

Acknowledgement of Country

The University of Queensland (UQ) acknowledges the Traditional Owners and their custodianship of the lands on which we meet.

We pay our respects to their Ancestors and their descendants, who continue cultural and spiritual connections to Country.

We recognise their valuable contributions to Australian and global society.

*The Brisbane River pattern from A Guidance Through Time
by Casey Coolwell and Kyra Mancktelow.*



The critical importance of mine waste- an Australian Perspective



MIWATCH 2023 Project Team



Group Leader/Enviro-geologist
A/Prof Anita Parbhakar-Fox



Deputy Leader/ Enviro-geochemist
Dr Laura Jackson



Geologist/ Mineralogist
Dr Kamini Bhowany



Geologist/ Mineralogist
Dr Kristy Guerin



Chemical Engineer
Annah Moyo



Metallurgical Engineer
Sibebe Nascimento



Environmental Geologist
Rosie Blannin



Environmental Engineer
Dr Zhengdong Han



Geologist
Enrique Saez-Salgado (PhD Candidate)



Geologist
Olivia Mejías (PhD candidate)



Exploration Geologist
Loren Nicholls (PhD Candidate)



Environmental Scientist
Sabrina Newton (Hons. Student)



Environmental Engineer
Sicheng Cai (Masters candidate)



Geologist
Holly Cooke (visiting Hons.student)



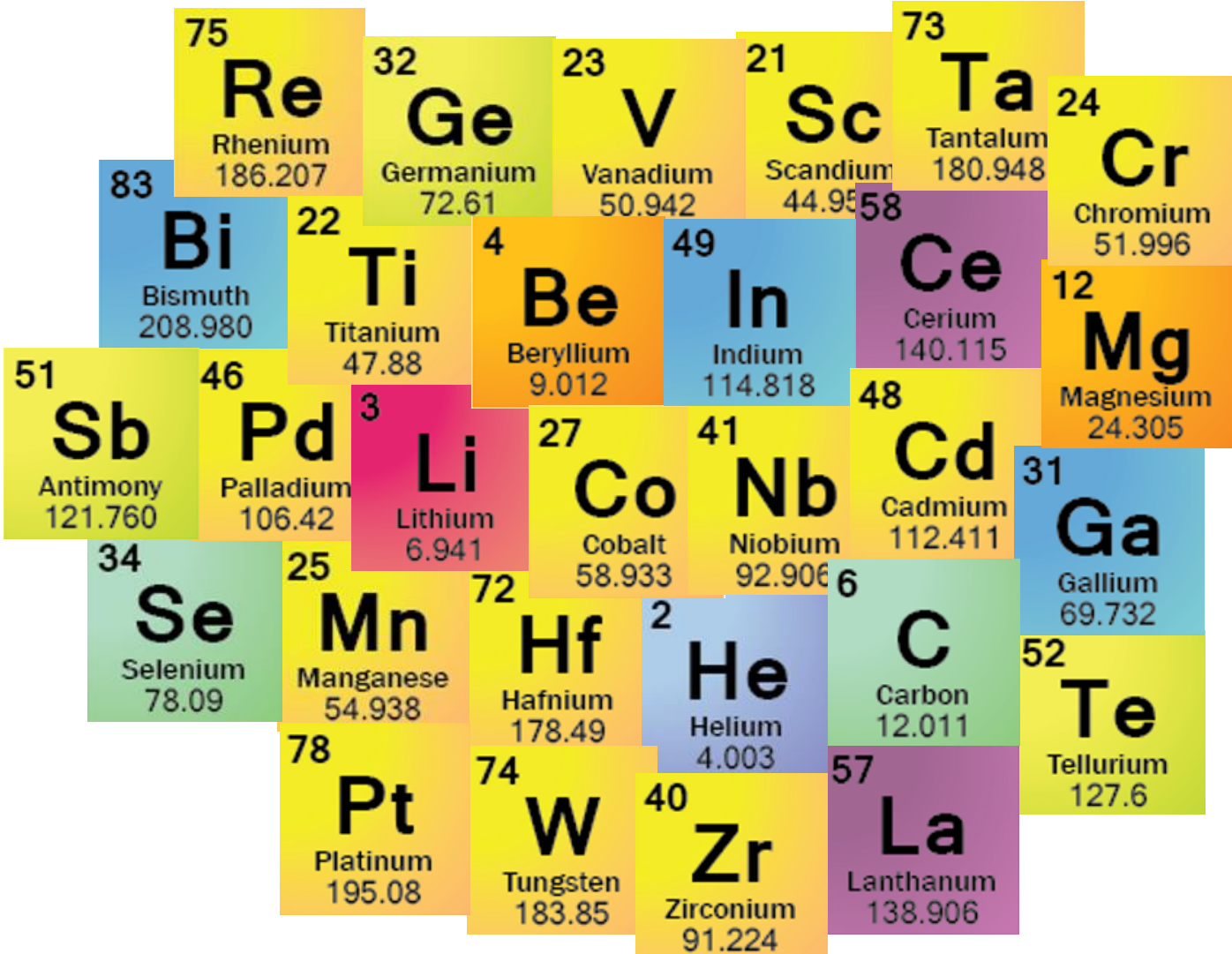
Research Assistant
Joshua Crow



Senior Research Technician
Lexi K'ng

CRMs in Australia

Critical Metals identified by the Australian Government



CRMs in Mine Waste: Driver for economic rehabilitation?

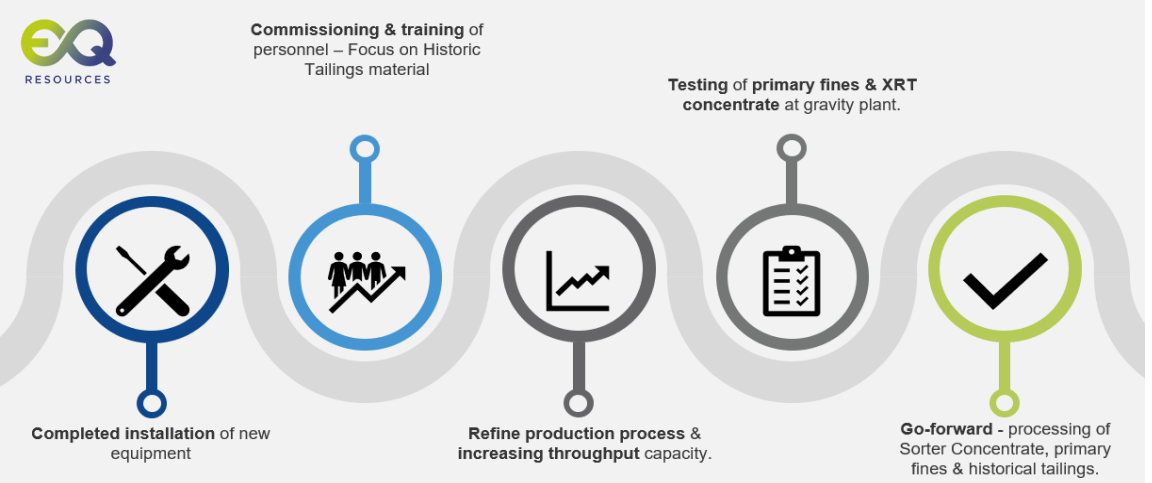


Mt Carbine Mine, Qld (W)

HPA and HPQ from waste

W, Sn from tailings

Mn from tailings



THE CONVERSATION
Academic rigour, journalistic flair

Arts + Culture Books + Ideas Business + Economy Education Environment + Energy Health Politics + Society Science + Technology

Tapping mineral wealth in mining waste could offset damage from new green economy mines

Published: May 31, 2022 6:32am AEST

Mining waste can hold stores of valuable minerals. Shutterstock

To go green, the world will need vast quantities of critical minerals such as manganese, lithium, cobalt and rare earth elements. But to some environmentalists, mining to save the planet is a hard pill to swallow if it leads to damage to pristine areas.

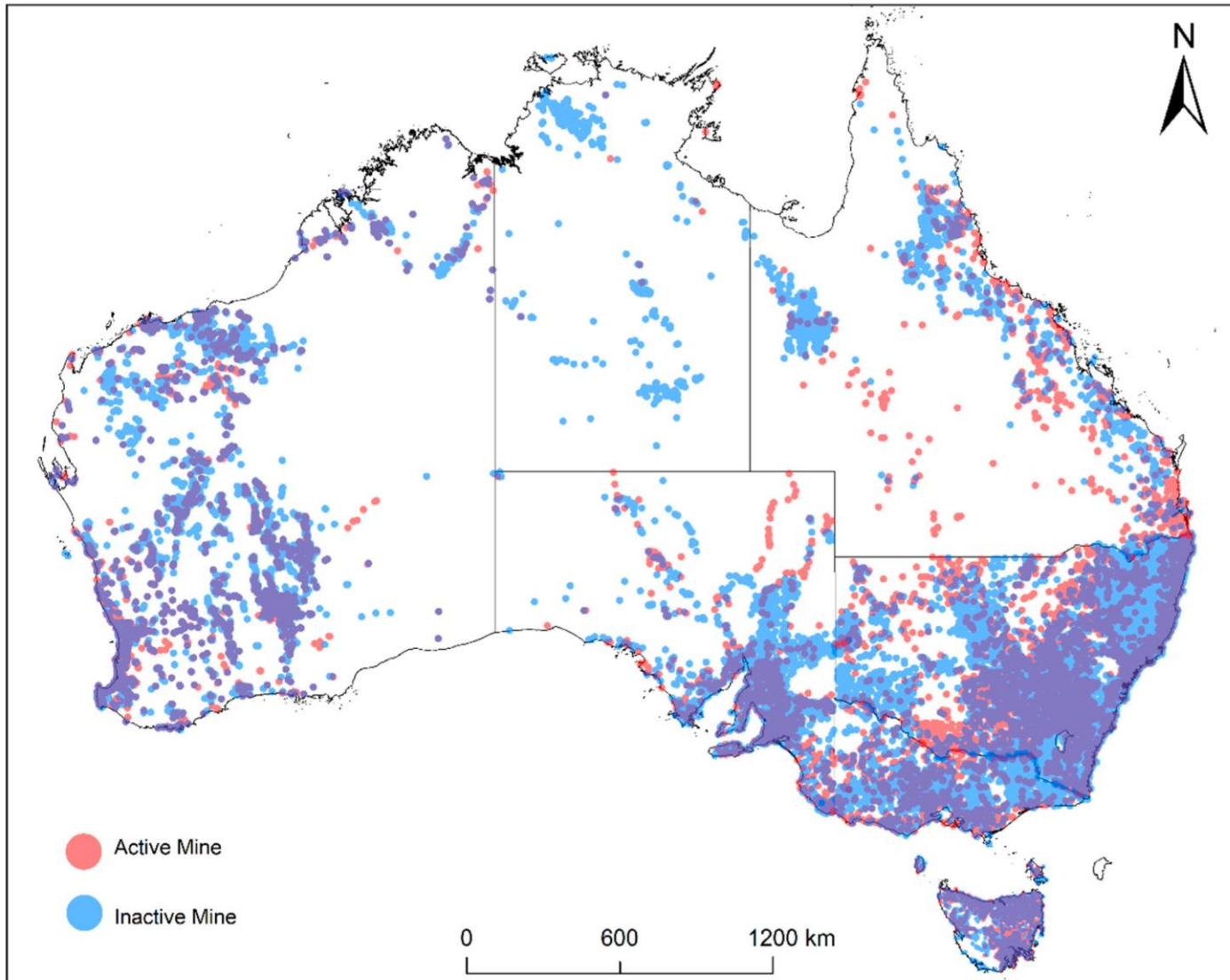
The good news is that in many cases, the mining for these minerals has already been done. After Australia's major miners dig up iron ore, billions of tonnes of earth and rock are left over. Hidden in these rock piles and tailing dams are minerals vital to high tech industries of today and tomorrow.

In recent years, we have seen a welcome focus on remining – the extraction of valuable minerals and metals from mining waste. While Australia has been slow to adopt this approach, it holds real promise. We don't necessarily have to mine more. We can mine smarter.

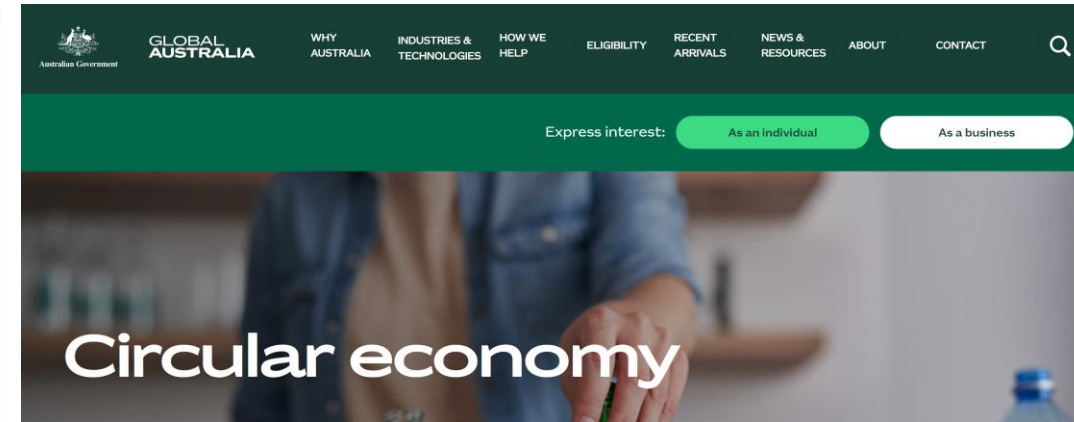
Authors

- Anita Parbhakar-Fox, Principal Research Fellow/Group Leader- MIWATCH, The University of Queensland
- Kamini Bhowany, Postdoctoral Research Fellow, The University of Queensland
- Kristy Guerin, Postdoctoral Research Fellow, The University of Queensland
- Laura Jackson, The University of Queensland
- Partha Narayan Mishra, The University of Queensland

The opportunities in Australia: ~ 50,000 sites



Werner et al. (2020)



Characterisation Programs

Stream 1: First pass investigation of mine waste

First-pass characterisation around Australia targeting mine waste from a range of commodities (e.g., base metals, precious metals, bauxite)



Team: UQ BRC-SMI, SEES,
honours students

Stream 2: Detailed site investigations (at 2 sites min.)

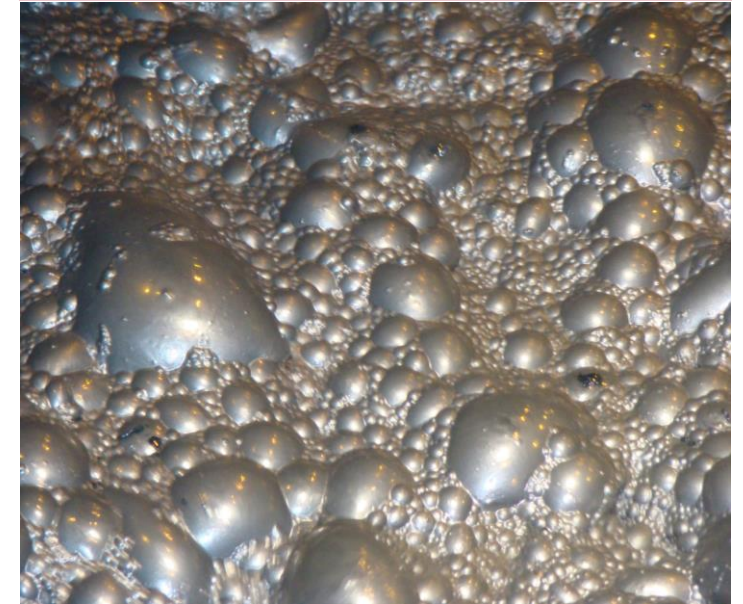
Fertile sites representative of different deposit styles chosen to explore, in depth, the relationship between geology, mineralisation and critical metal fertility



Team: UQ BRC, JKMRC, CMM,
PhD students

Stream 3: Bespoke mineral processing methodologies

Trialling of novel processing methodologies which will give the greatest economic recovery of critical metal(s) for mine waste materials

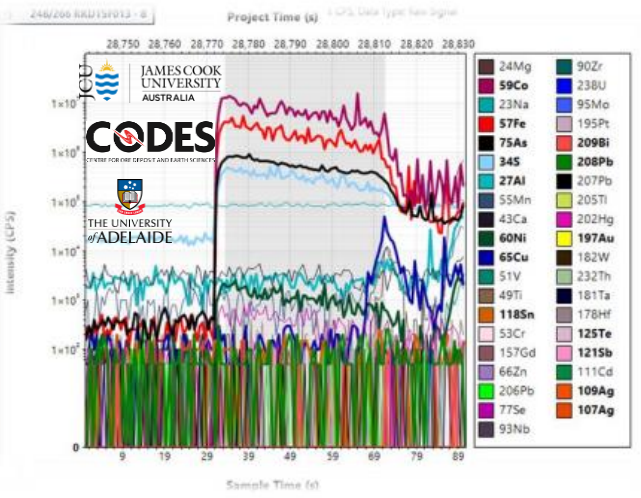
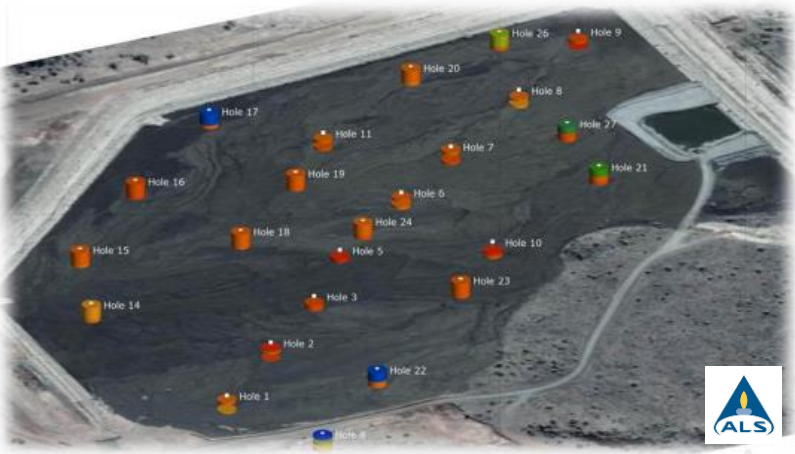


Team: UQ JKMRC, BRC, SEES,
Civil & Chem. Eng. & METS

Stream:1 Sampling and analytical program

Conventional

Additional (but not optional!)



Understanding the mineralogical host (and mineral chemistry) of the target commodity is **critical** to choosing the **right re-processing technology**

National sampling program- Mine waste atlas

Partnerships with State Government and GA have been imperative to begin this national conversation focussed on unlocking these complex ore bodies...
(100's more sites to go!)

WESTERN AUSTRALIA
In discussion



Kicked off Stream 1 program (5x sites)



NORTHERN TERRITORY



4x Stream 1 sites



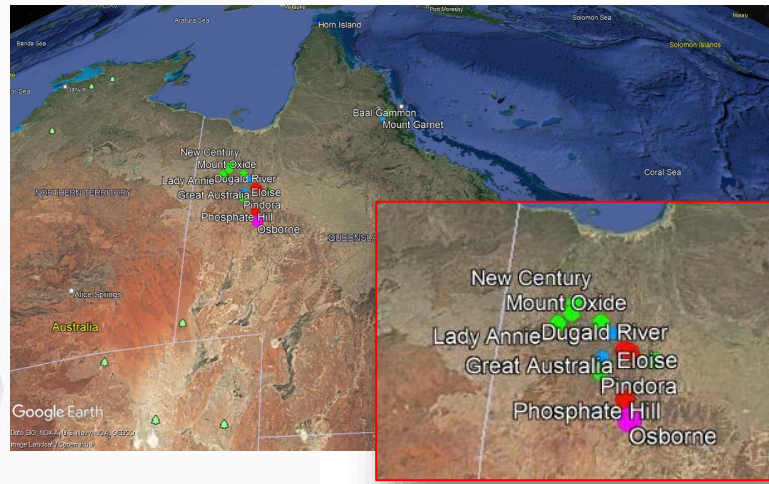
29
Metals

QUEENSLAND

**44x Stream 1 sites
3x Stream 2 sites**



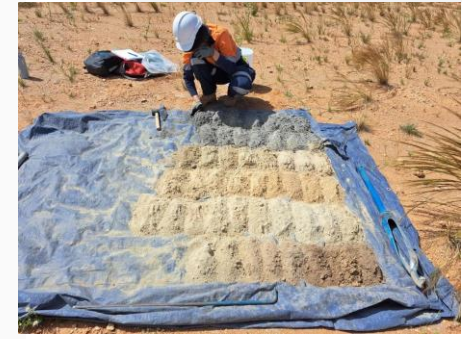
10 Stream 1 sites
Australian Government
Geoscience Australia
2 Stream 2 sites



SOUTH AUSTRALIA



NEW SOUTH WALES



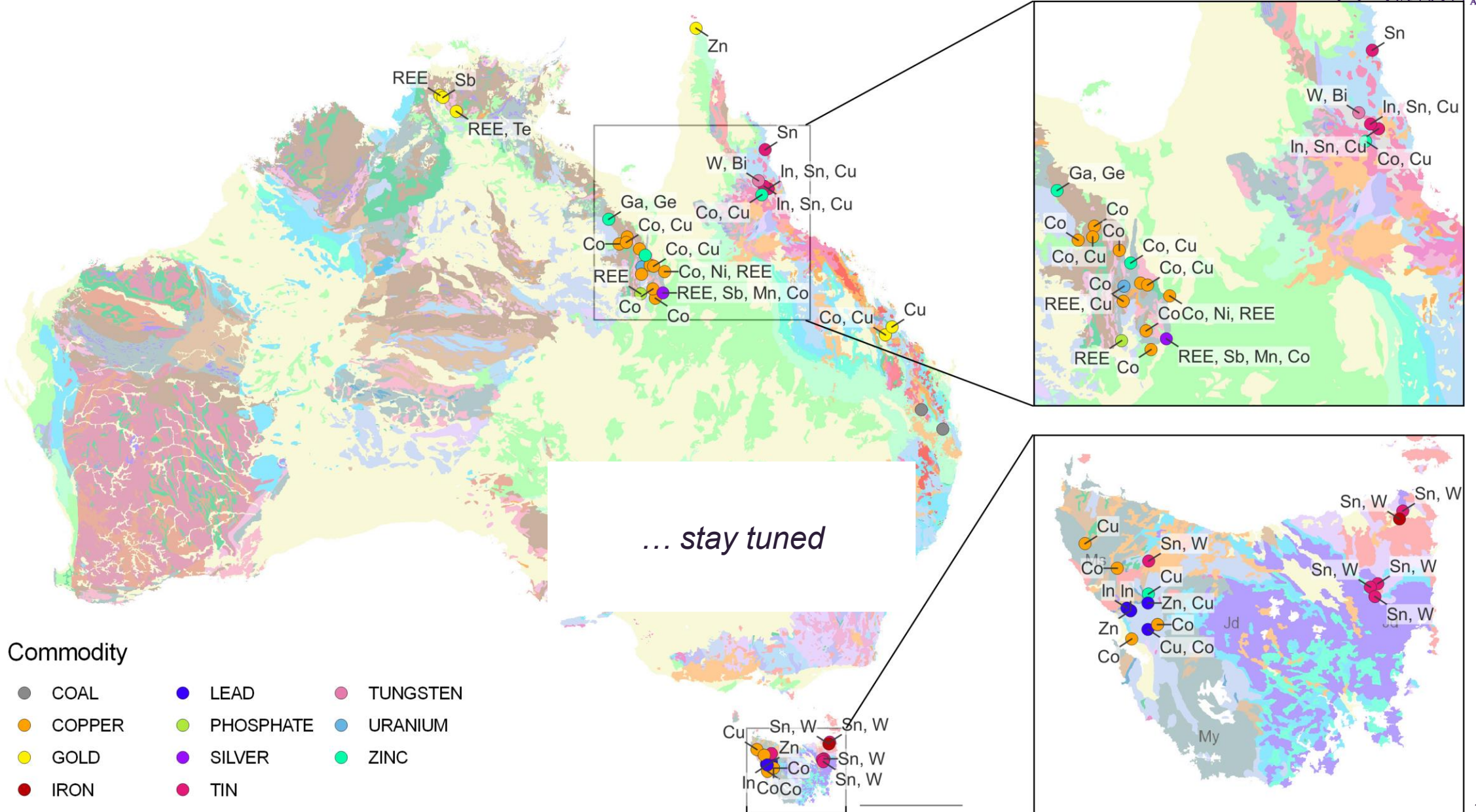
20x Stream 1 sites



VICTORIA

Previous data collected

Summary of findings to date...



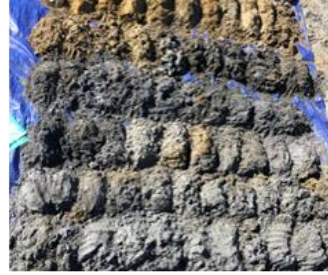
- Commodity**
- COAL
 - LEAD
 - TUNGSTEN
 - COPPER
 - PHOSPHATE
 - URANIUM
 - GOLD
 - SILVER
 - ZINC
 - IRON
 - TIN

Types of wastes sampled (QLD)



Waste Rock

Capricorn Copper, Mt Oxide, Pindora,
Lady Annie, Baal Gammon, Horn
Island, *Mary Kathleen*
Great Australia, Wolfram Camp



Tailings

Capricorn Copper, Rocklands, Herberton,
Mt Garnet, Horn Island, Mary Kathleen,
New Century, Osborne, Selwyn
Collingwood, Eloise, Cannington, Wolfram Camp



Spent heap leach/ metallurgical slimes

Mt Cuthbert, Pindora, Lady Annie,
Phosphate Hill



Metallurgical slag

Mount Morgan
Mount Chalmers



Bauxite residues

To target in next campaigns- search
for REEs, Ga, Ge

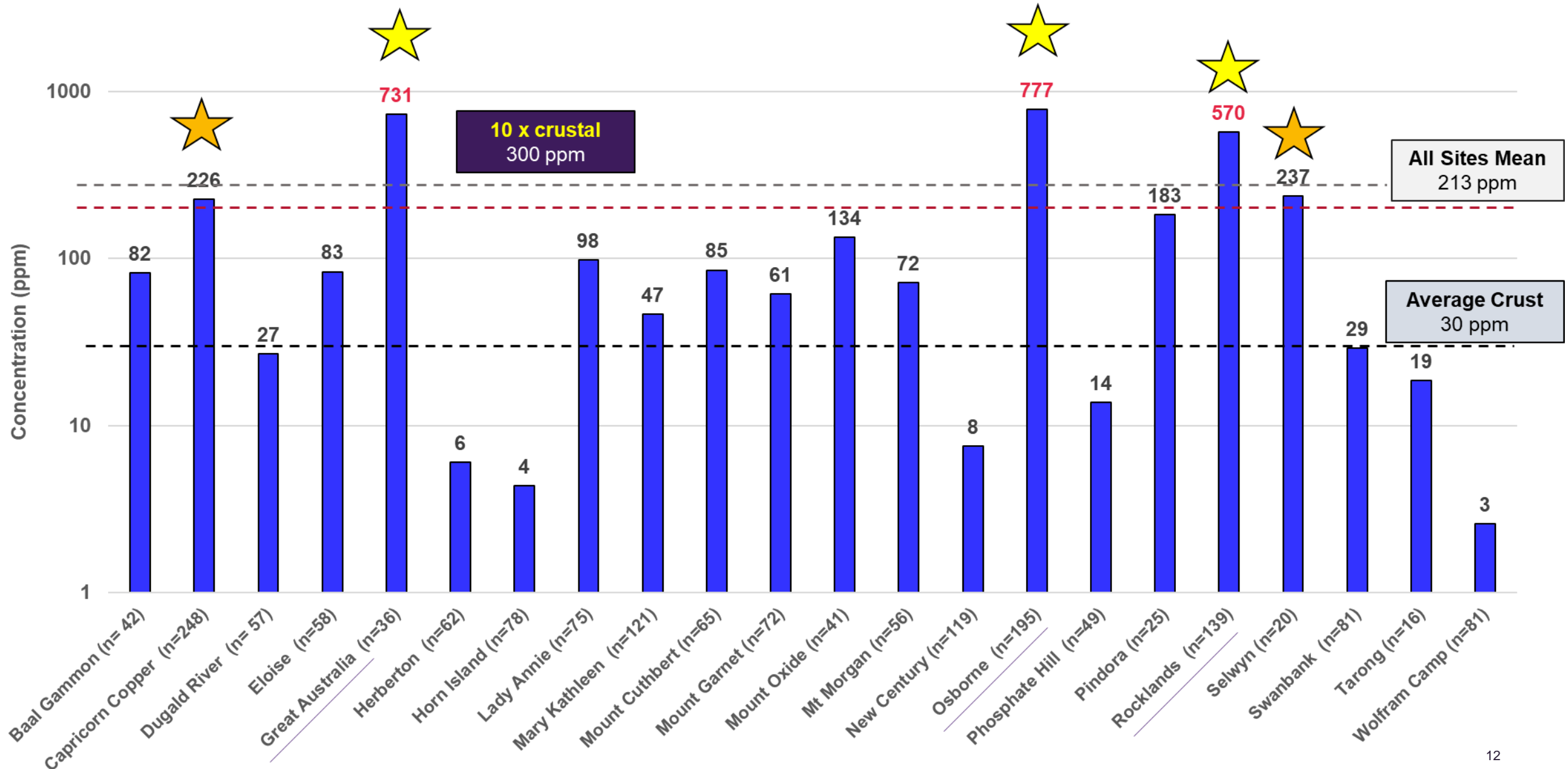


Coal mine waste

Tarong, Swanbank

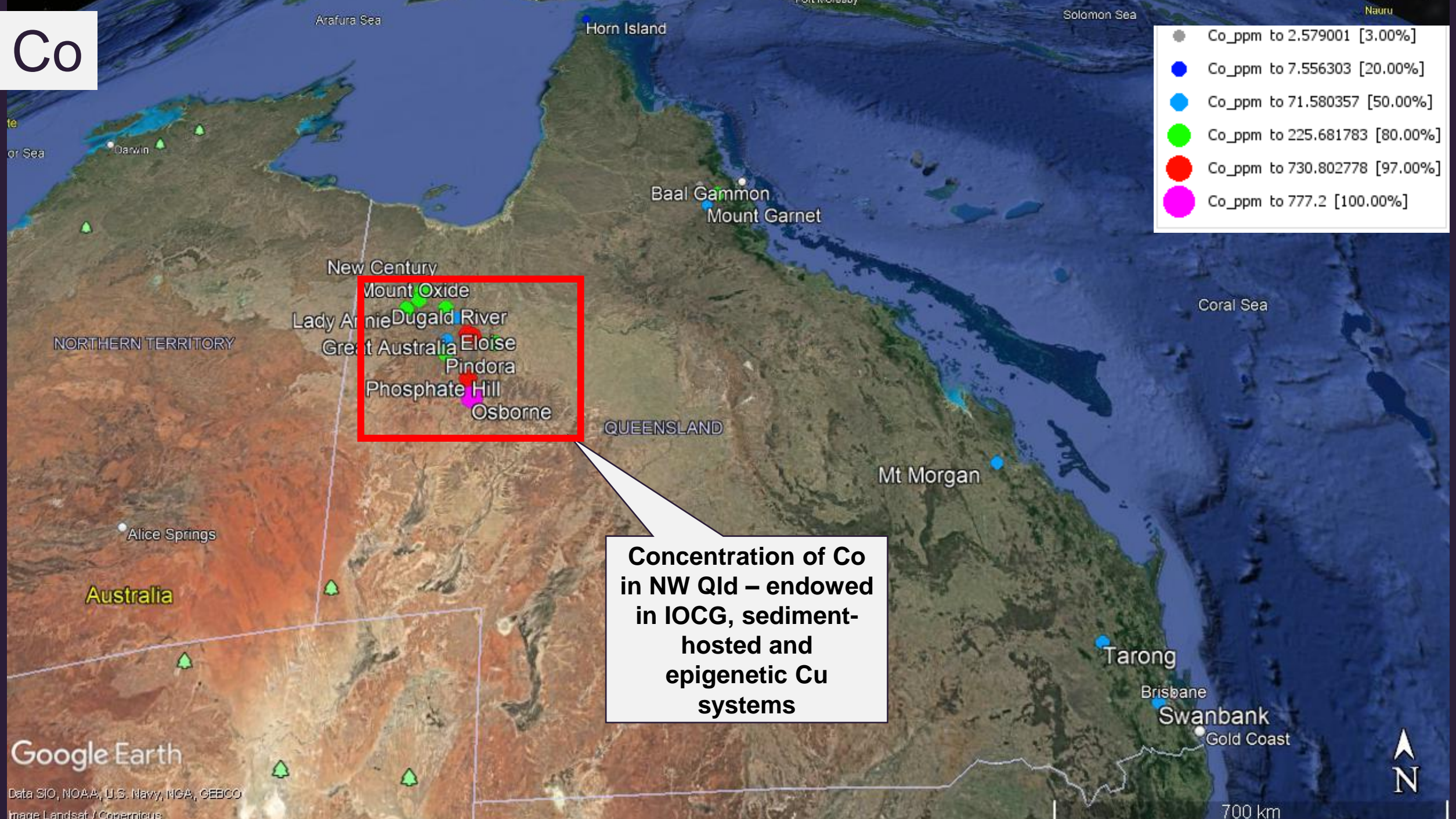
Provision of data and access to sites for samples by companies is acknowledged

Stream 1: QLD- Cobalt in mine waste



Co

- Co_ppm to 2.579001 [3.00%]
- Co_ppm to 7.556303 [20.00%]
- Co_ppm to 71.580357 [50.00%]
- Co_ppm to 225.681783 [80.00%]
- Co_ppm to 730.802778 [97.00%]
- Co_ppm to 777.2 [100.00%]



New Century
 Mount Oxide
 Lady Ann
 Dugald River
 Great Australia
 Eloise
 Pindora
 Phosphate Hill
 Osborne

**Concentration of Co
 in NW Qld – endowed
 in IOCG, sediment-
 hosted and
 epigenetic Cu
 systems**

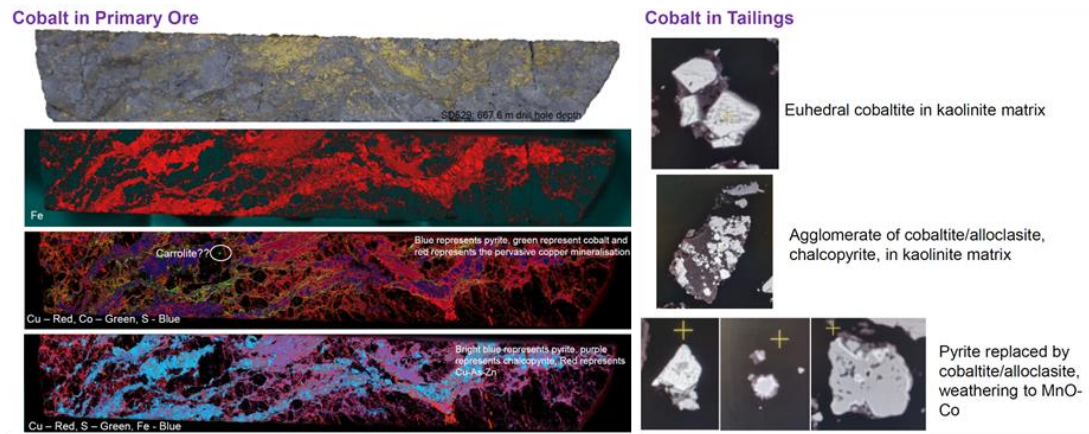
Google Earth

Data SIO, NOAA, U.S. Navy, NGA, GEBCO
 Image Landsat / Copernicus

700 km



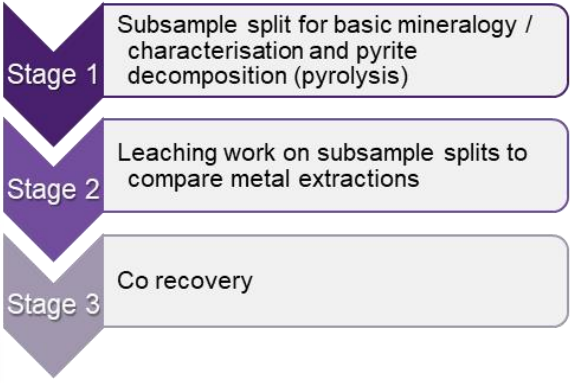
Stream 1: QLD- Cobalt recovery- next steps



Capricorn Copper
Stream 2 PhD: Loren Nicholls-
 Co in ore to tails



Rocklands
Stream 2: Collaboration with JOGMEC-
 metallurgical testing- flotation and bioleaching (SMI)



Osborne
Stream 3: Bulk sample being tested
 by Cobalt Blue and SMI (bioleaching)



Great Australia
 More field sampling- Co in pyrite in
 waste rock- what about other wastes?

QLD- Mine waste re-use options

Site	Waste Type	New Economy Metal Target(s)?	Next steps
Baal Gammon (n= 42)	Waste rock	In, Sn, Cu	Stream 2- Olivia Mejias PhD
Capricorn Copper (n=248)	Tailings	Co, Cu, Ni	Stream 2- Loren Nicholls PhD
Dugald River (n= 57)	Waste rock and tailings	Co, Ga, Ge, In	Still investigating
Eloise (n=58; GA site)	Tailings	Ni, Mn, (Au)	Still investigating
Great Australia (n=36)	Waste rock and tailings	Co- very high in waste rock	Still investigating
Herberton (n=62)	Tailings	Sn, W	Test tailings 'sand' potential
Horn Island (n=78)	Waste rock and tailings	Au	Further sampling and test sortability
Lady Annie (n=75)	Heap leach and waste rock	Cu	Heap leach- potential for 'sand'
Mary Kathleen (n=121)	Waste rock and tailings	REEs- La and Ce	UQ REE project (still investigating waste rock)
Mount Cuthbert (n=65)	Heap leach	Co, Cu	Stream 3- hydromet. options for Co, Cu
Mount Garnet (n=72)	Tailings	Sn	High pyrite- potential acid asset
Mount Oxide (n=41)	Waste rock	Cu, Cu	Stream 3- hydromet. options for Co, Cu
Mt Morgan (n=56; n= 60)	Slag, Waste rock	Au, Cu, W, In (Zn)	Hard to process? Aggregate or cement options
New Century (n=119)	Tailings	Ga, Ge	New Century Resources
Osborne (n=195)	Tailings	Co	Stream 3- testing by Cobalt Blue and SMI
Phosphate Hill (n=49)	Slimes and phosphogypsum	REEs- Dy, Er, Pr, Sm,Tb, Y	UQ REE project?
Pindora (n=25)	Heap leach and waste rock	Co, Cu, REE	Stream 3- hydromet. options for Co, Cu; potential for 'sand'
Rocklands (n=139)	Tailings	Co	Stream 3- Collaboration with JOGMEC and SMI
Selwyn (n=20)	Tailings	Co	No further testing planned
Swanbank (n=81)	Ash	V, Sc, REEs	Still investigating
Tarong (n=16)	Ash	Sc , REEs	Still investigating
Wolfram Camp (n=81)	Tailings and waste rock	W, Mo, Re	Recommercialisation- active project

A scenic landscape at sunset. The sun is low on the horizon, casting a warm orange and yellow glow across the sky. The sky is filled with soft, wispy clouds. In the foreground, there is a dense forest of trees with green foliage. The trees are silhouetted against the bright sky. A white banner is at the top of the image with the text "Thank you for listening".

Thank you for listening

A/Prof. Anita Parbhakar-Fox
a.parbhakarfox@uq.edu.au
+61 400 850 831

Thank you for the support:



Australian Government
Geoscience Australia



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Metals

