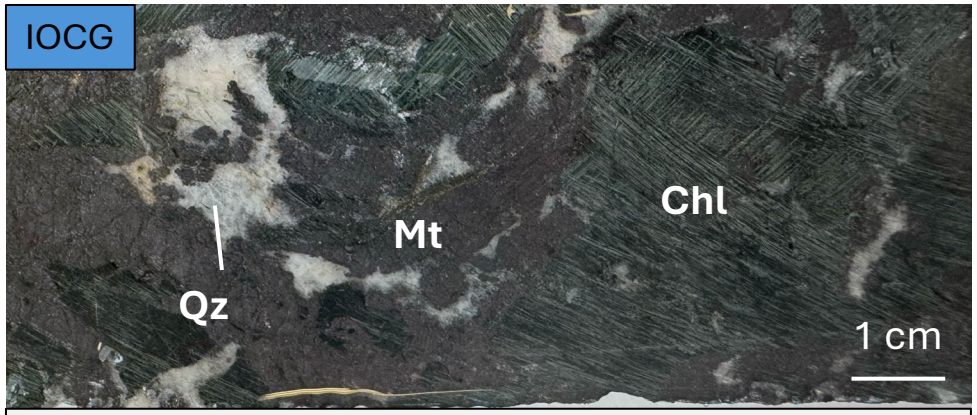
Hao et al., 2020

INTRODUCTION

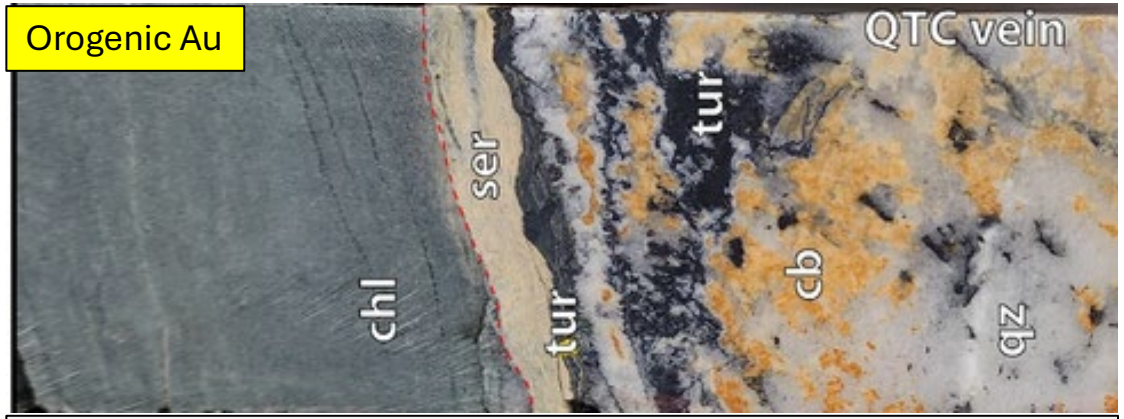
Chlorite chemistry



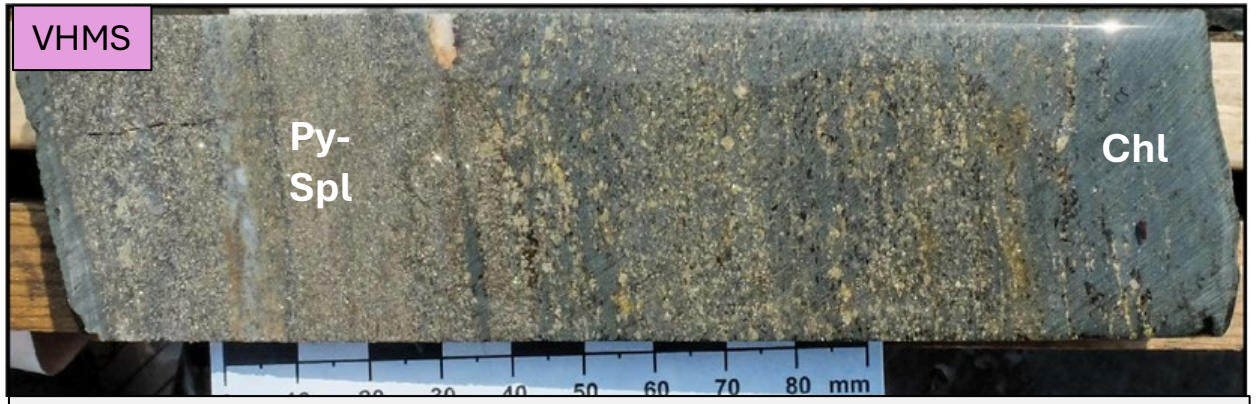
Propylitic alteration - *Resolution, USA (Cooke et al. 2020)*



Ironstone – *White Devil, Australia*



Chlorite alteration - *Val d'Or, Canada (Pedemonte et al. 2026)*

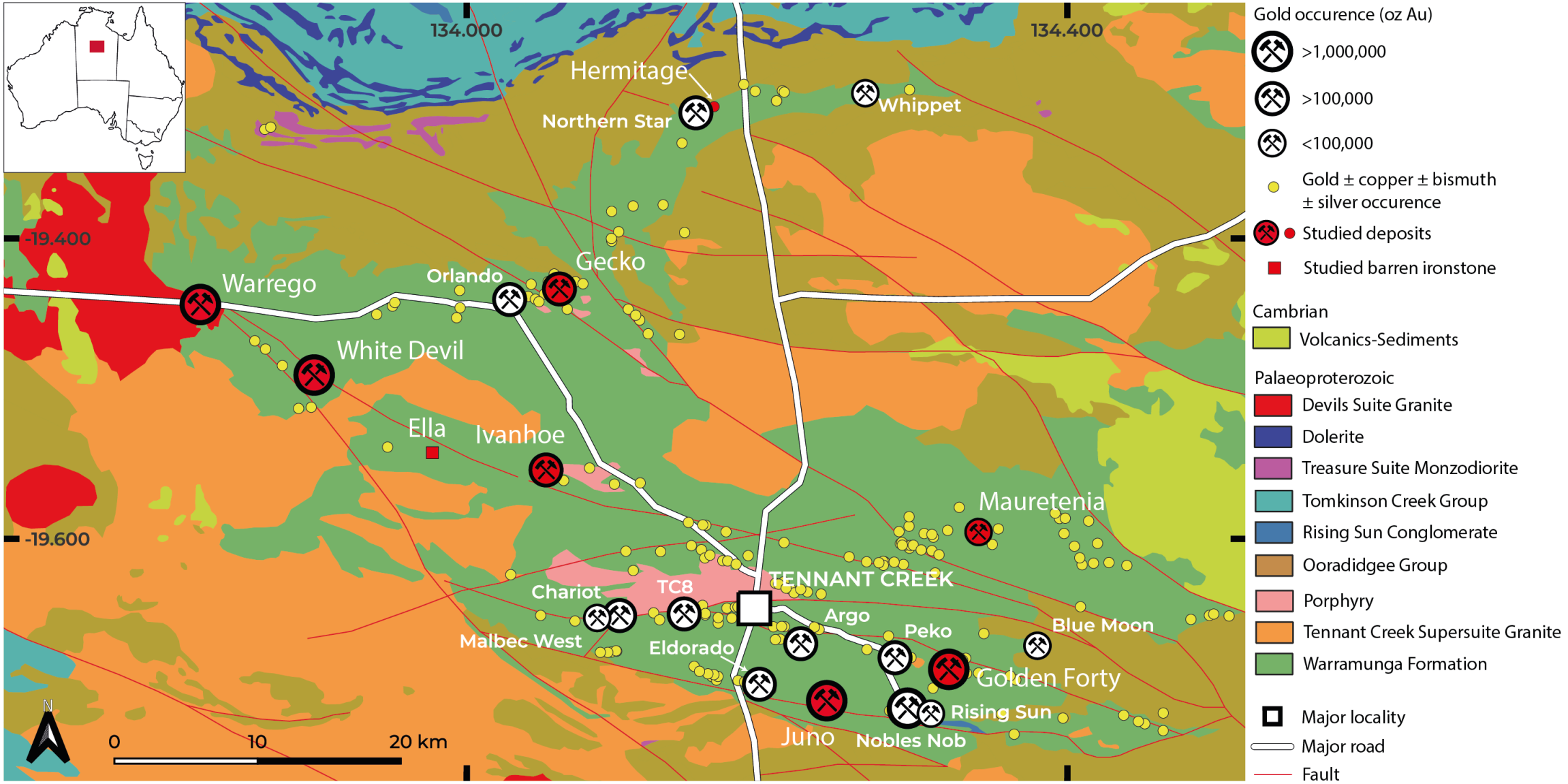


Chlorite alteration - *Finlayson Lake, Canada (Denisova et al. 2023)*

➔ Chlorite has been used as a vectoring tool in numerous deposit types. What about in Tennant Creek ??

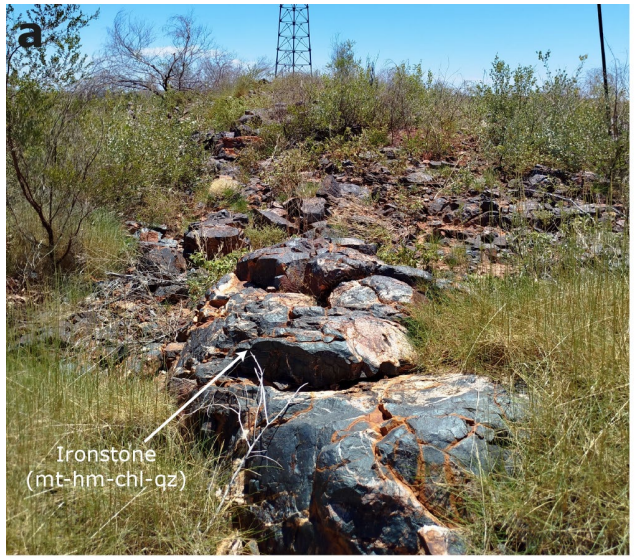
INTRODUCTION

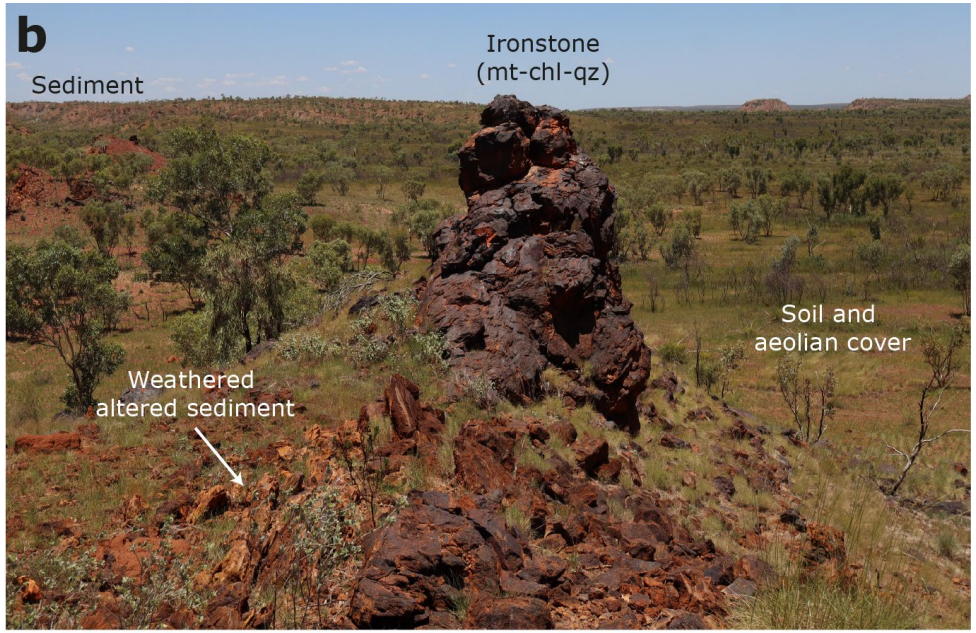
Geology of the Tennant Creek province

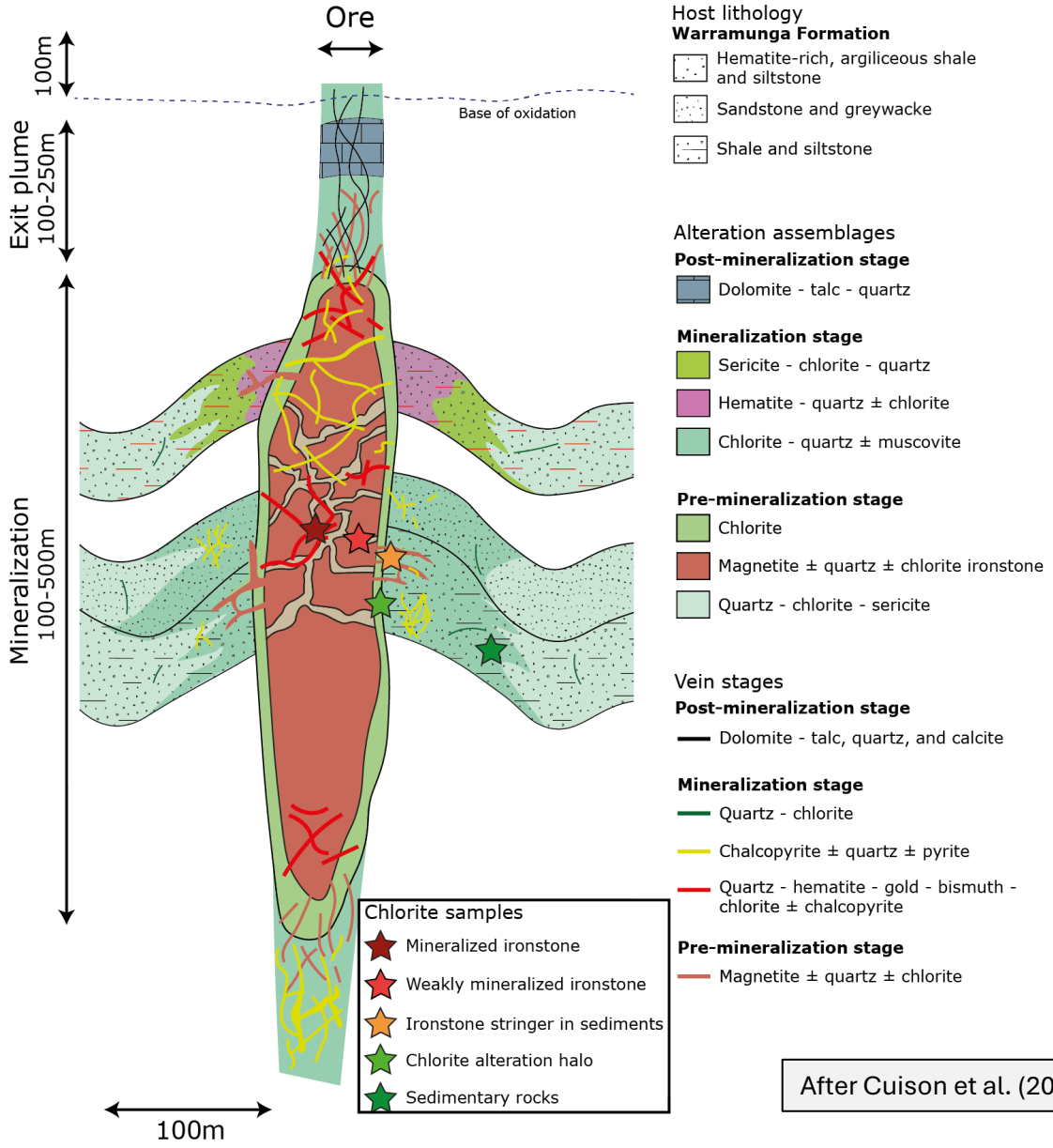


INTRODUCTION

Geology of the Tennant Creek deposits



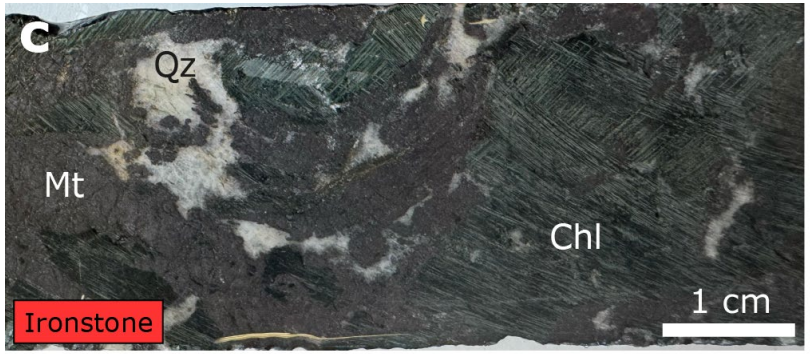


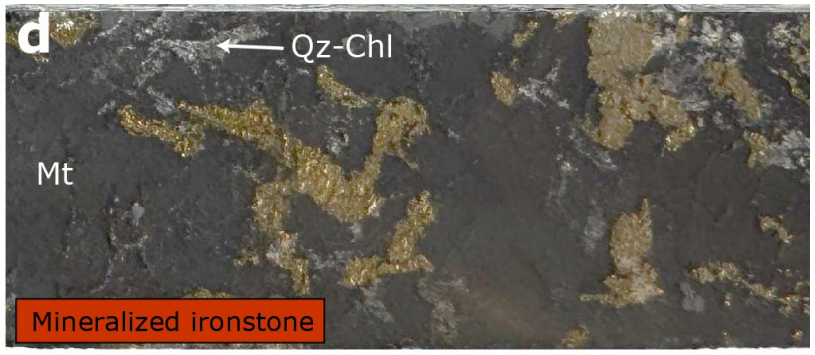


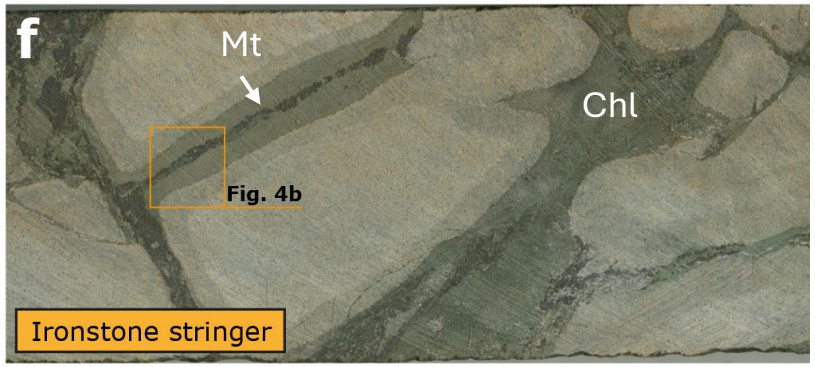
After Cuison et al. (2015)

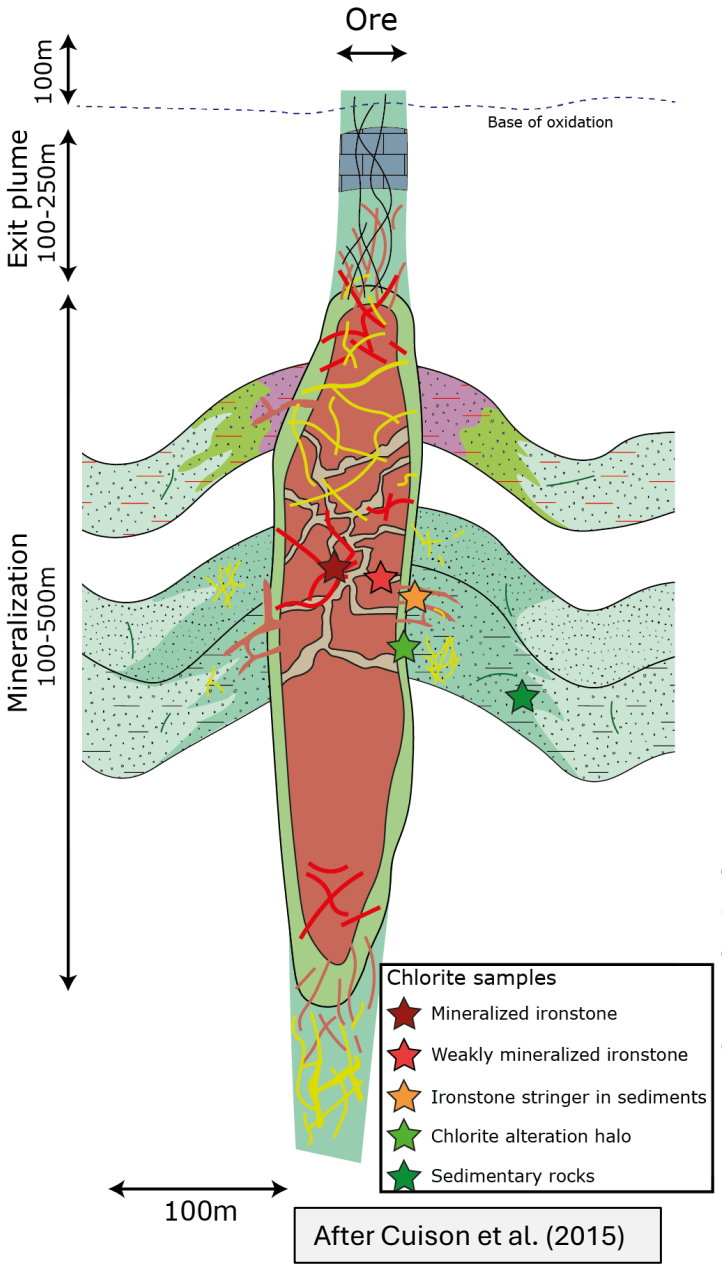
INTRODUCTION

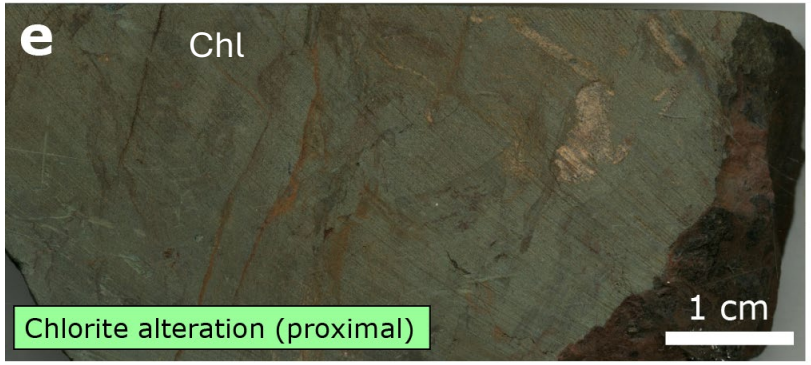
Chlorite is widespread in Tennant Creek deposits

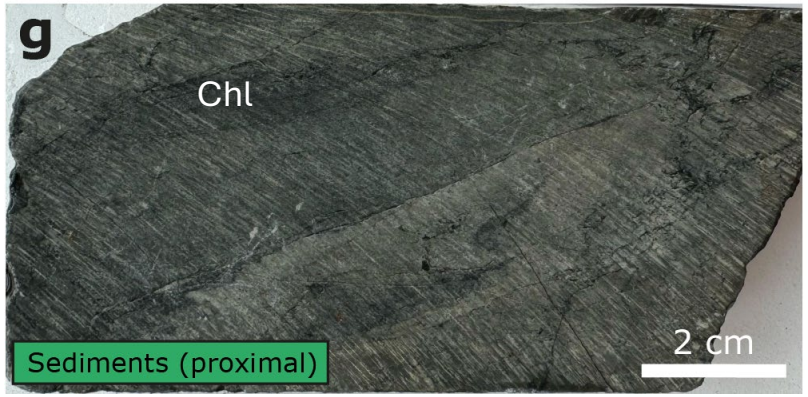


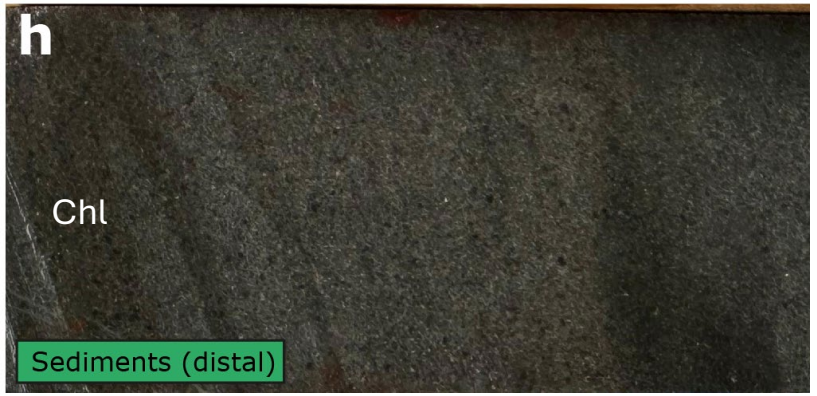












INTRODUCTION — A multiscale approach

Sample scale

mm - cm

Near-mine scale

BROWNFIELDS
1 - 100 m

Deposit scale

GREENFIELDS
100 m – 3 km

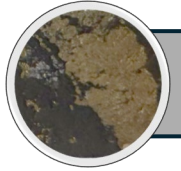
Province scale

GREENFIELDS
> 50 km

Global scale

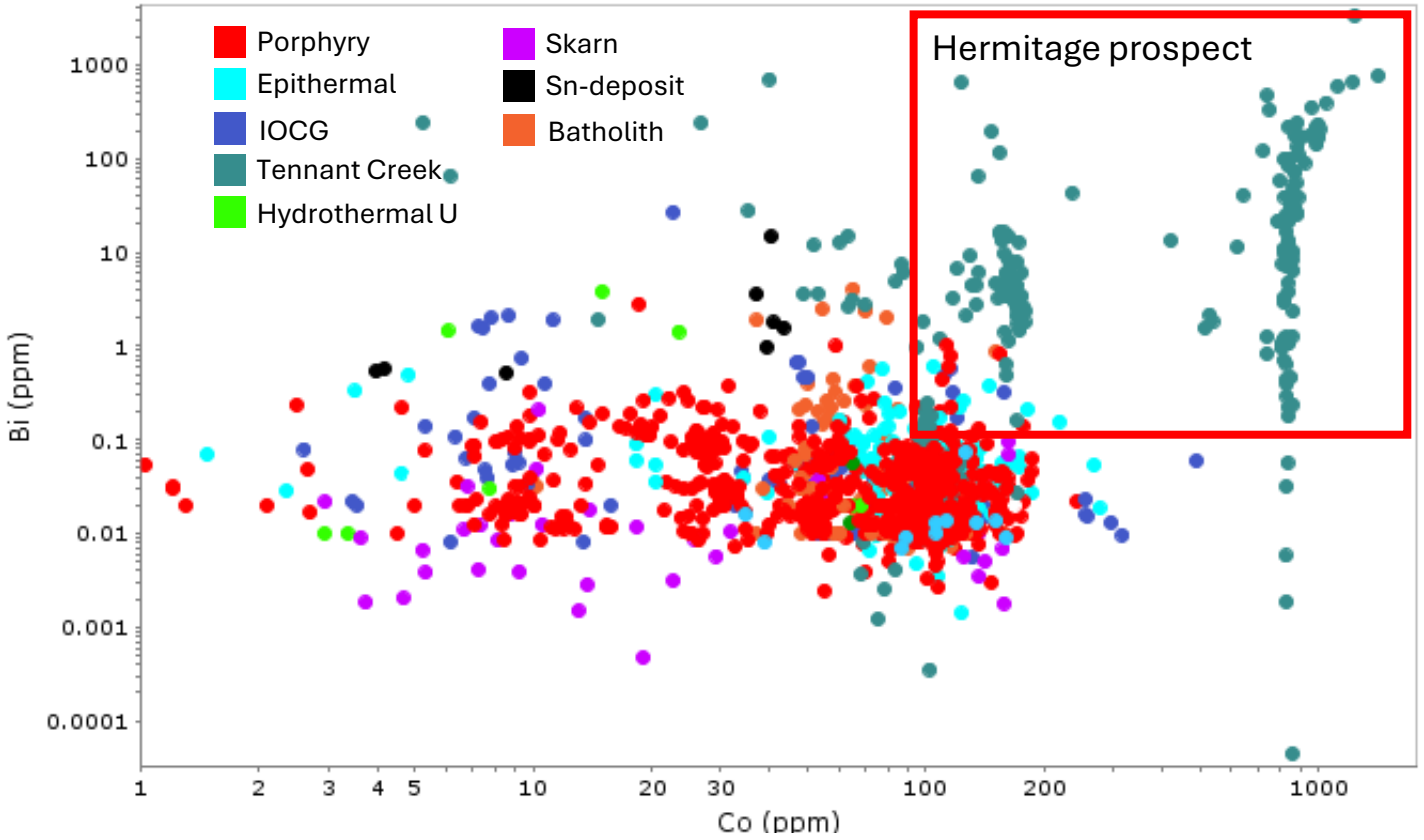
DEPOSIT CLASSIFICATION
WORLD

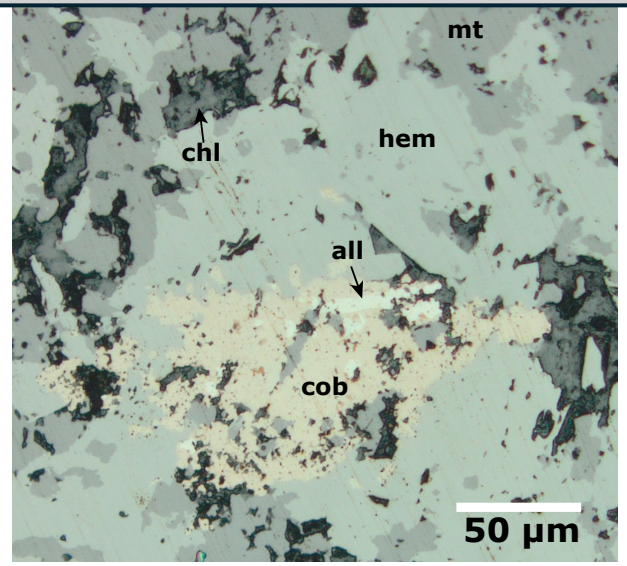
Several scales, several approaches, ONE TOOL : Chlorite chemistry

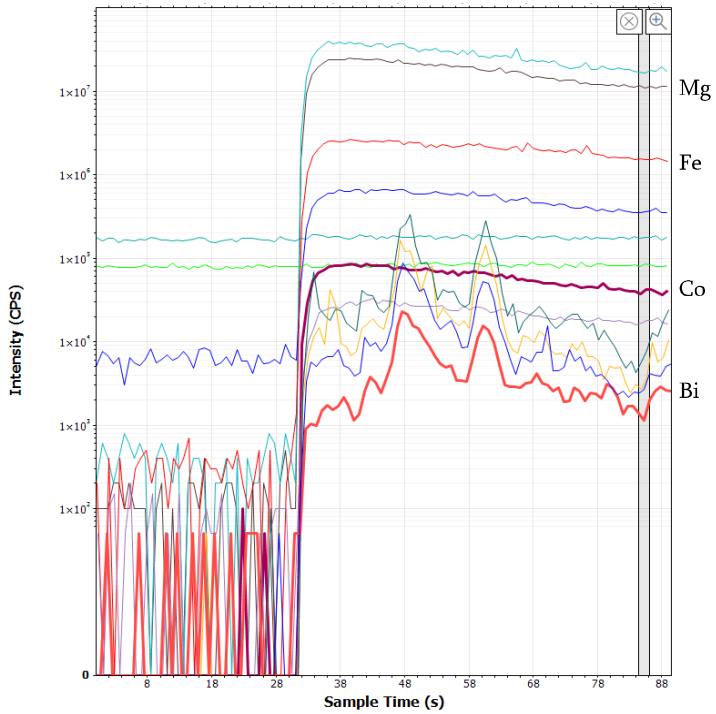


SAMPLE SCALE

Chlorite as an indicator of critical metals

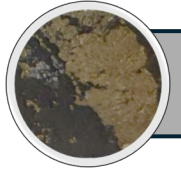






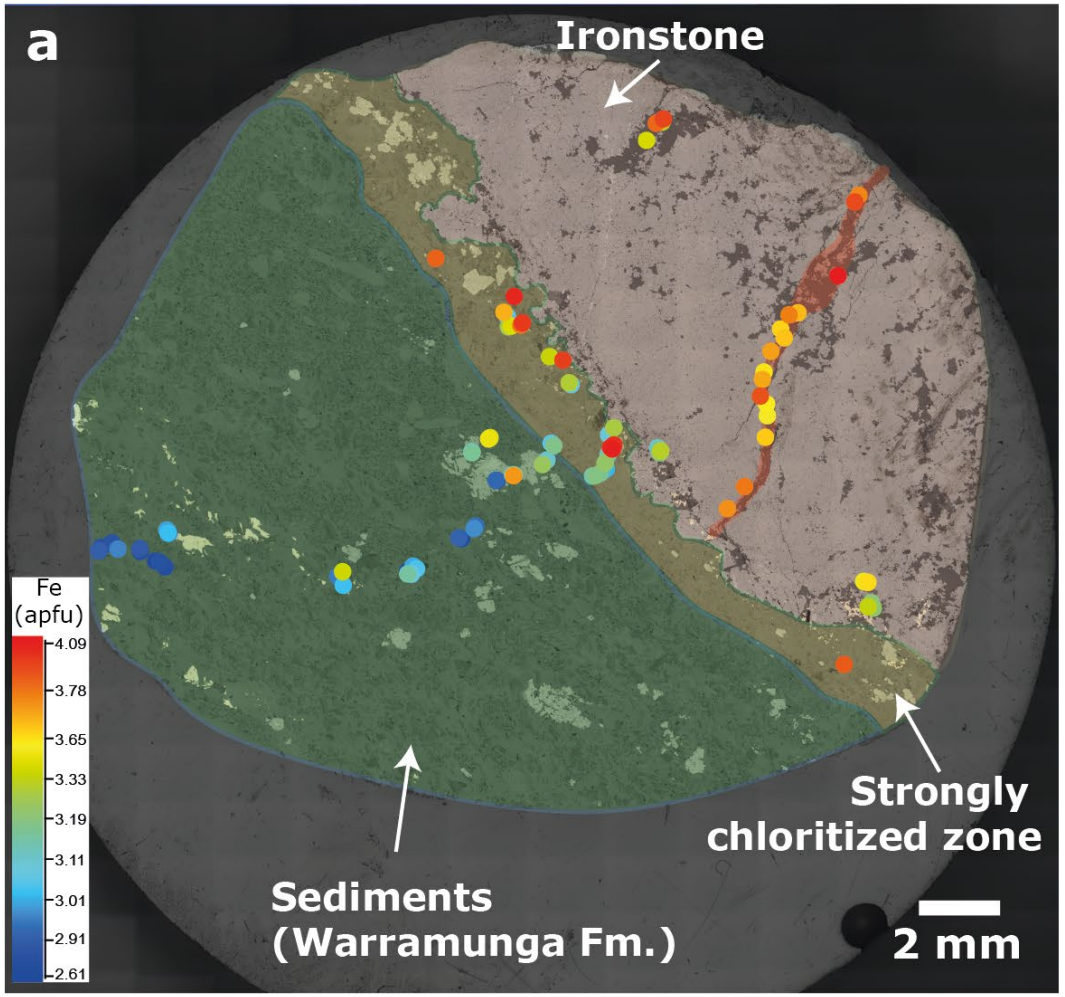
➔ Chlorite chemistry provides information about critical metals present in some of Tennant Creek deposits

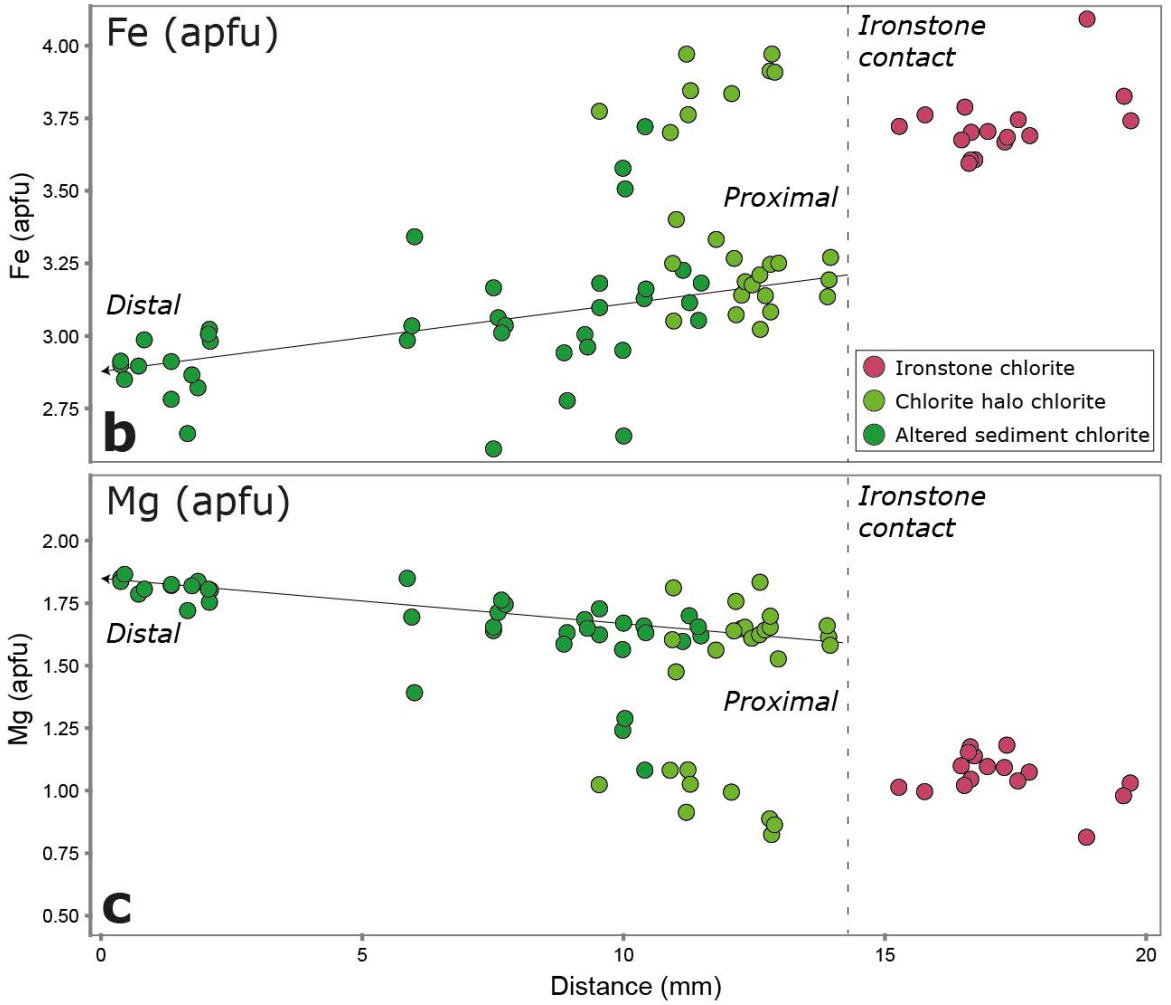
➔ Cobalt is incorporated into the chlorite structure proximal to Co mineralization.



SAMPLE SCALE

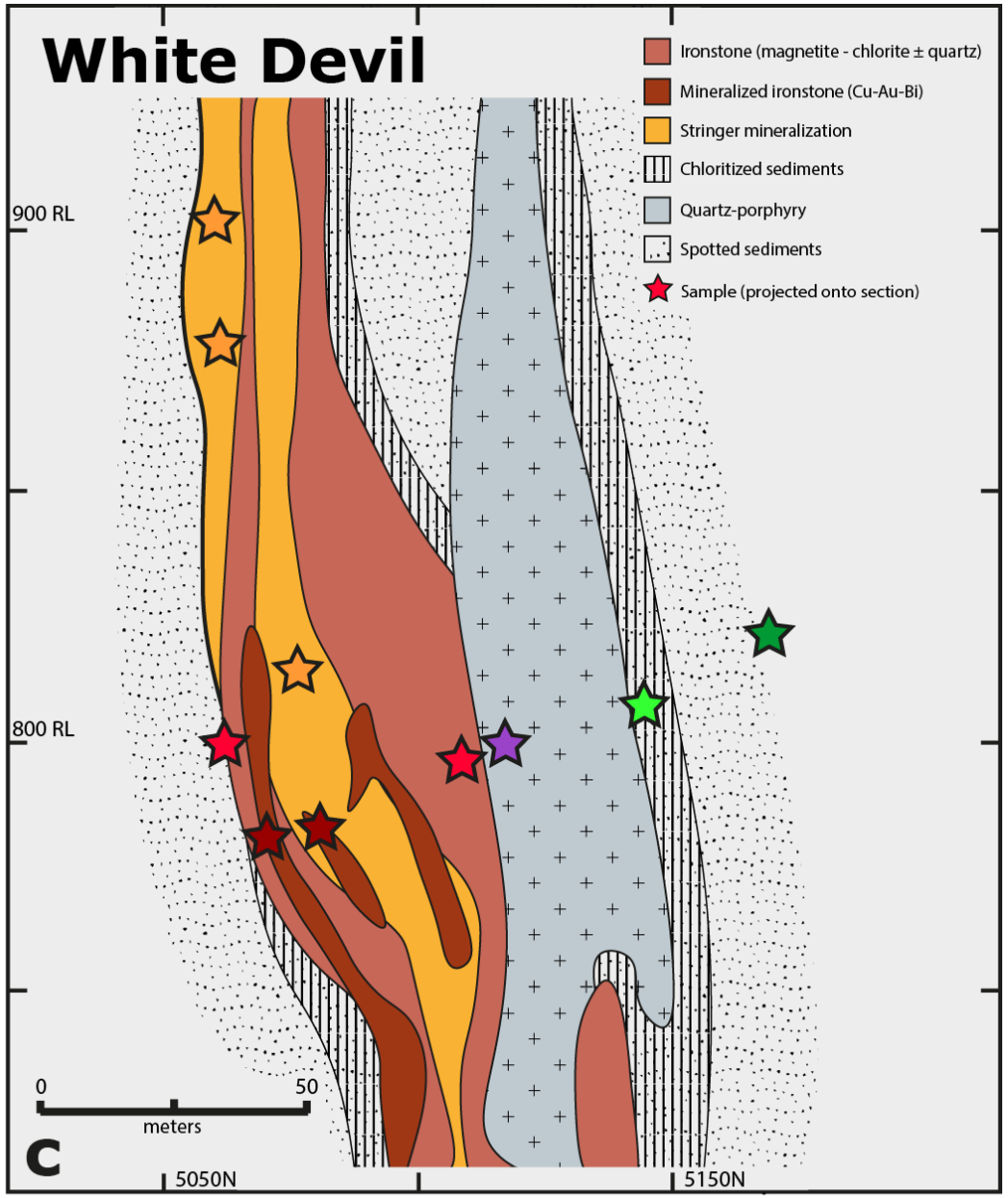
Chlorite composition gradients at sample scale

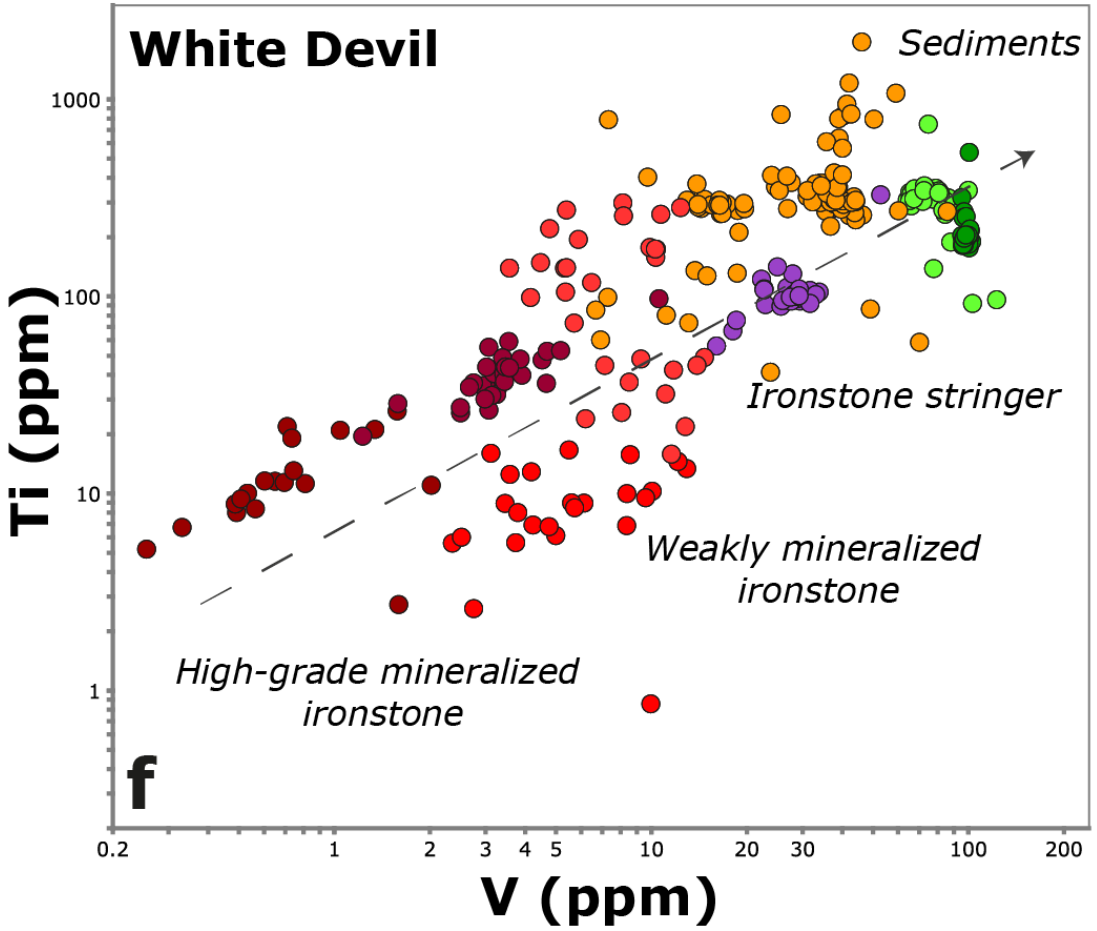




➔ Sample-scale variations in chlorite composition away from ironstone highlight fluid flow pathways in Tennant Creek systems

OREBODY SCALE — Chlorite chemistry as a vectoring tool to high-grade ore





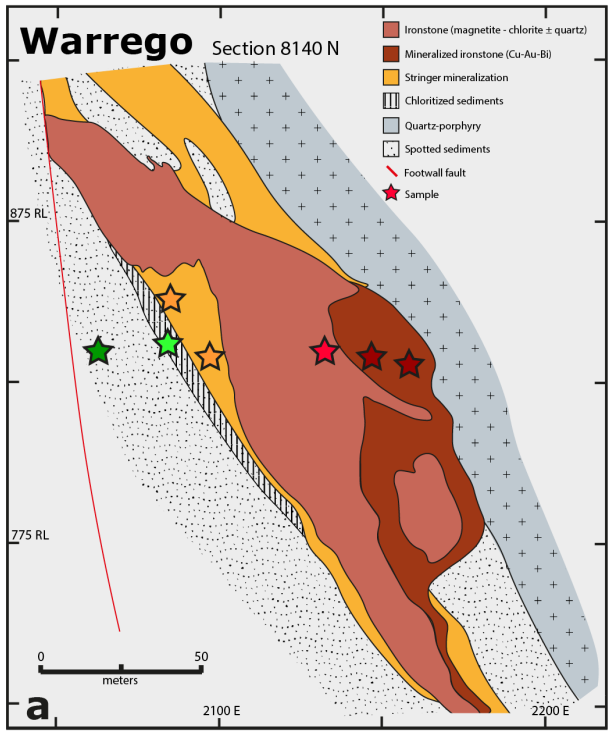
➔ Chlorite chemistry variations within ironstone body pointing towards mineralized centre of the deposit

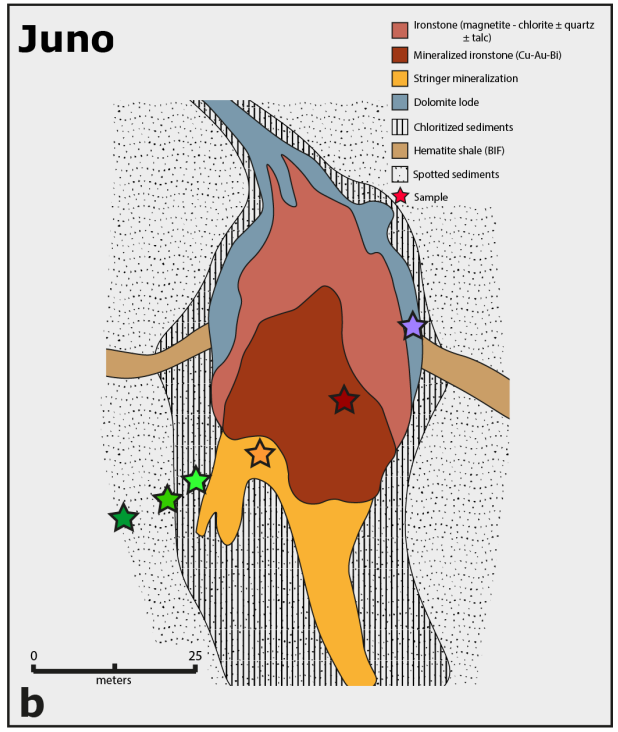
OREBODY SCALE

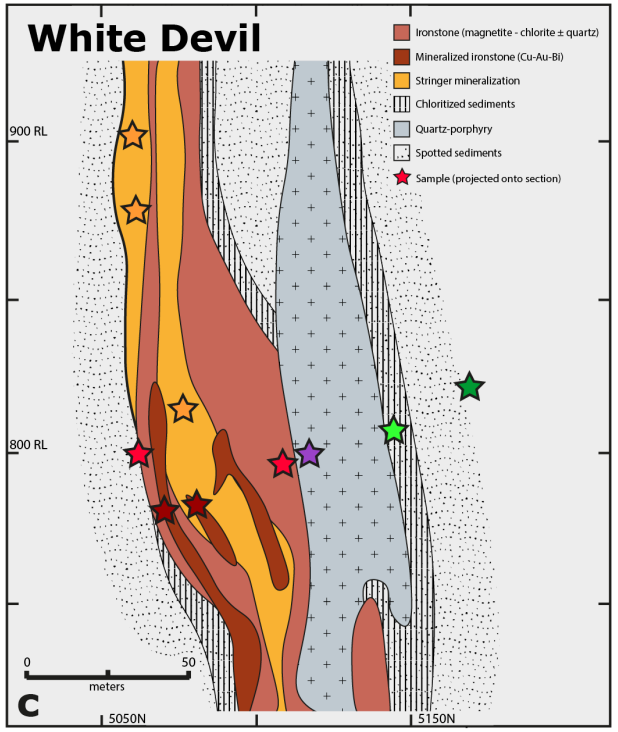
Chlorite chemistry as a vectoring tool to high-grade ore

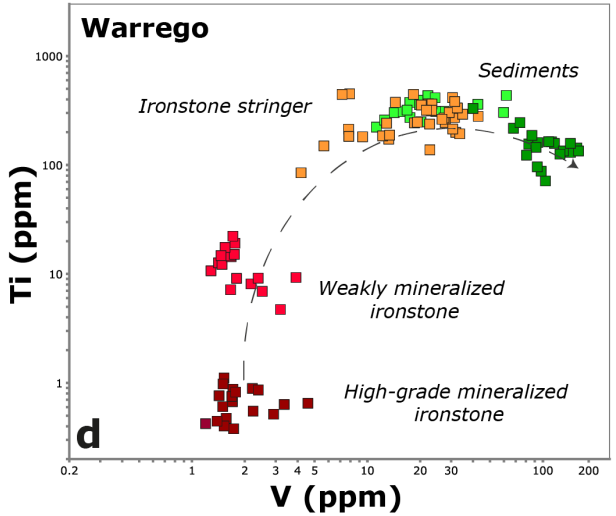
- Consistent patterns across deposits highlighting high grade zones in brownfield environments

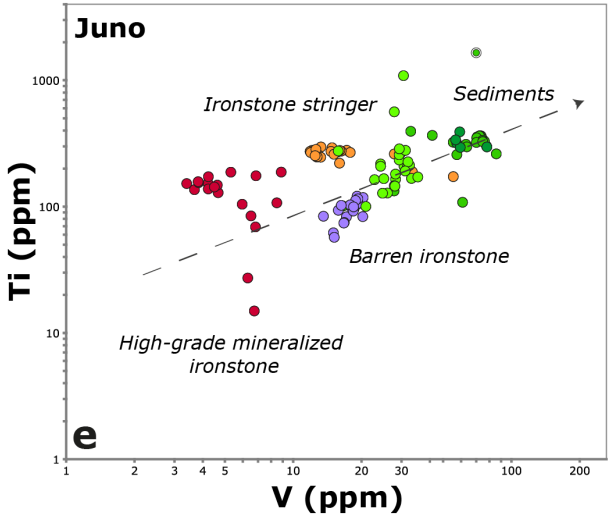
Near Golden Forty East

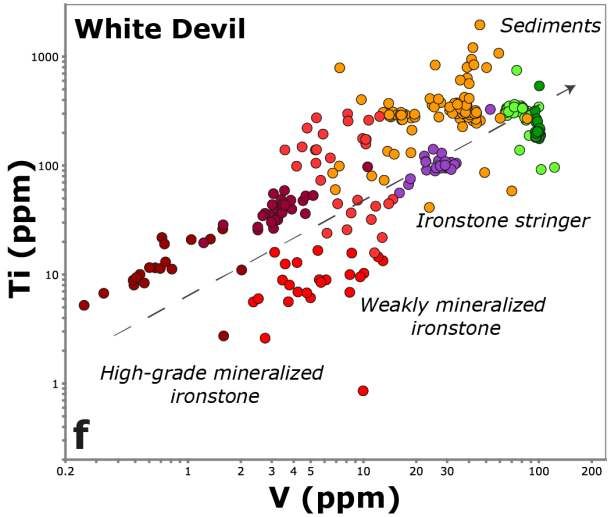






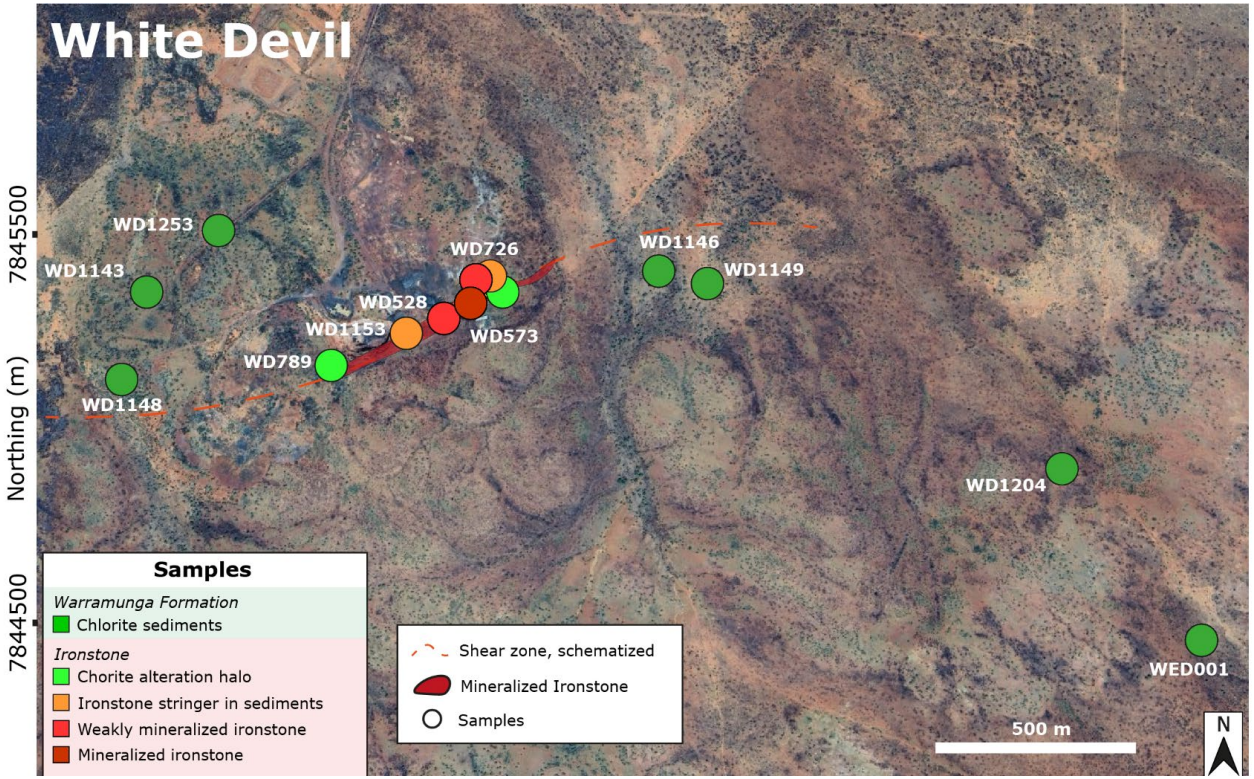


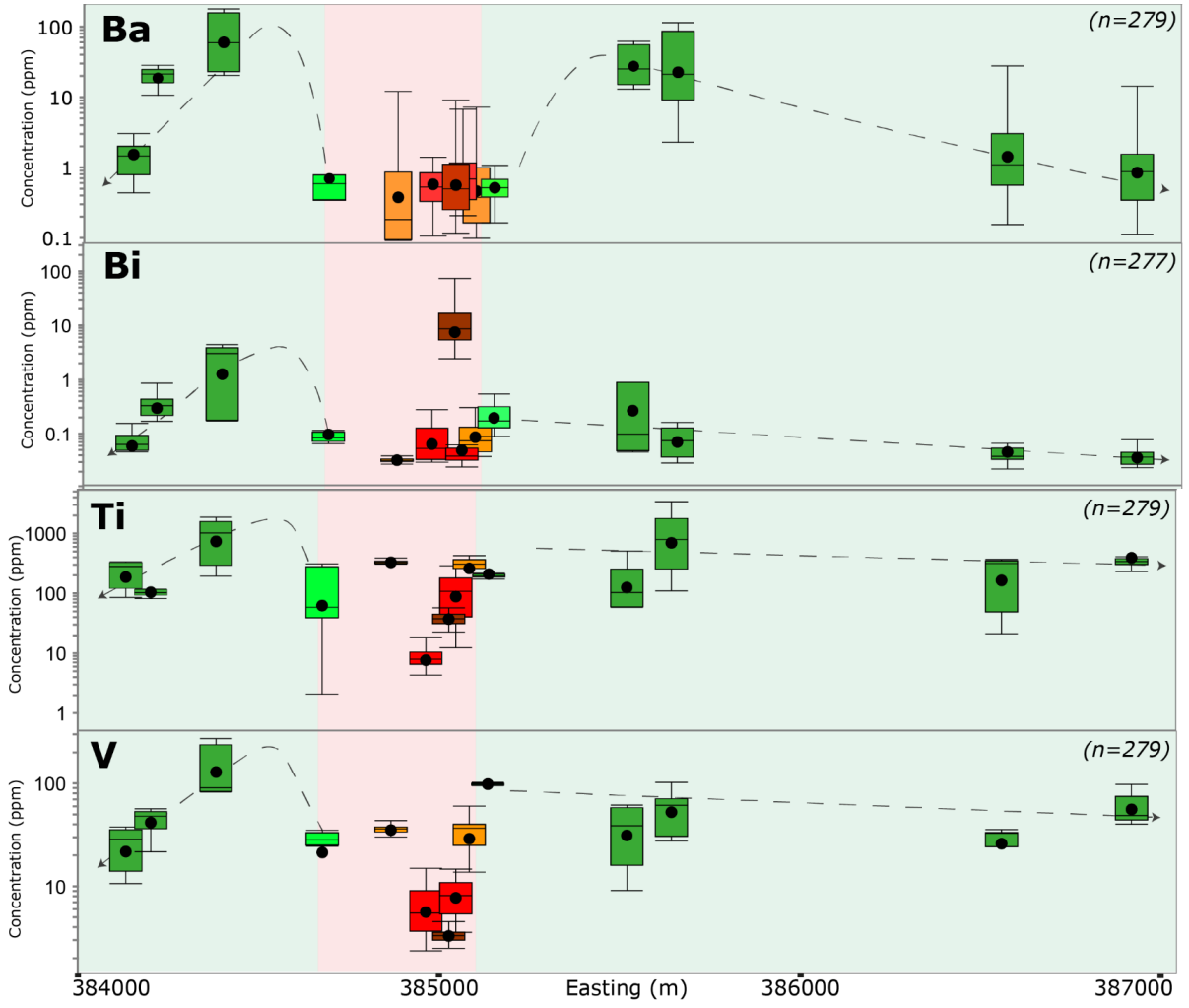




DEPOSIT SCALE

White Devil case study



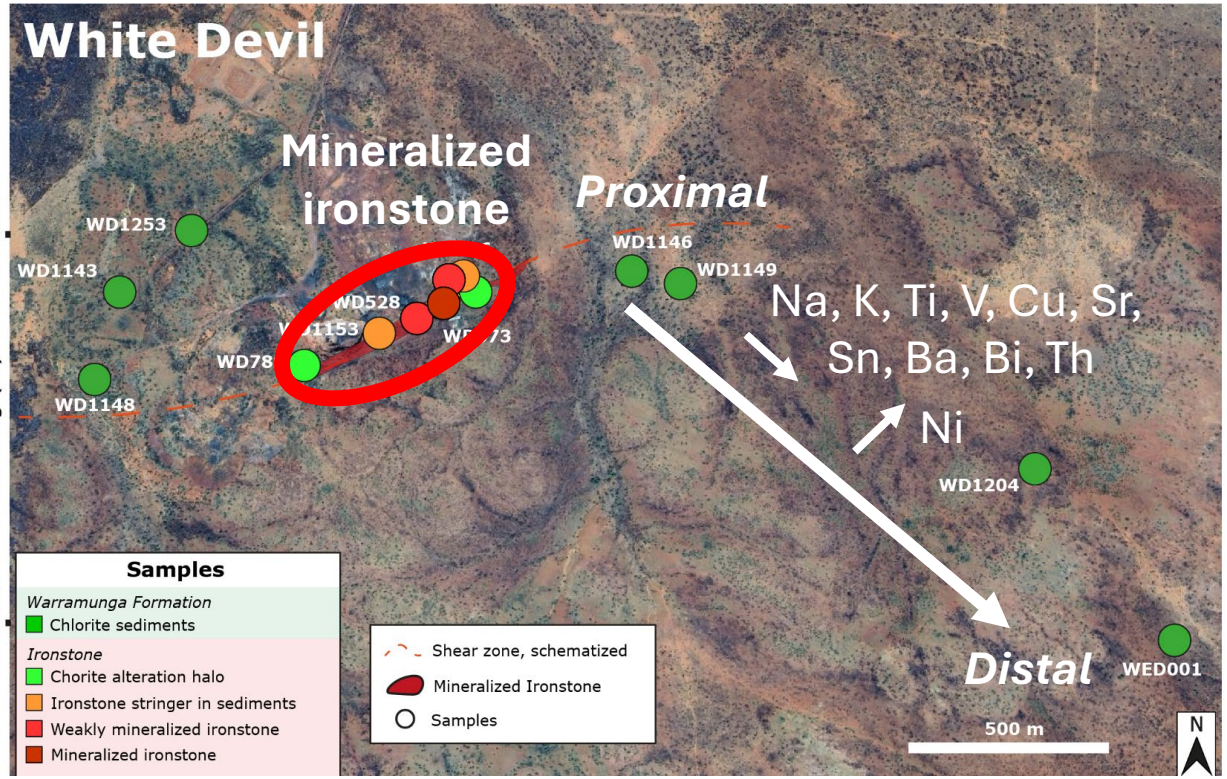


➔ Systematic variations in chlorite chemistry (e.g., K, V, Bi, Ni…) can indicate mineralization well beyond mapped alteration zones and geochemical anomalies, with vectors up to 1500 meters

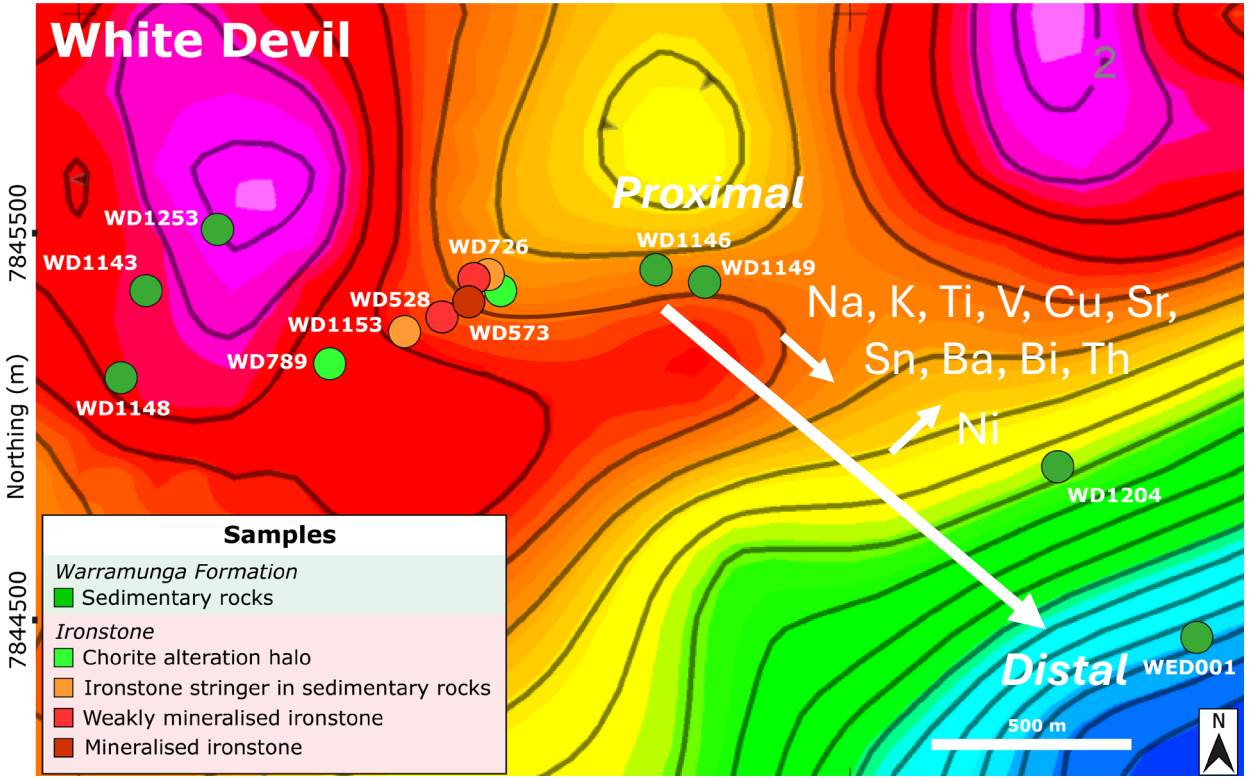
DEPOSIT SCALE

White Devil case study

SATELLITE



GRAVITY



➔ Vectors are observed perpendicular to main structures controlling hydrothermal fluid flow.

➔ Application of chlorite chemistry in greenfield or undercover terrains has the potential to guide the next generation of discoveries.

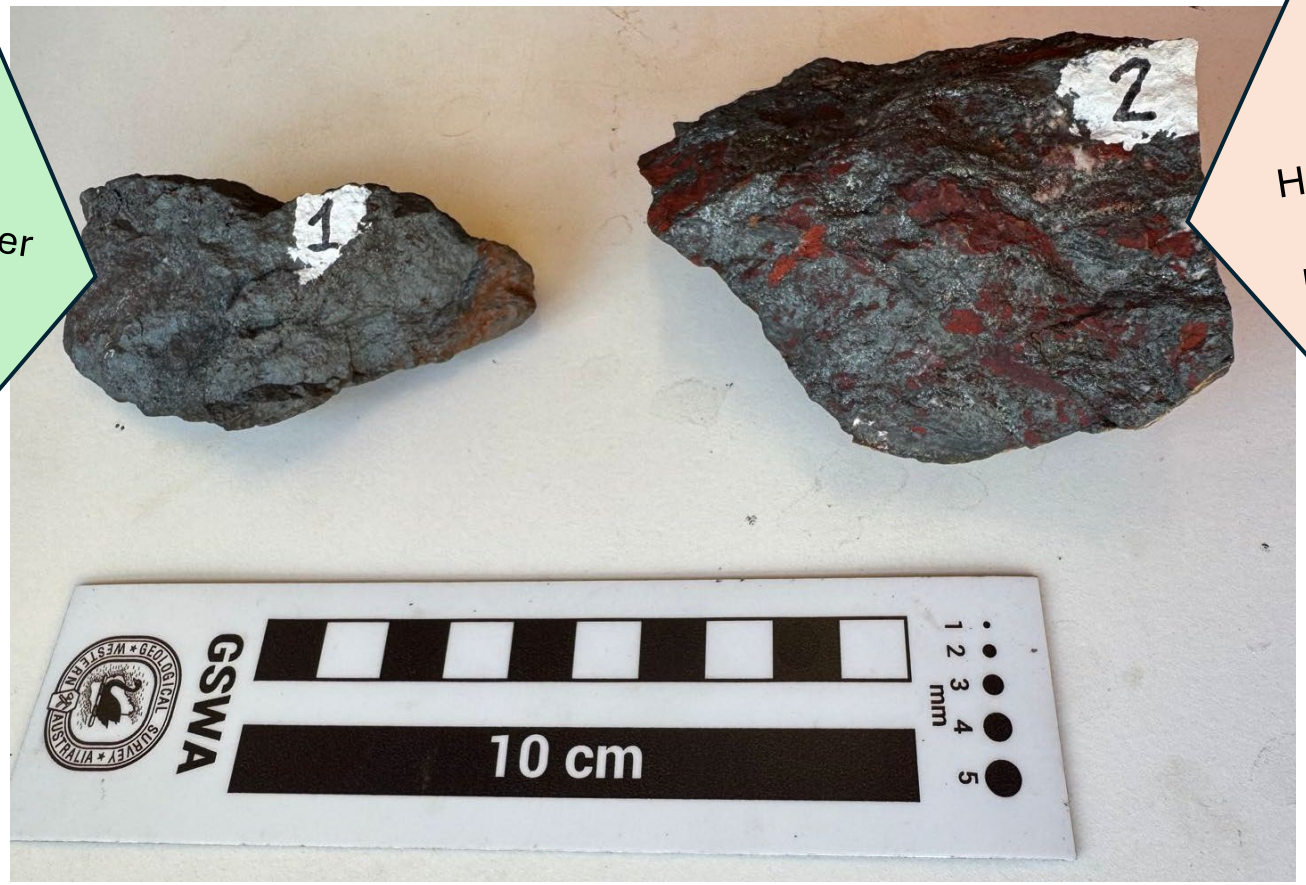
PROVINCE SCALE

Mineralized vs. Barren ironstone

Nobles Nob ironstone

Hematite-chlorite-quartz±jasper ironstone

Hosting a 1,000,000+ Oz. Au deposit (*1.996 Mt @ 17.3 g/t Au*)



Barren ironstone

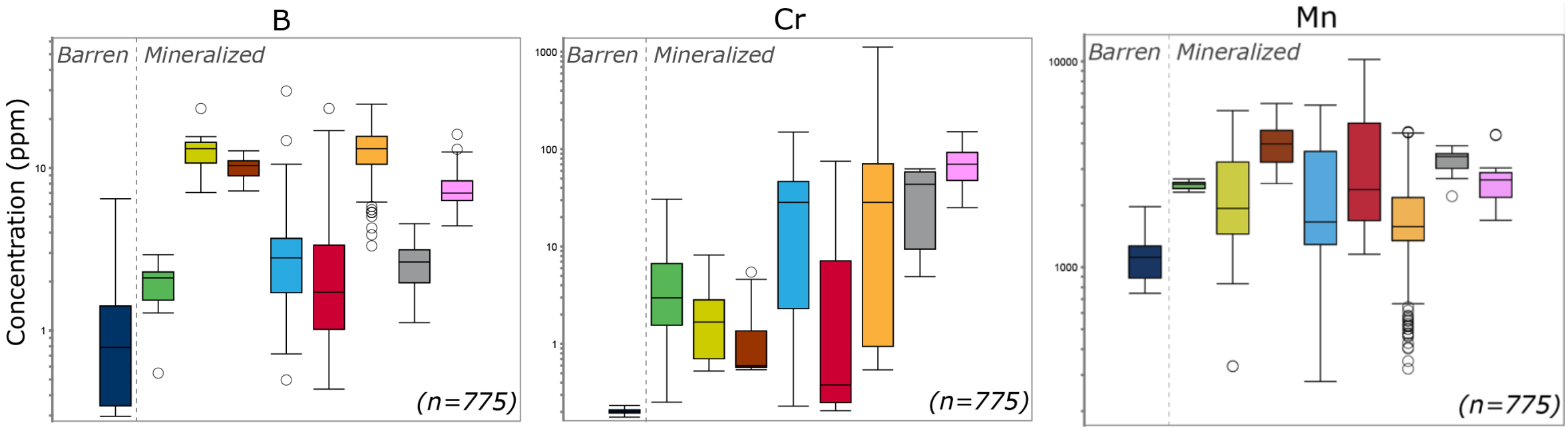
Hematite-chlorite-quartz±jasper ironstone

Does not host a single ounce of gold

Can you spot any differences?

PROVINCE SCALE

Mineralized vs. Barren ironstone



➔ Chlorite distinguishes barren from mineralized ironstones (B, Cr, Mn, Fe, Cu, Sr, Sn, U…)

➔ Variations explained by different ironstone and/or fluid chemistry

Barren ironstone
- Ella

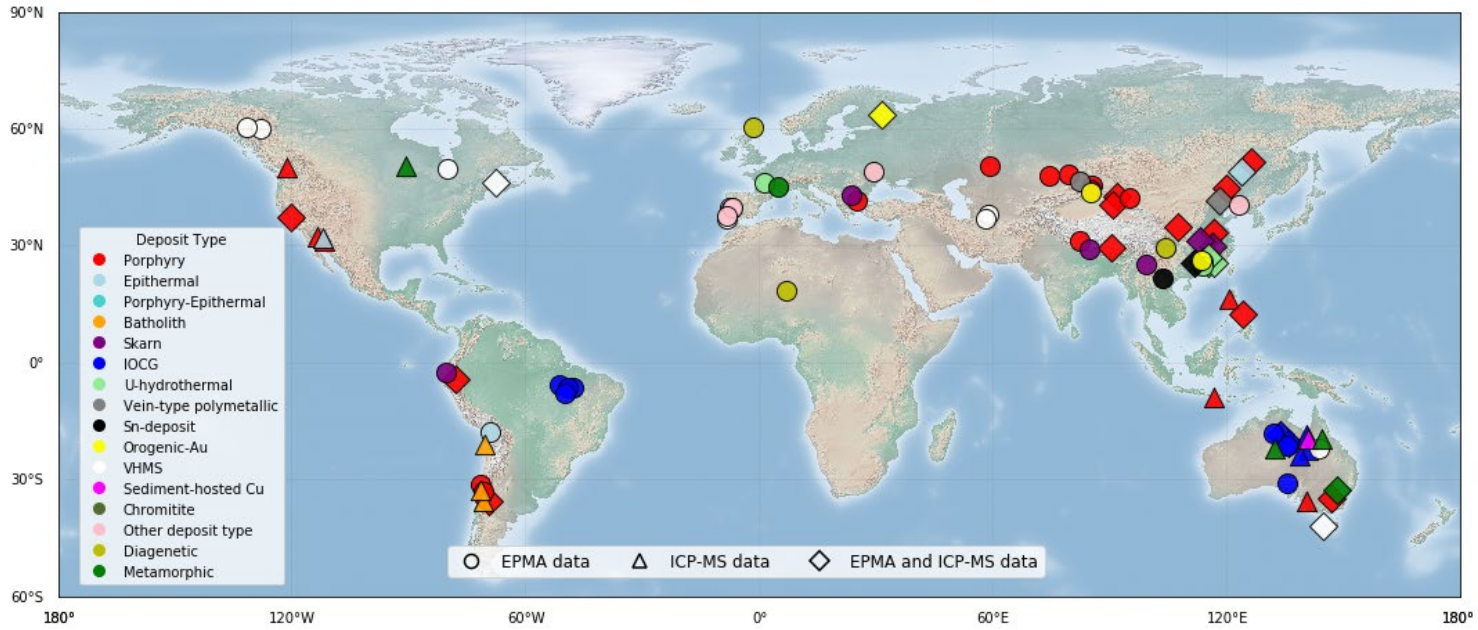
Mineralized ironstones
- Gecko
- Golden Forty
- Ivanhoe
- Juno
- Warrego
- White Devil
- Mauretenia
- Hermitage

GLOBAL SCALE

Chlorite as a tool to classify ore deposit types

- Tennant Creek deposits differ from typical IOCG systems in that they have spatially restricted chlorite-rich hydrothermal alteration haloes and are enriched in Bi.

- Comparison with chlorite chemistry data from 90+ deposits worldwide

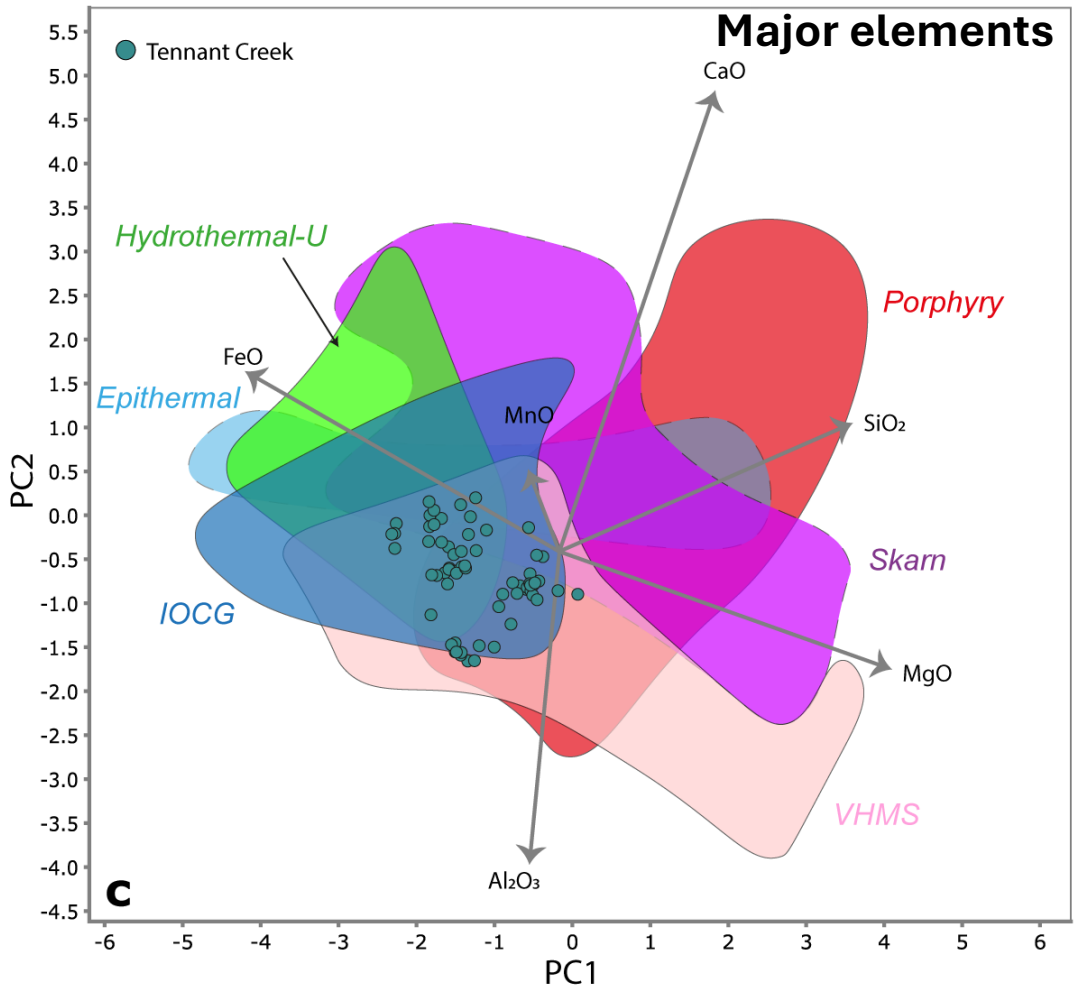


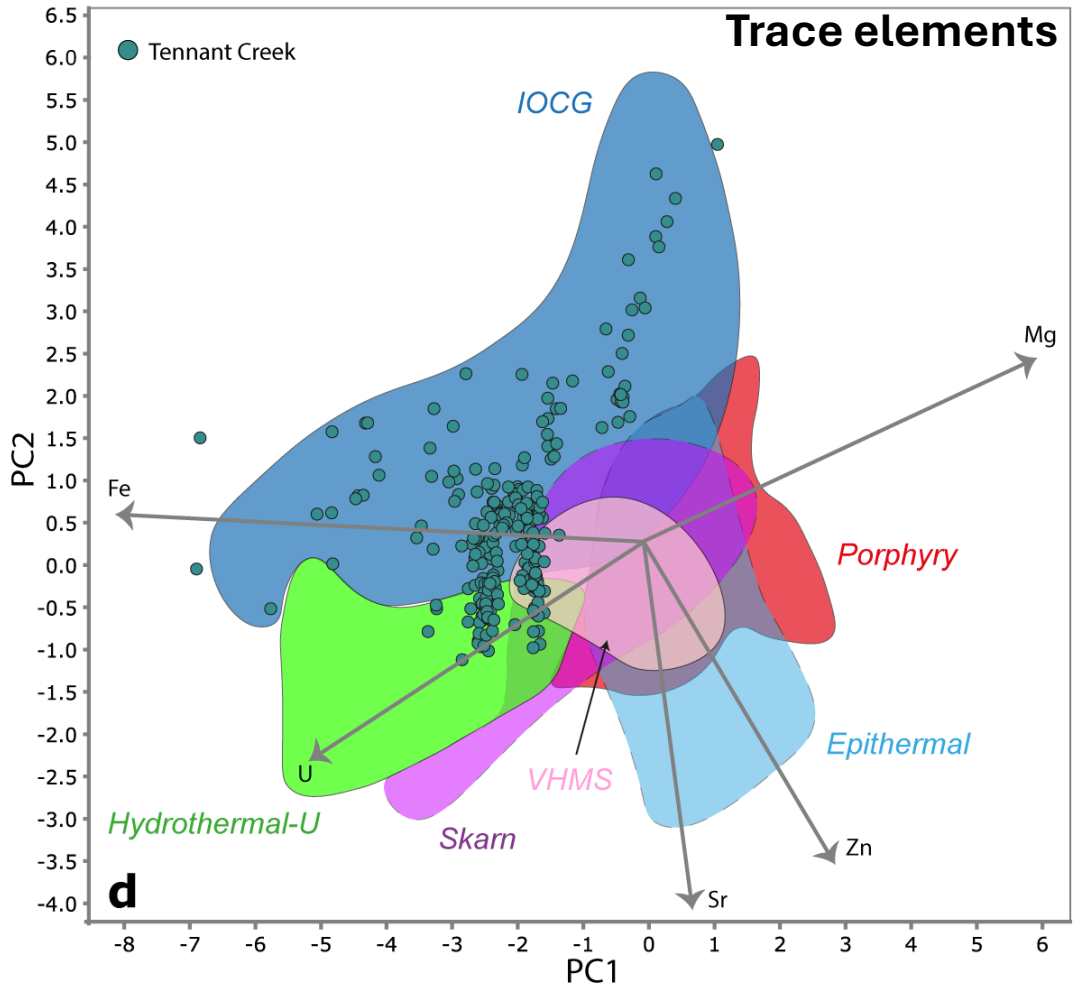
EPMA – ICPMS analysis on Tennant Creek chlorite

Chlorite chemistry data from literature (~100 deposits)

→ Data cleaning and filtering → Multivariate statistical methods → Deposit classification

GLOBAL SCALE — Chlorite as a tool to classify Tennant Creek deposits





➔ Chlorite chemistry is a powerful tool to classify ore deposit types

➔ Tennant Creek chlorite coincides with global IOCG chlorite, contributing to resolve the debated classification of TC

➔ Known chlorite vectors from different environments (porphyry, VMS…) are therefore not relevant for Tennant Creek ■

CONCLUSIONS — Chlorite chemistry : a multiscale tool

Sample scale

Modelling tool

Retraces fluid flow pathways

mm - cm

Near-mine scale

Vectoring tool

High-resolution vectoring within ironstone towards high-grade ores

BROWNFIELDS
1 - 100 m

Deposit scale

Vectoring tool

Geochemical vectors to ore across strike well beyond visible alteration haloes (>2 km)

GREENFIELDS
100 m – 3 km

Province scale

Fertility tool

Clear distinction between mineralized and barren ironstones

GREENFIELDS
> 50 km

Global scale

Modelling tool

Reinforce classification of Tennant Creek deposits as IOCG type, contributing to the understanding and modelling of deposits

DEPOSIT CLASSIFICATION
WORLD

CONCLUSIONS

Chlorite chemistry : the Swiss Army knife for exploration in Tennant Creek

Vectoring to ore in proximal environments (brownfields)

Vectoring to ore in distal environments (greenfields)

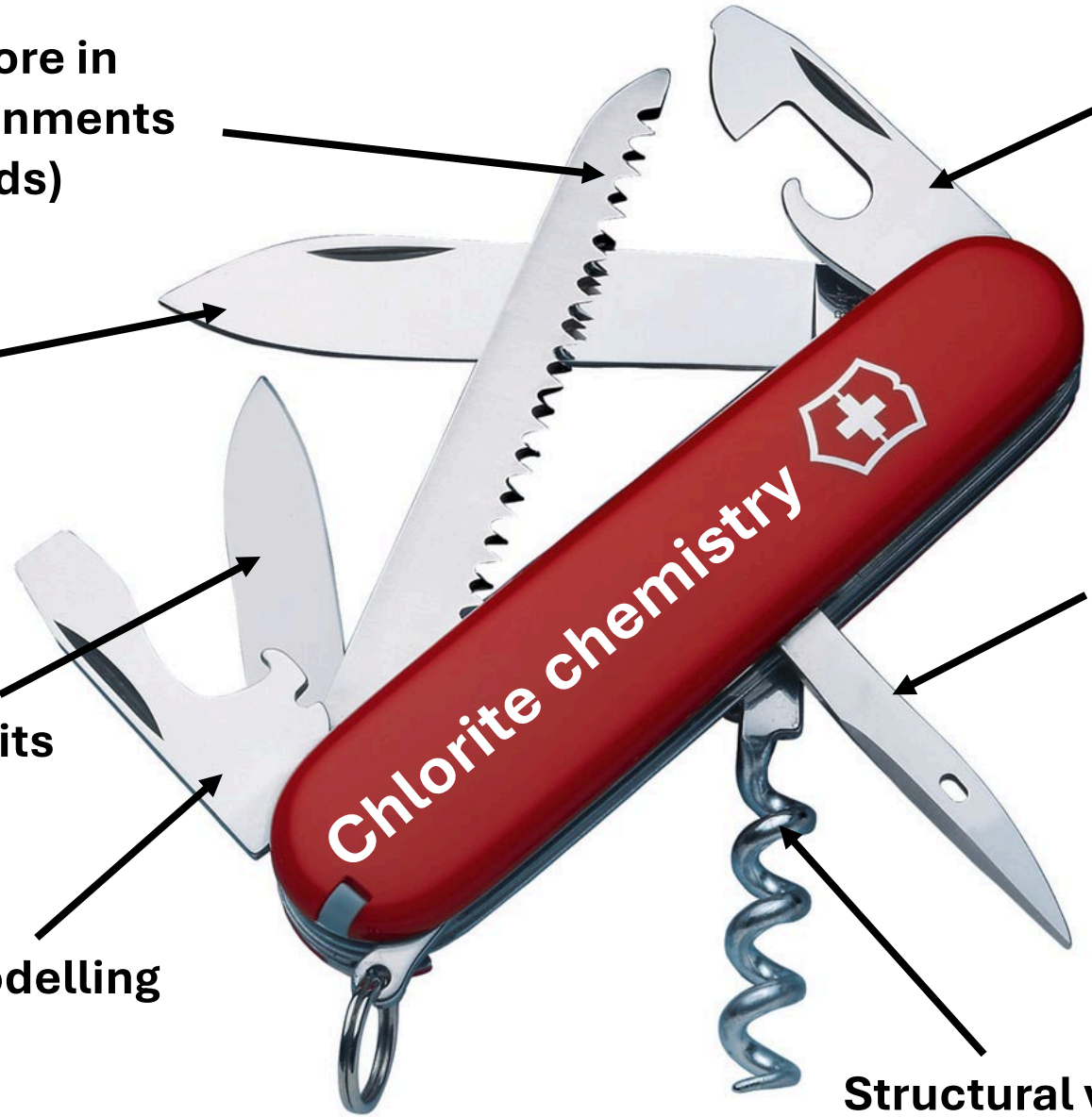
Ironstone fertility assessment

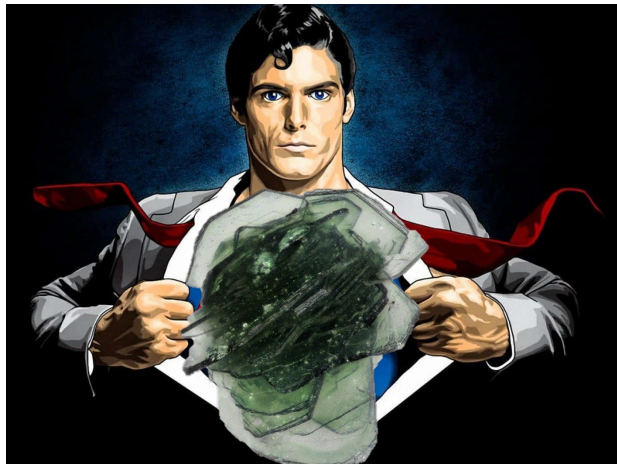
Thermobarometer

Classification of Tennant Creek deposits

Deposit modelling

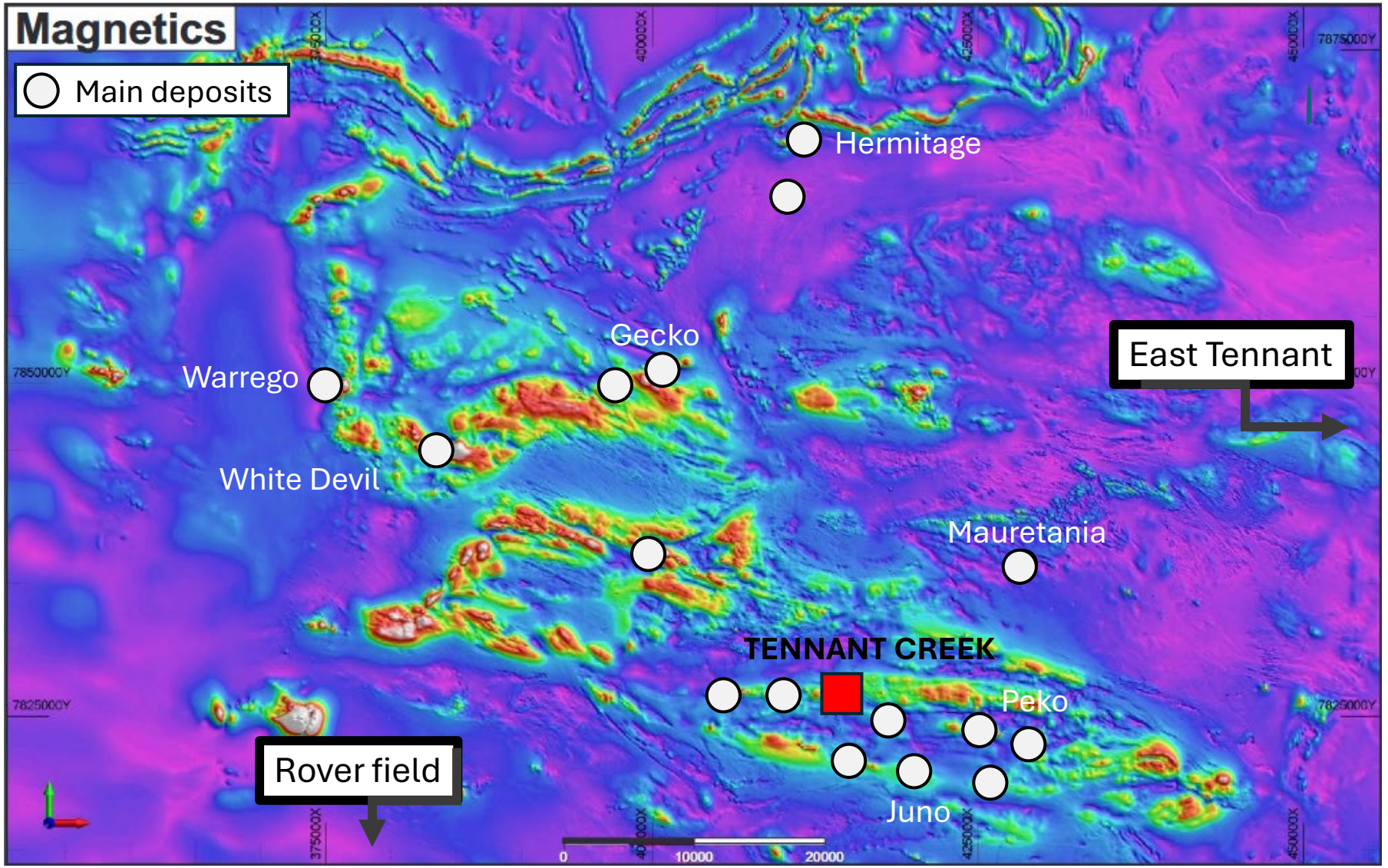
Structural vector





CONCLUSIONS

Tennant Creek and beyond...



Modified after Cuison et al., 2015

- Chlorite chemistry may be a powerful exploration tool in undercover or underexplored regions, such as in the **East Tennant** and **Rover Field**
- Potential to contribute to future discoveries in and around the Tennant Creek province

Thank you for your attention!

ELSEVIER

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Chlorite chemistry as a tool to classify ore deposits: Global compilation and application to the Tennant Creek Au-Bi-Cu deposits

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emmerson resources