



Australian Government
Geoscience Australia



Critical
Minerals
Mapping
Initiative

Critical Minerals in Ores

Towards an understanding of critical mineral abundances in mineral deposits

Dr David Huston | Principal Research Scientist

The work of many

Geoscience Australia:

D Champion, O Raymond, D Huston, S Van der Wielen, M Sexton, E Bastrakov, M Haynes, I Schroder, G Butcher, S Hawkins, J Lane, S McAlpine, K Czarnota, A Britt

Geological Survey of Canada

K Lauzière, C Lawley, M Gadd, J-L Pilote, F Létourneau

United States Geological Survey

M Granitto, A Hofstra, D Kreiner, P Emsbo, K Kelley, B Wang, G Case, G Graham

Others

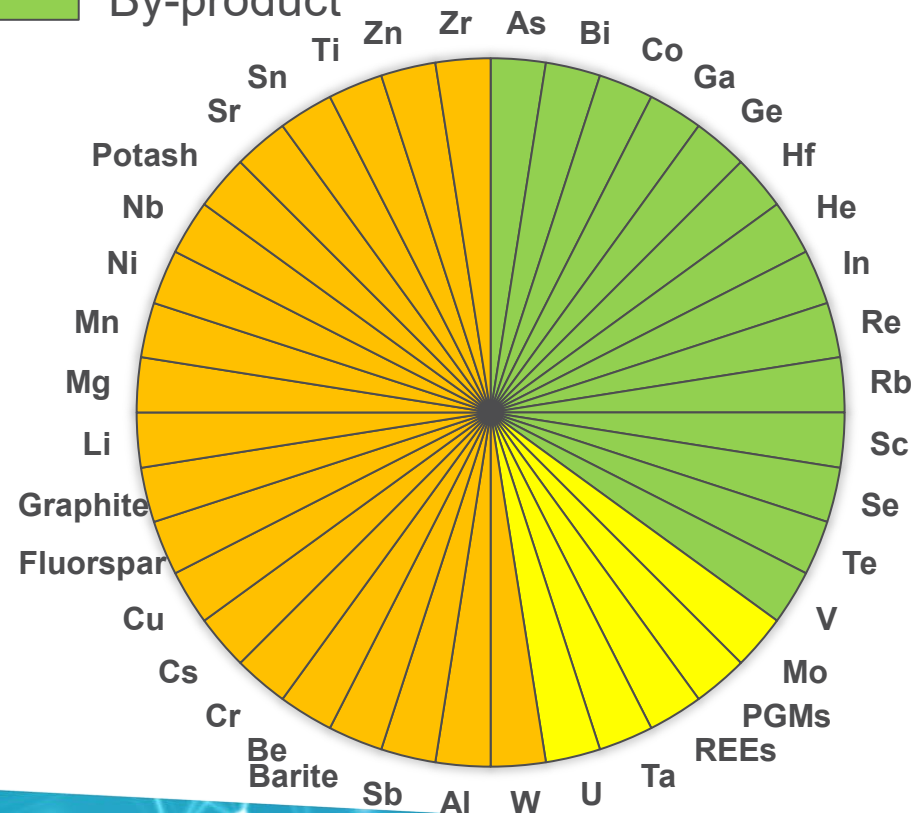
V Lisitsin (Geological Survey of Queensland)

Production of critical minerals

	Market value (Billion US\$ - 2017)
REEs	24.3
PGEs	12.5
Co	6.0
V	1.6
In	0.60
Ta	0.25
Ge	0.18

Source: Mudd et al. (2019)

- Main/co-product
- Co- or by-product
- By-product



Release of Critical Minerals in Ores (CMiO) Database

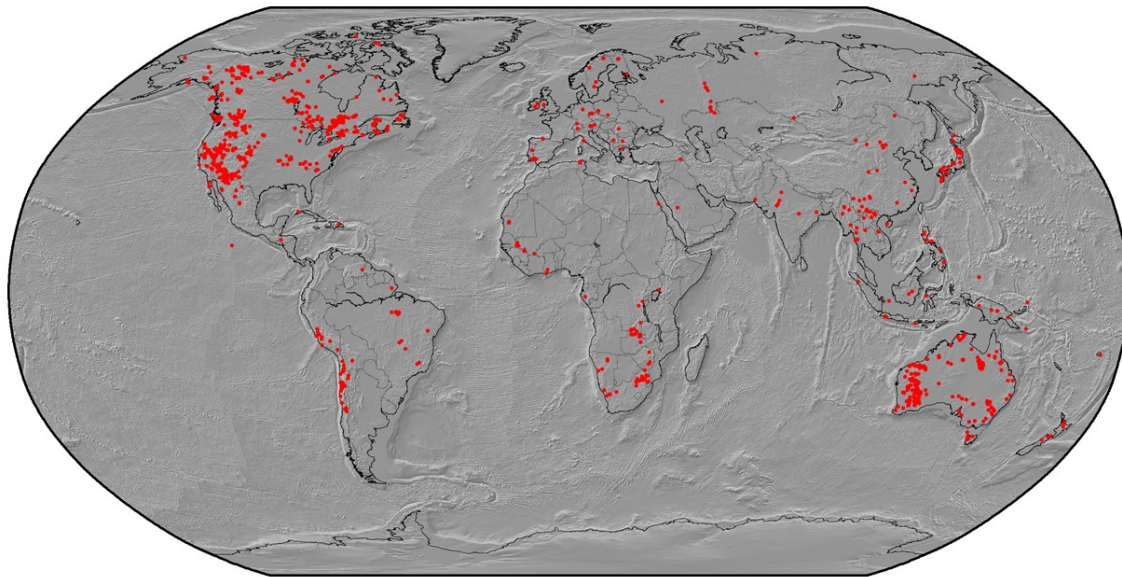


Figure 1. CMMI ore sample location map.

- Released **TODAY!**
- 7,311 samples
- From 60 countries
- Sourced from published datasets (e.g. OSNACA) and GA, GSC and USGS geochemical databases
- Classified using Hofstra et al. (2021) classification
- Dataset includes as many elements as possible along with analytical metadata
- Updated semi-annually

Access web service directly:

<https://services.ga.gov.au/gis/critical-minerals/wms>

CMMI Portal Release:

criticalminerals.org or <https://portal.ga.gov.au/persona/cmmi>



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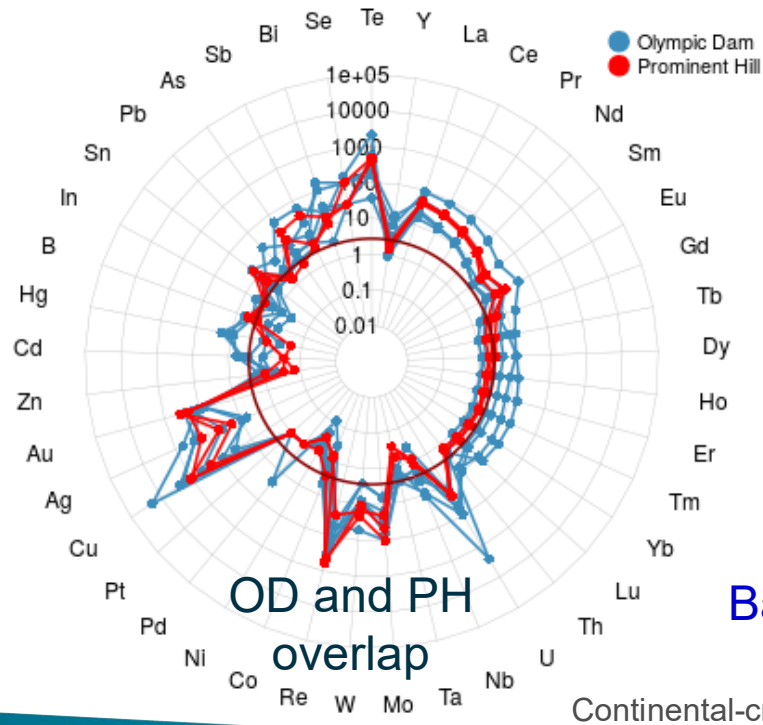
About Layers Location Search Data & Publications

Tools Clip Map Narrator

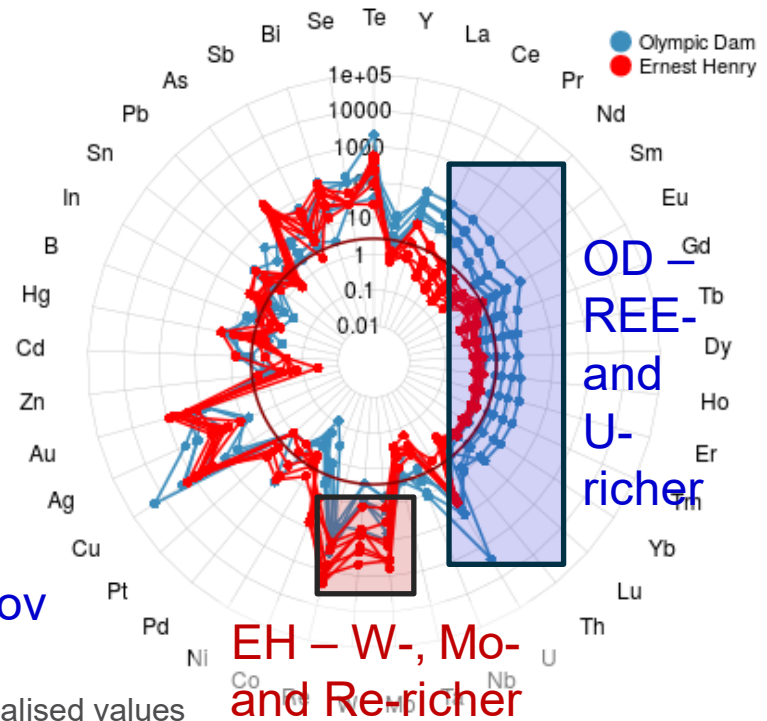


Potential uses of the database – classifying deposit types

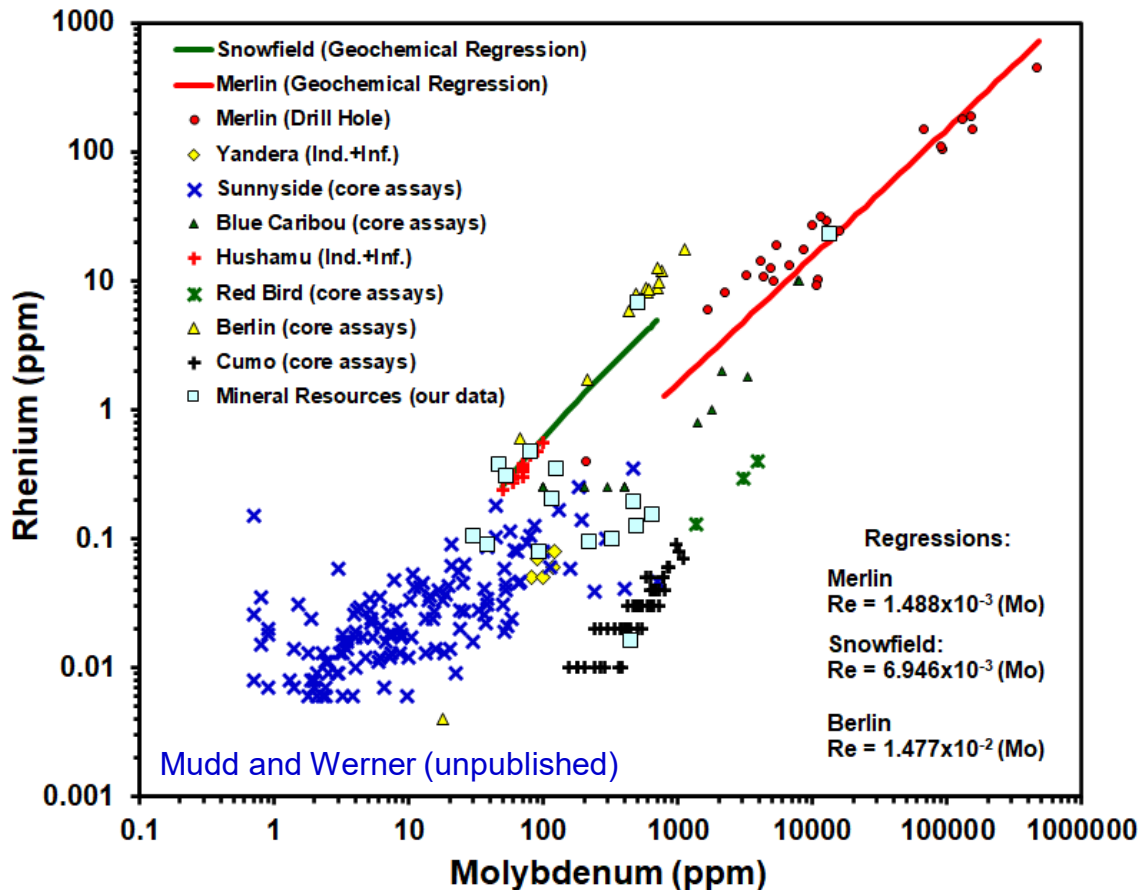
Hematite-dominant vs hematite-dominant



Hematite-dominant vs Magnetite-dominant



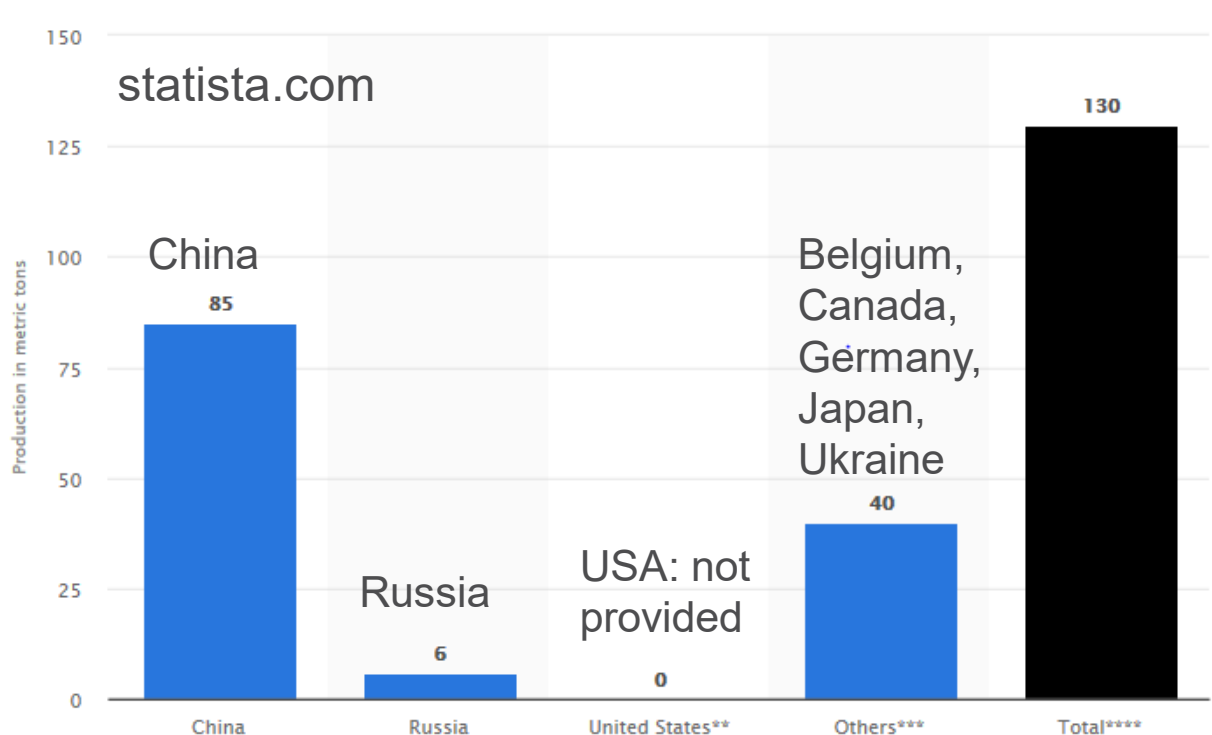
Potential uses of the database – assessing critical minerals in ores



- Strong correlation between Re in Mo in many mineral deposits
- The Re/Mo ratio is probably dependent on the type of deposit
 - Deposits associated with intermediate magmas have higher Re/Mo
 - Deposits associated with felsic magmas have lower Re/Mo
- Deposit classification may aid in predicting Re concentration in Mo and Cu-Mo ores

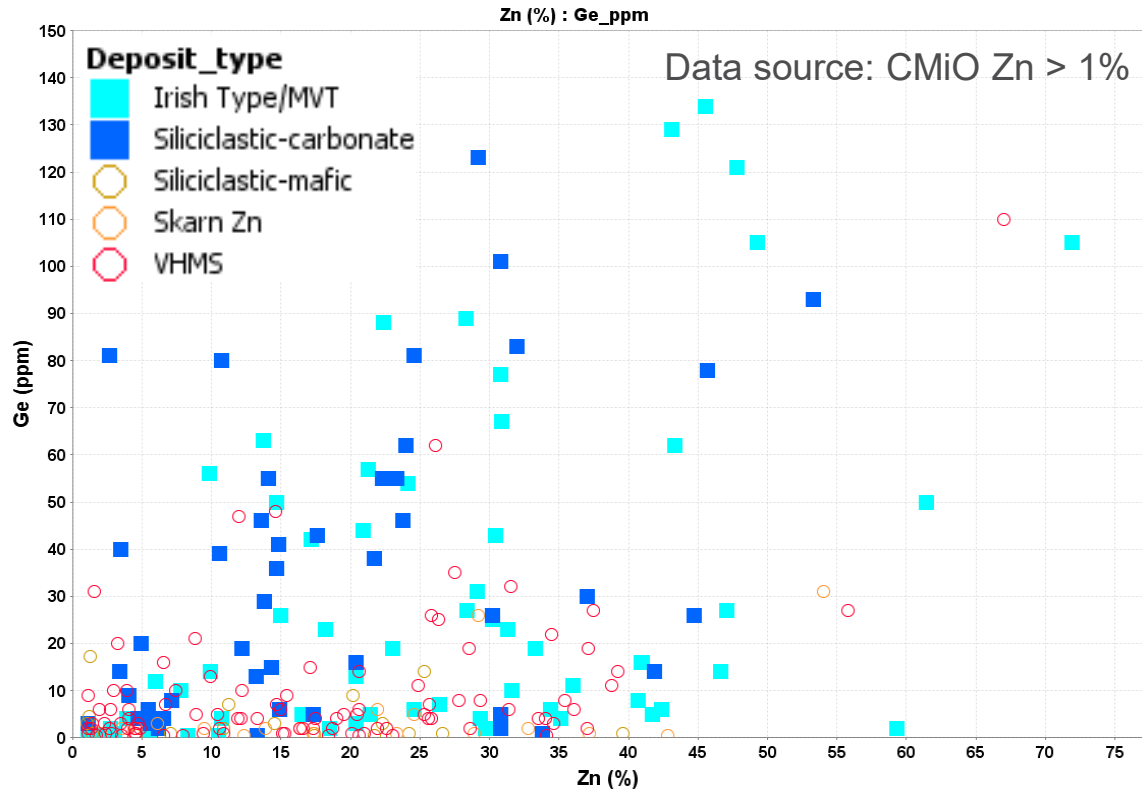
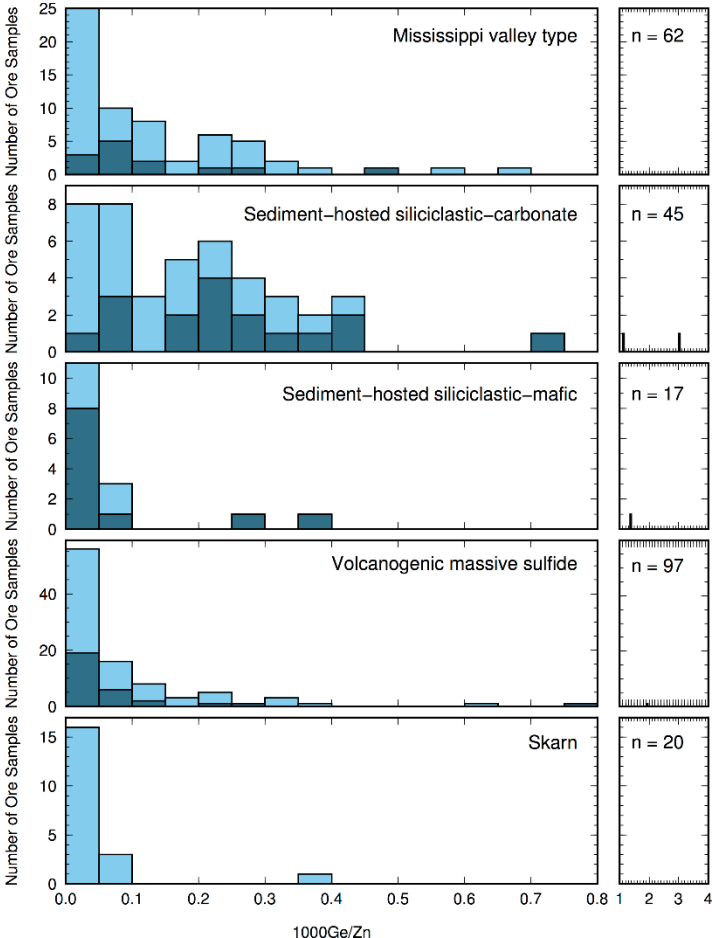
Germanium – a minor but critical element

- Used in (fibre) optics, as semi-conductor and as polymer catalyst
- Production increased from 58 t in 2000 to 130 t in 2019
- China dominant producer (65% in 2019)
- Production is not where resources are (Glencore export zinc concentrates to China and north Europe)
- Australian grades and resources not publicly known

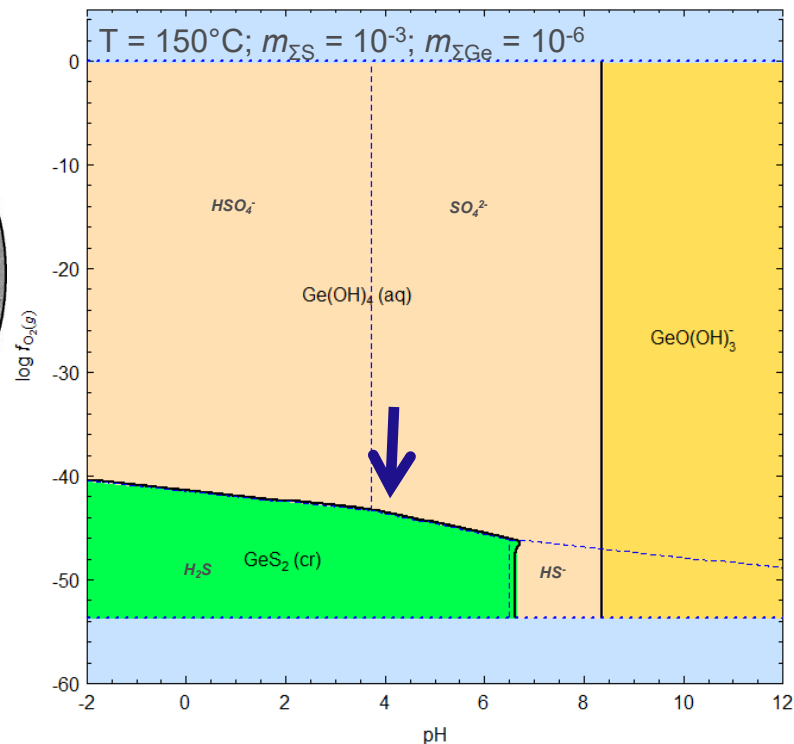
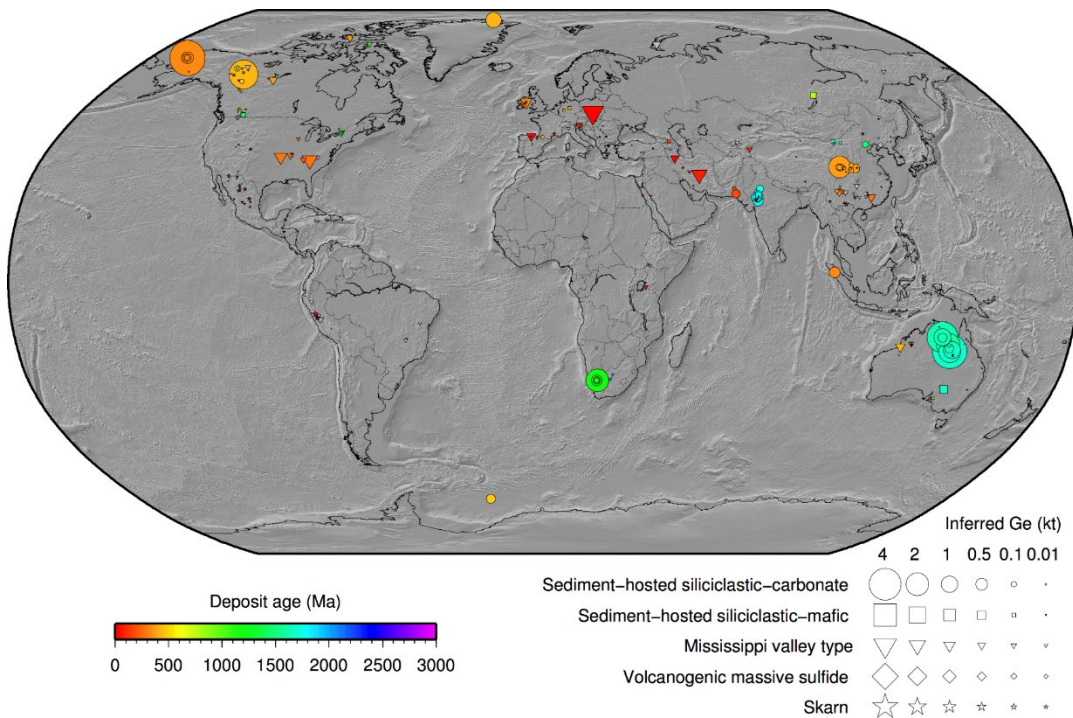


Huston, Bastrakov and Champion

Germanium – a minor but critical element



Germanium – a minor but critical element



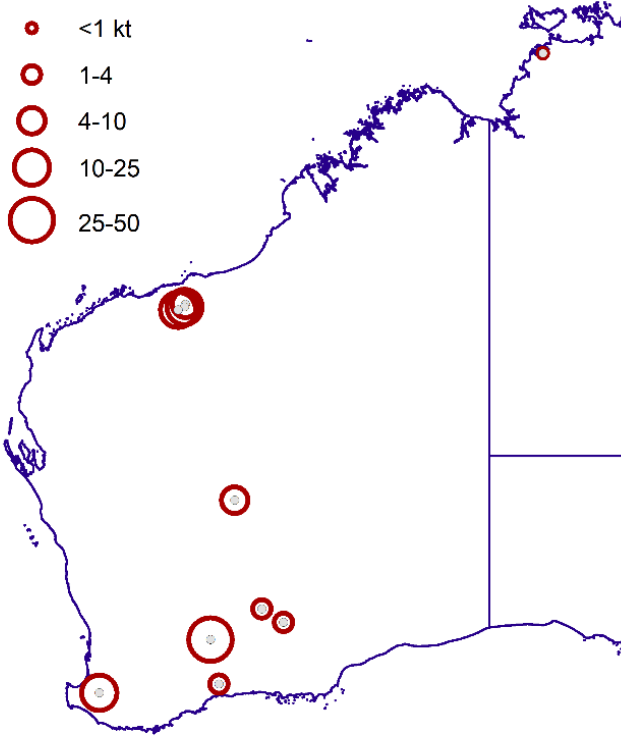
Results indicative only and require confirmation

Bastrakov and Dick (2019, GeoTPD
<https://geoscienceaustralia.shinyapps.io/RedOx-pH/>)

Predicting Ta, Nb and Sn endowment of pegmatites

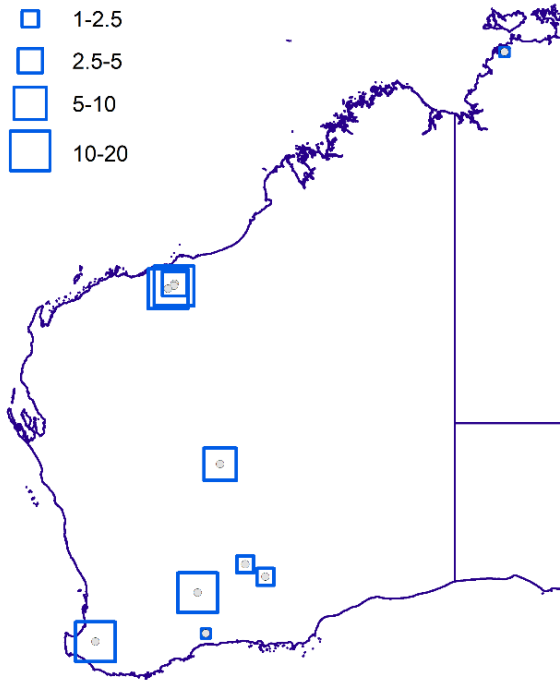
Median Ta₂O₅ (kt)

- Deposit
- <1 kt
- 1-4
- 4-10
- 10-25
- 25-50



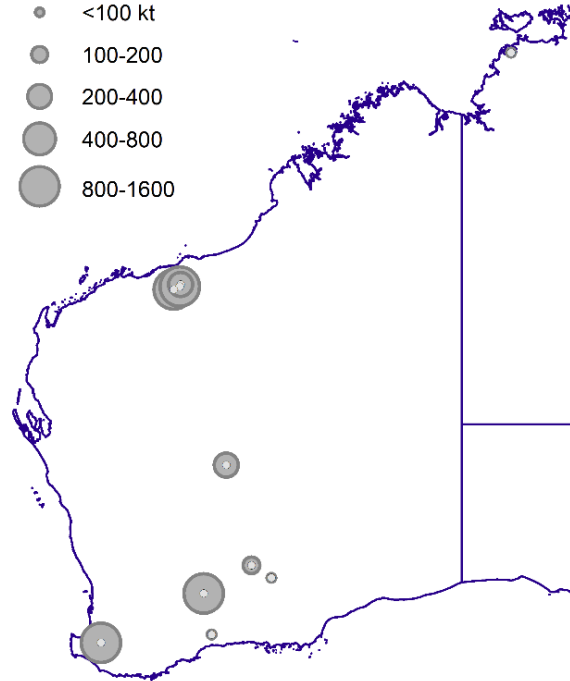
Median Nb₂O₅ (kt)

- <1 kt
- 1-2.5
- 2.5-5
- 5-10
- 10-20



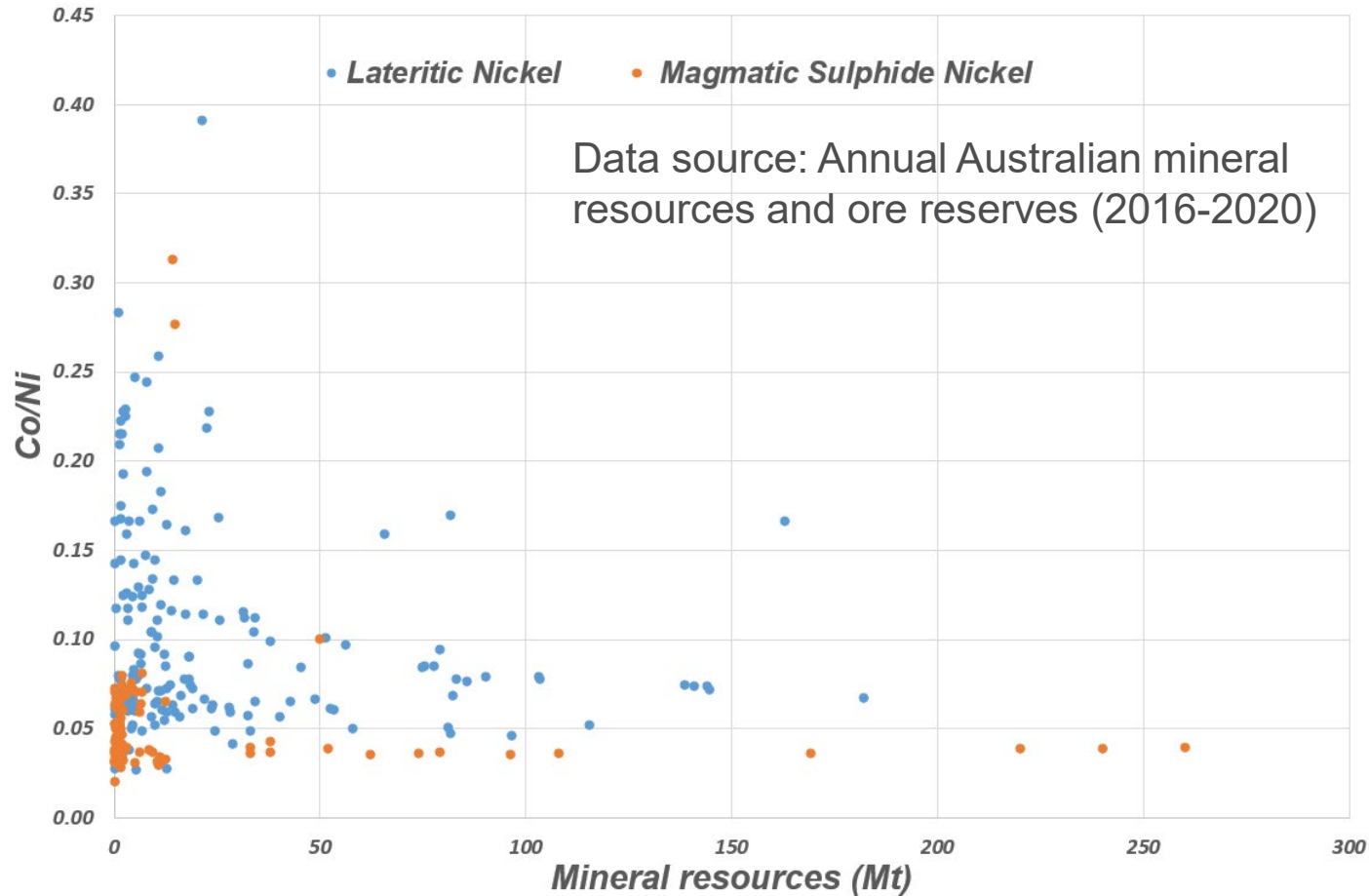
EDR of Li₂O₂ (kt)

- Deposit
- <100 kt
- 100-200
- 200-400
- 400-800
- 800-1600



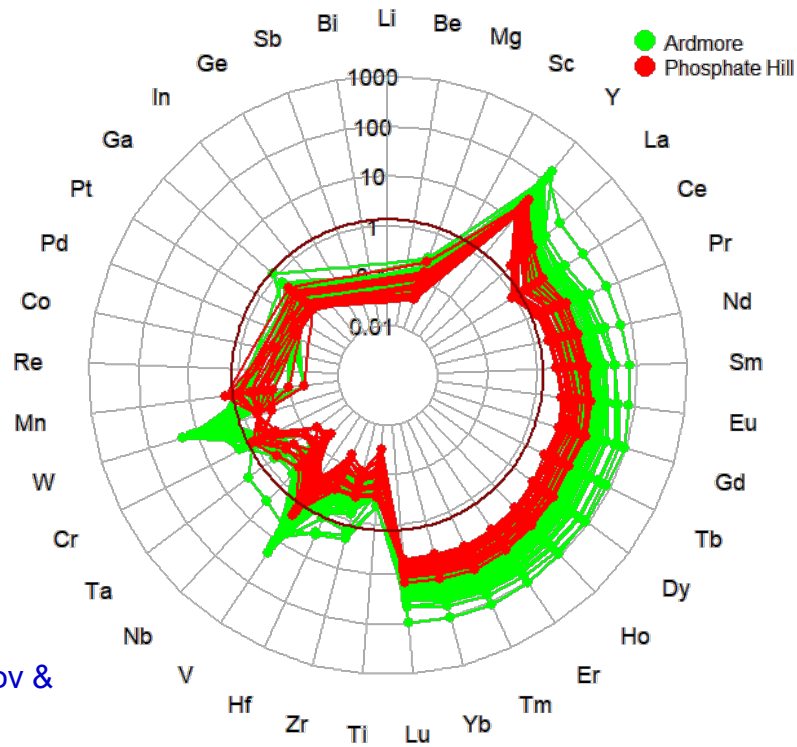
Champion

Cobalt in nickel deposits

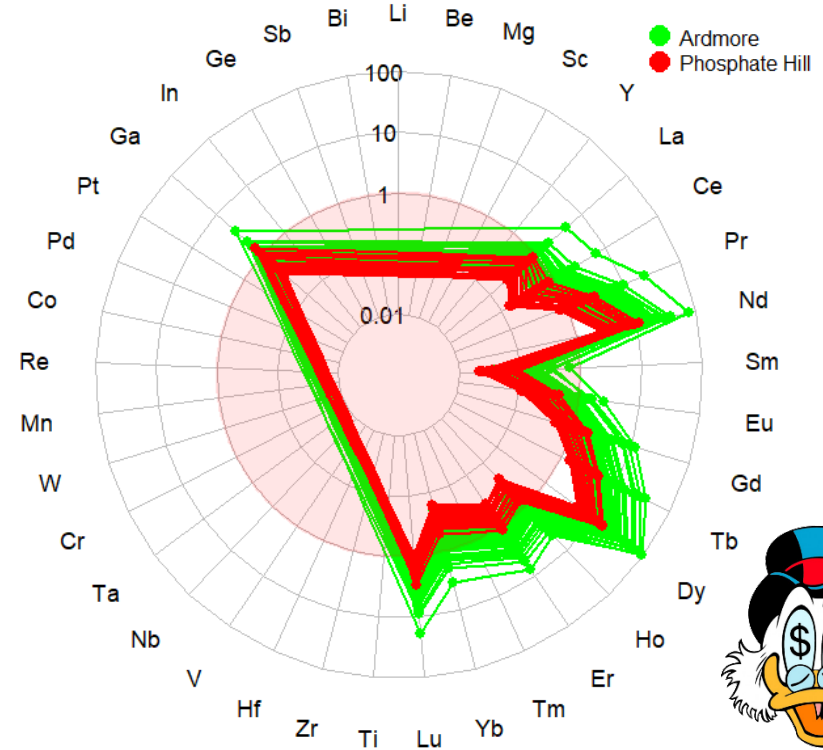


Critical minerals in phosphorites

Continental-crust-normalised



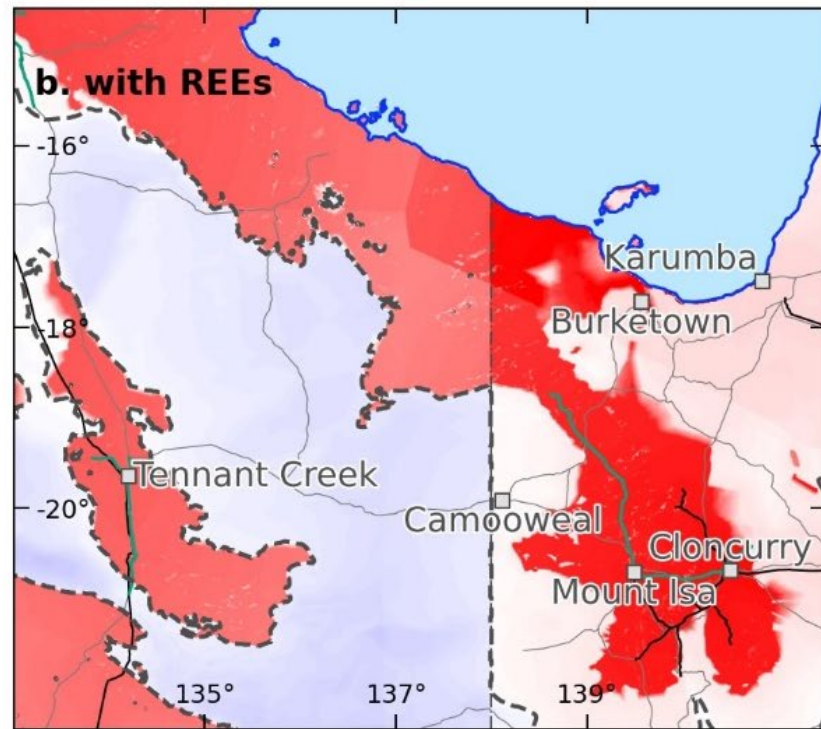
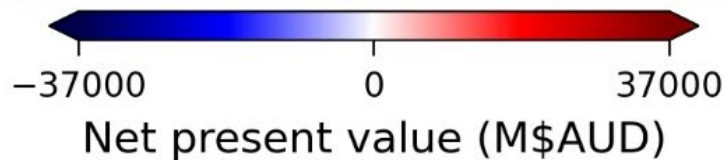
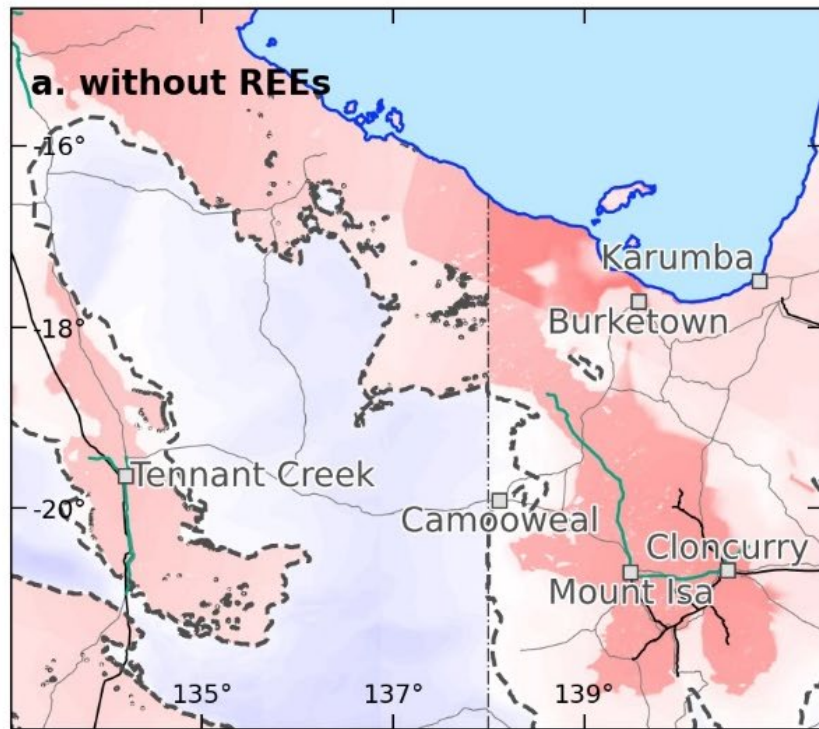
US\$-normalised (per tonne)



Valetich,
Bastrakov &
Huston

Data source: Geological Survey of Queensland

By-products and deposit viability



Conclusions

- CMMI CMiO database – largest global database on ore geochemistry
- Can be used to predict potential sources of critical minerals
- Other potential uses
 - Geochemical classification of deposits
 - Deposit-scale vectoring
 - Environmental baselines

Future work

- Updated semi-annual
- Further analysis of data – prediction of CM sources and ore processes
- Additional tools
 - Radar diagrams
 - Incorporate live-time price information



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Thank You

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