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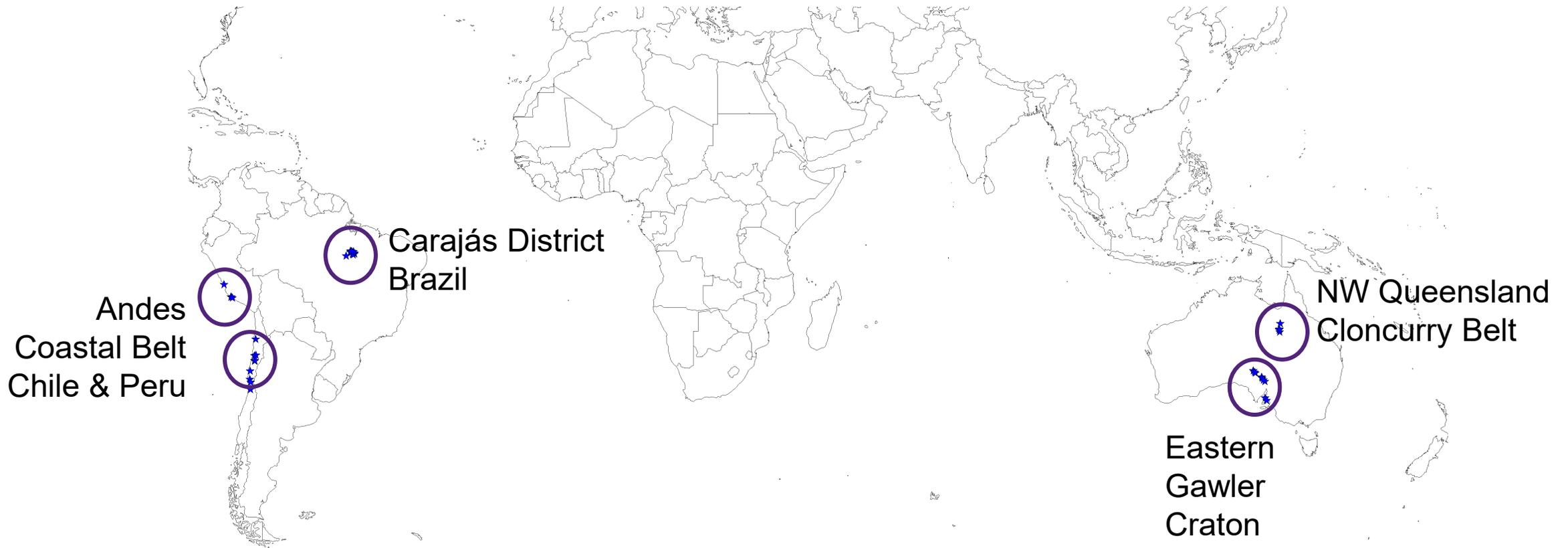
CREATE CHANGE

# IOCG Terranes: How does Northwest Queensland Compare?

Paul Gow

June 2019

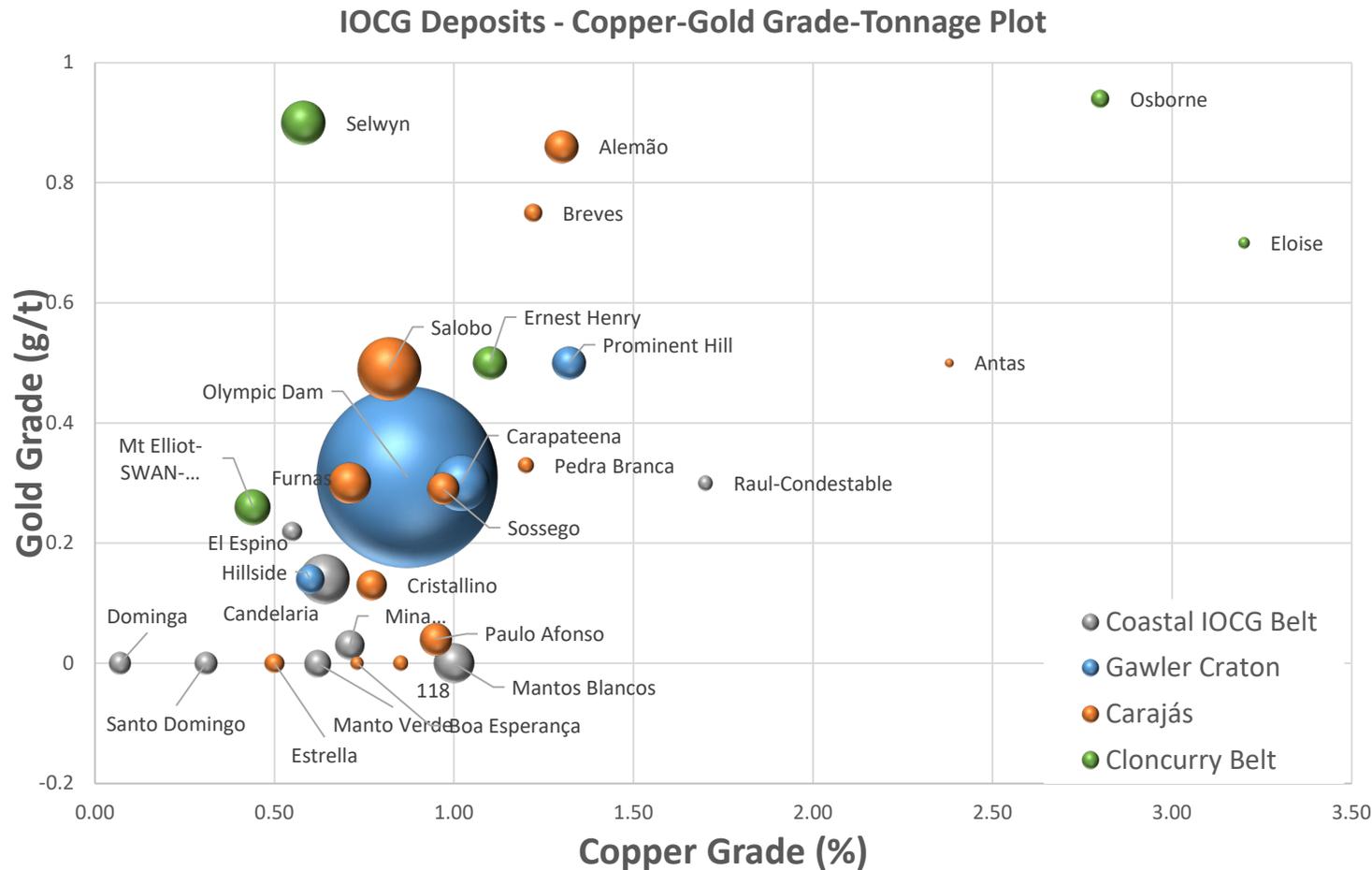
# Four key copper-producing IOCG terranes



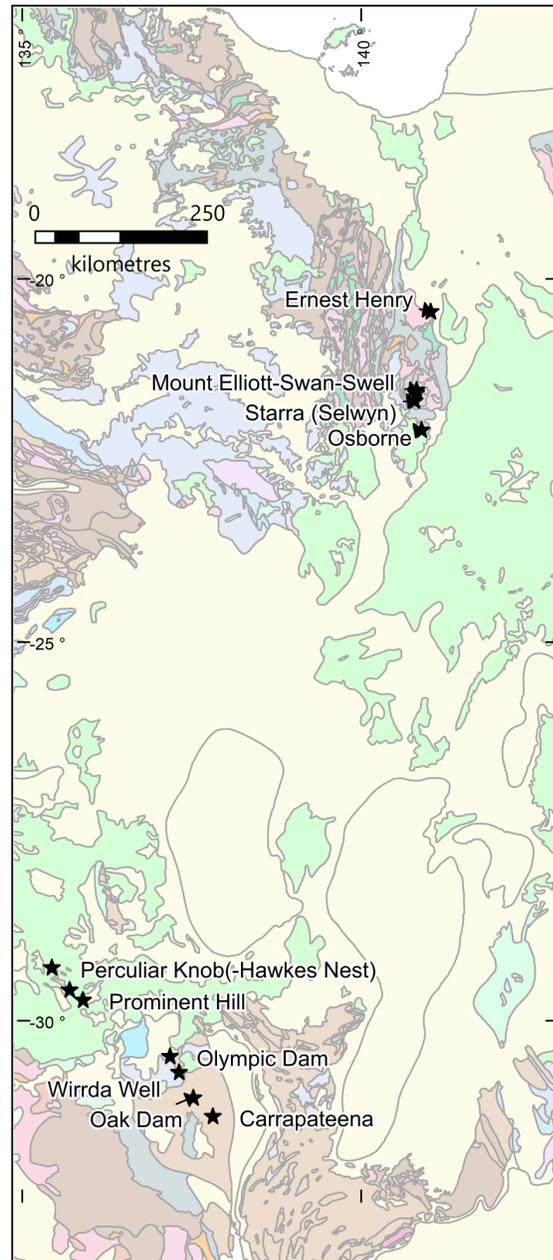
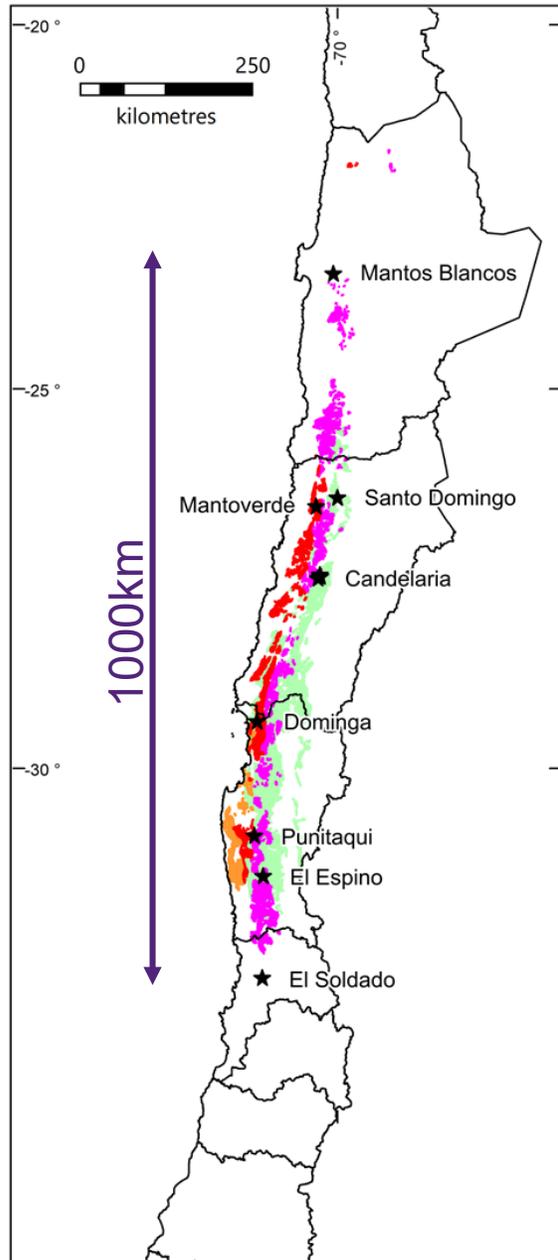
# Key deposits by terrane

	Peru	Chile	Carajas	Gawler	NWQ
Operational (Current or Historic)	Marcona, Raul- Condestable	Candelaria, Mantoverde, Mantos Blancos, Punta del Cobre, (Plus iron mines Algarrobo, El Romeral, Los Colorados)	Sossego- Sequierinho, Salobo, Igarape Bahia/Alemão, Antas	Olympic Dam, Prominent Hill	Ernest Henry, Osborne, Kulthor, Eloise, Selwyn, Mt Elliot-Swan- Swell, E1, Monakoff
Development / Exploration	Mina Justa	Dominga, Santo Domingo, El Espino, Marimaca?, Productora?	Cristalino, Furnas, Pedra Branca, Breves, Paulo Afonso, Gameleira, Grota Funda, GT-46	Carrapateena, Oak Dam, Hillside	Jericho

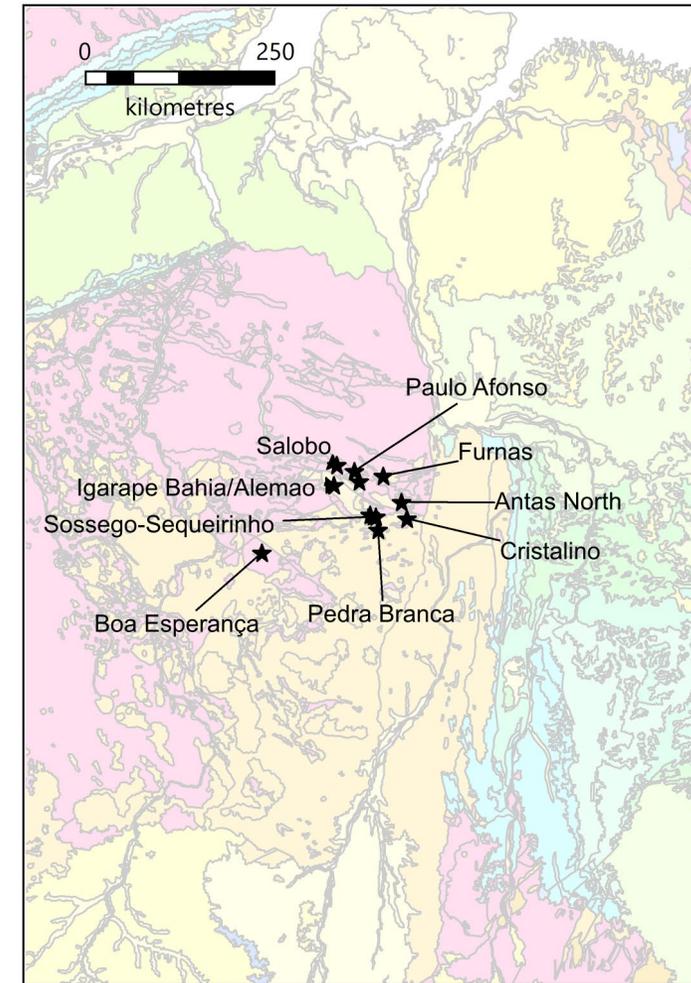
# Grade-tonnage comparison



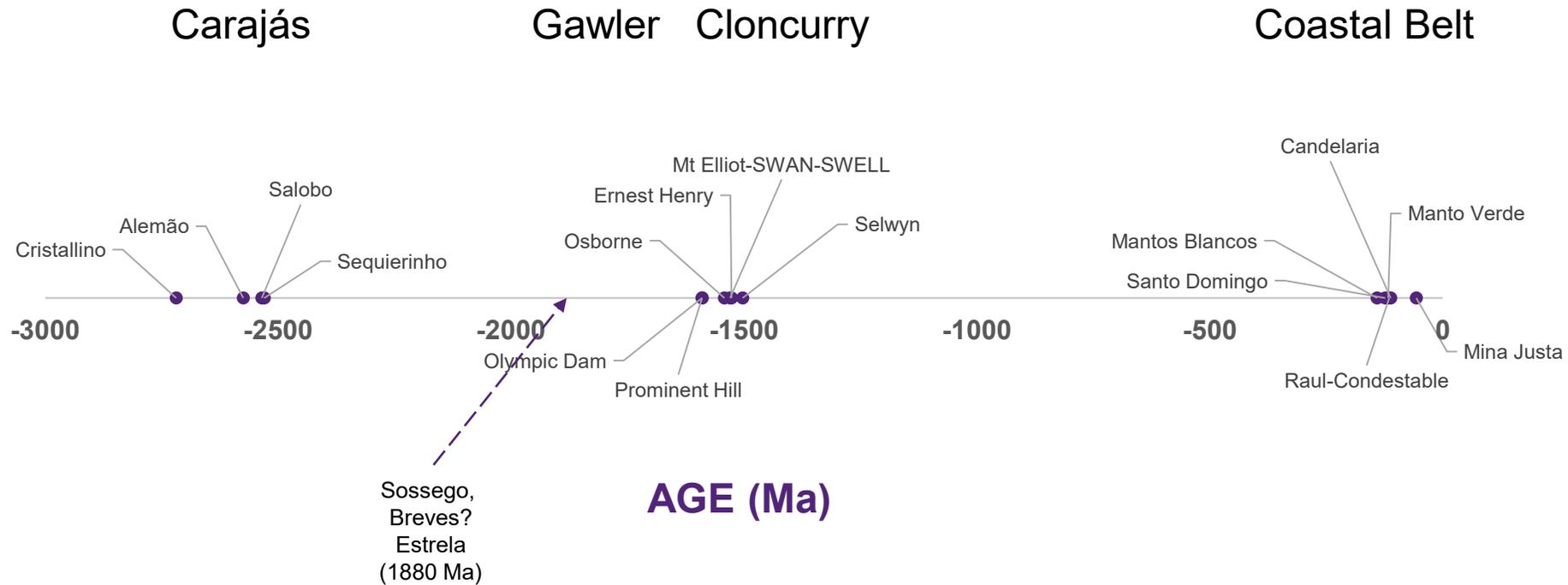
- Olympic Dam is head and shoulders above the field in terms of tonnes and grade
- Eloise, Osborne & Antas are all relatively high grade copper
- Selwyn, Alemão, Osborne are all gold-rich
- Chilean deposits typically low gold, two are essentially copper starter projects for iron mines



# Size of mineralised terrane

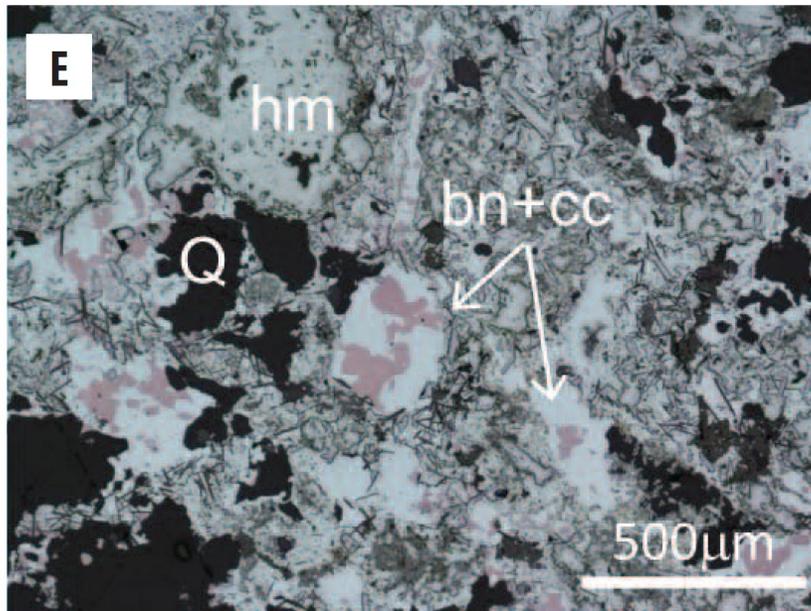


# Age of Mineralisation



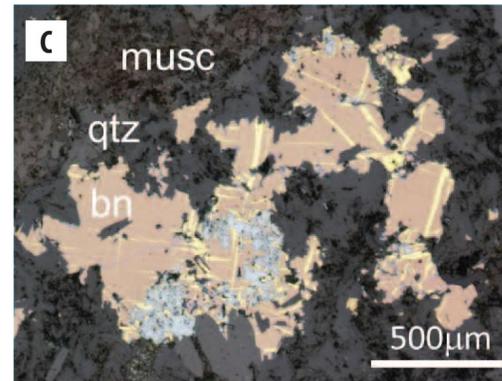
# Copper sulphide mineralogy

## High copper species



Bornite-chalcocite from the Olympic Dam deposit (Ehrig et al, 2017)

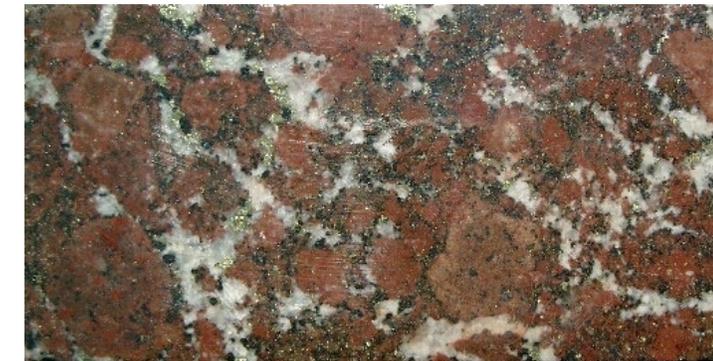
## Chalcopyrite-bornite



ABOVE: Chalcopyrite lamellae in bornite from the Olympic Dam deposit (Ehrig et al, 2017)  
BELOW: Massive chalcopyrite from the Salobo deposit.



## Chalcopyrite



Magnetite, carbonate, biotite with economic chalcopyrite and minor pyrite mineralization. (From Ernest Henry rock type collection.)

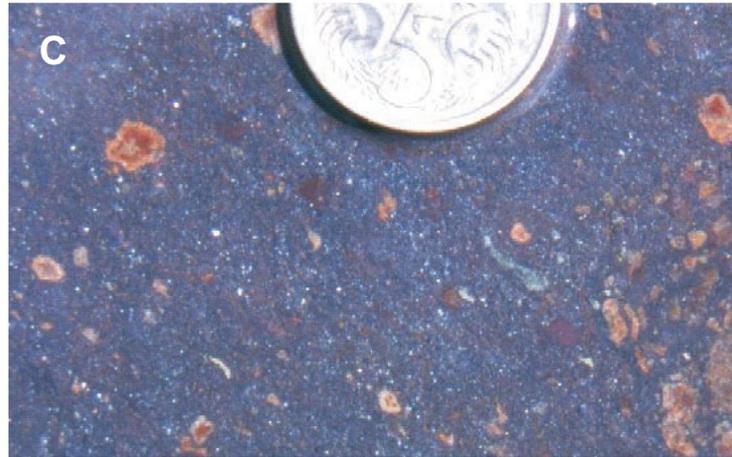
# Iron oxide mineralogy

hematite



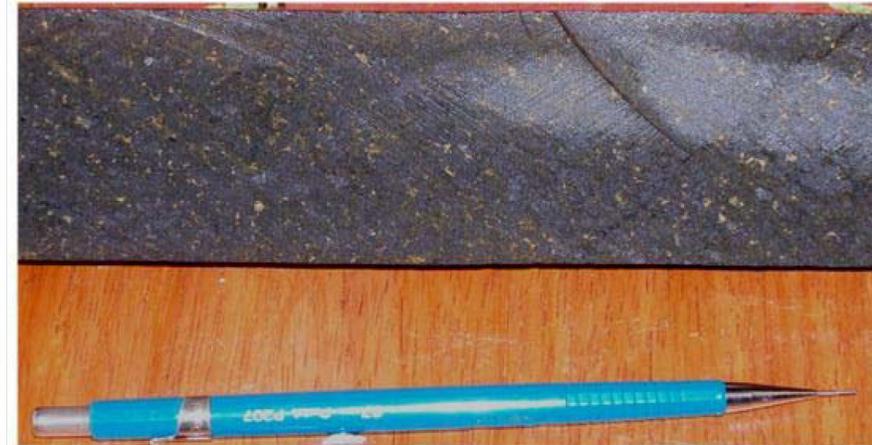
Sericitised and silicified corroded volcanic clasts in auriferous earthy hematite breccia (DP002, 200.60 m) from Prominent Hill (Belperio and Freeman, 2004 - PACRIM)

hematite



Chalcocite mineralisation within bluish-grey hematite-silica matrix supported breccia (DP003, 463.5 m) from Prominent Hill (Belperio and Freeman, 2004 - PACRIM)

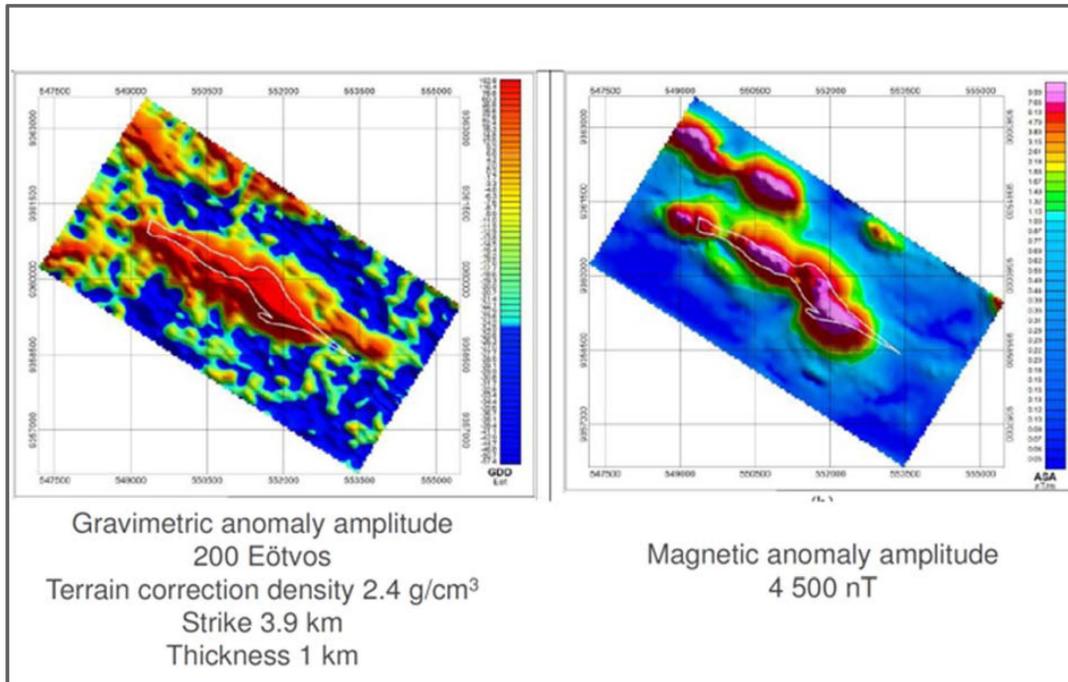
magnetite



Massive magnetite-chalcopyrite from the Salobo deposit.

# Geophysical signatures – potential fields

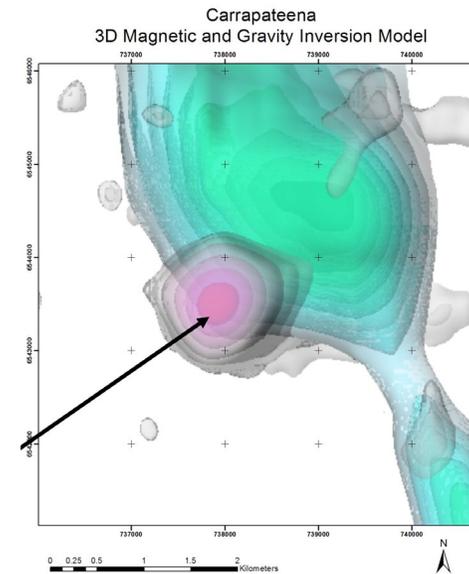
## Salobo



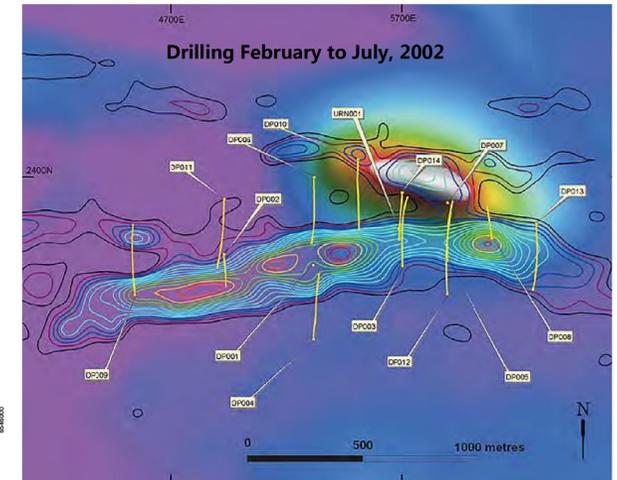
Note: Figure courtesy Vale, 2015. White outline is the current extend of the Salobo mineralization, projected to surface

Source: Silver Wheaton (2017) NI43-101 report

## Carrapateena



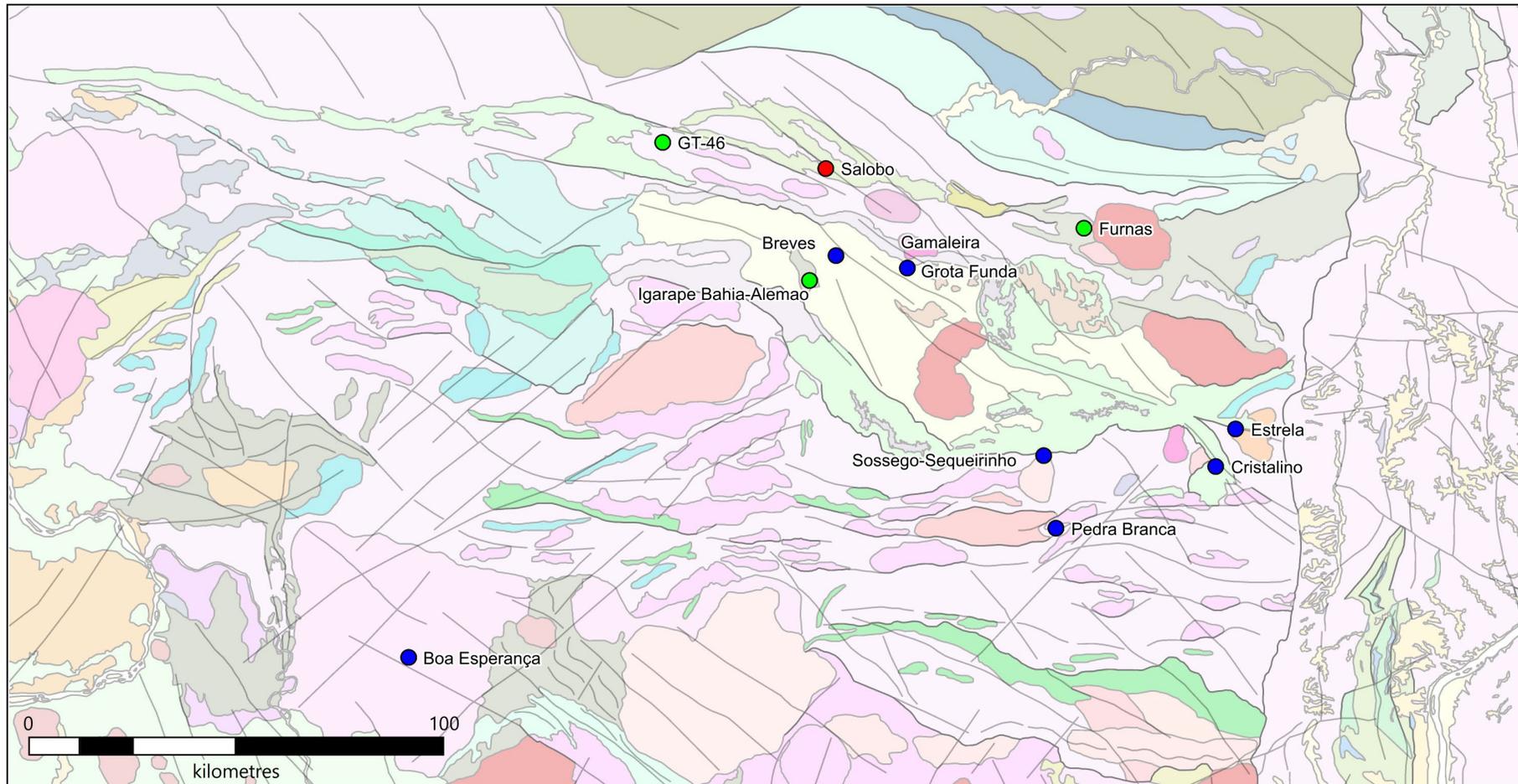
Source: Vella (2013) presentation



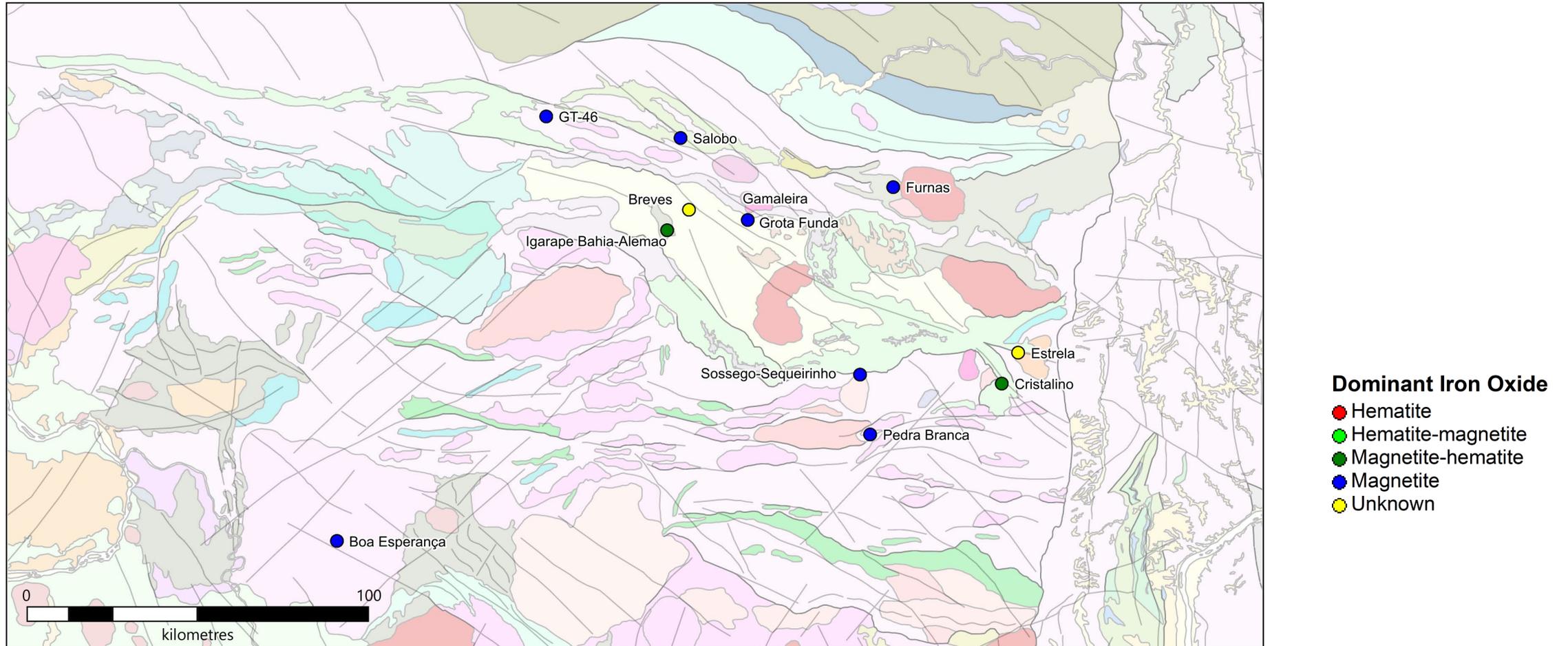
## Prominent Hill

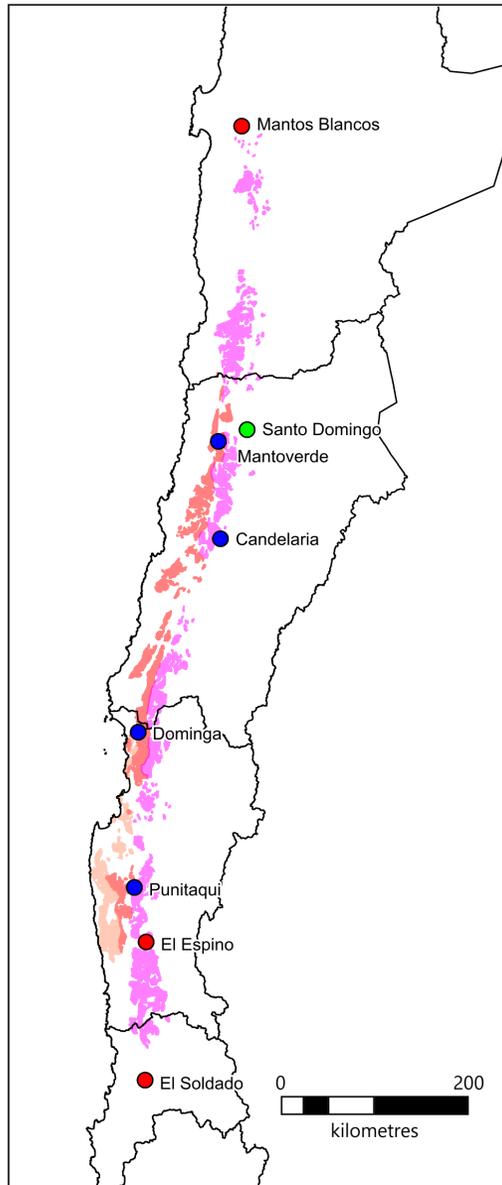
Source: Minotaur Presentations

# Copper sulphide species – Carajás District



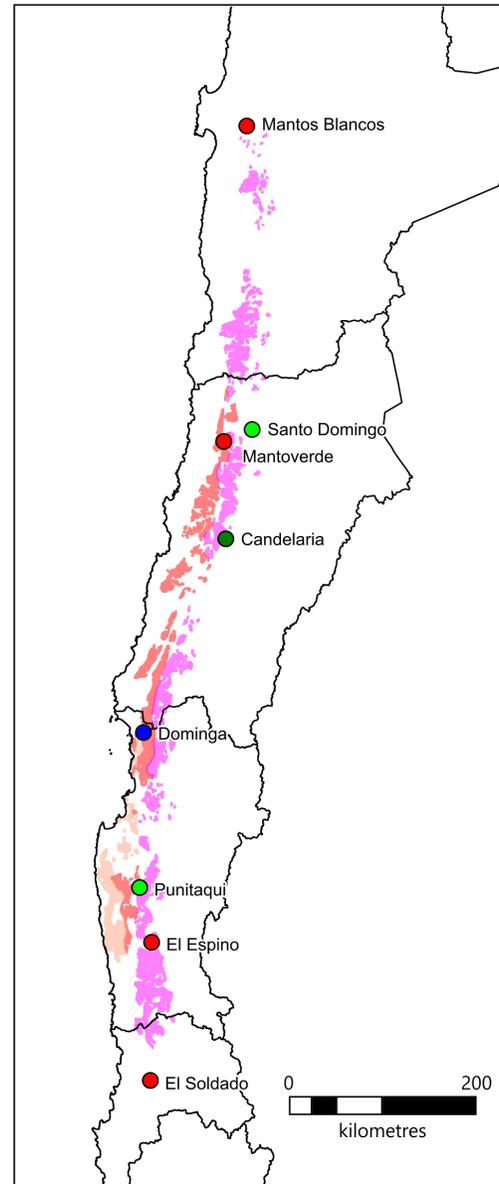
# Iron oxide species – Carajás District





**Dominant Copper Sulfide**

- High copper species
- Chalcopyrite-bornite
- Chalcopyrite

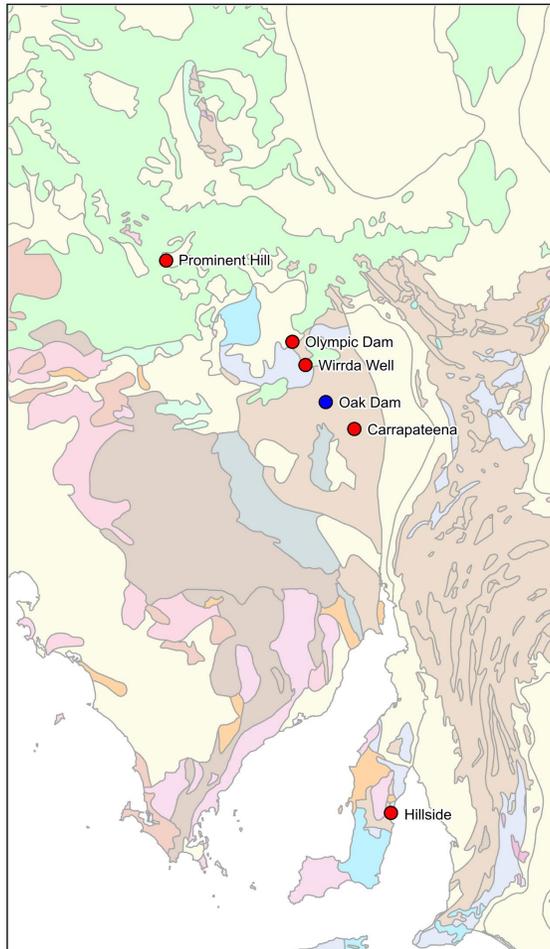


**Dominant Iron Oxide**

- Hematite
- Hematite-magnetite
- Magnetite-hematite
- Magnetite
- Unknown

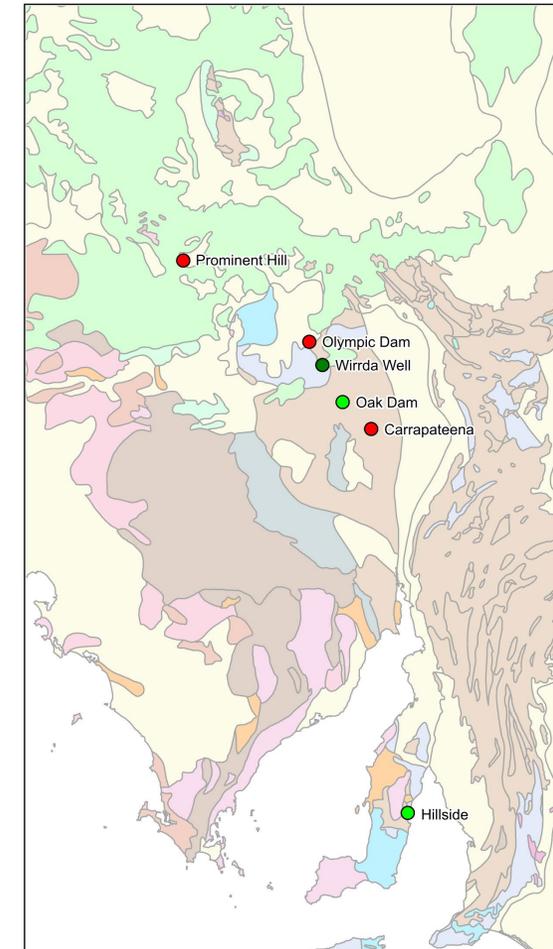
# Copper sulphide & Iron Oxide species – Coastal Belt

# Copper sulphide & iron oxide species – Gawler Craton



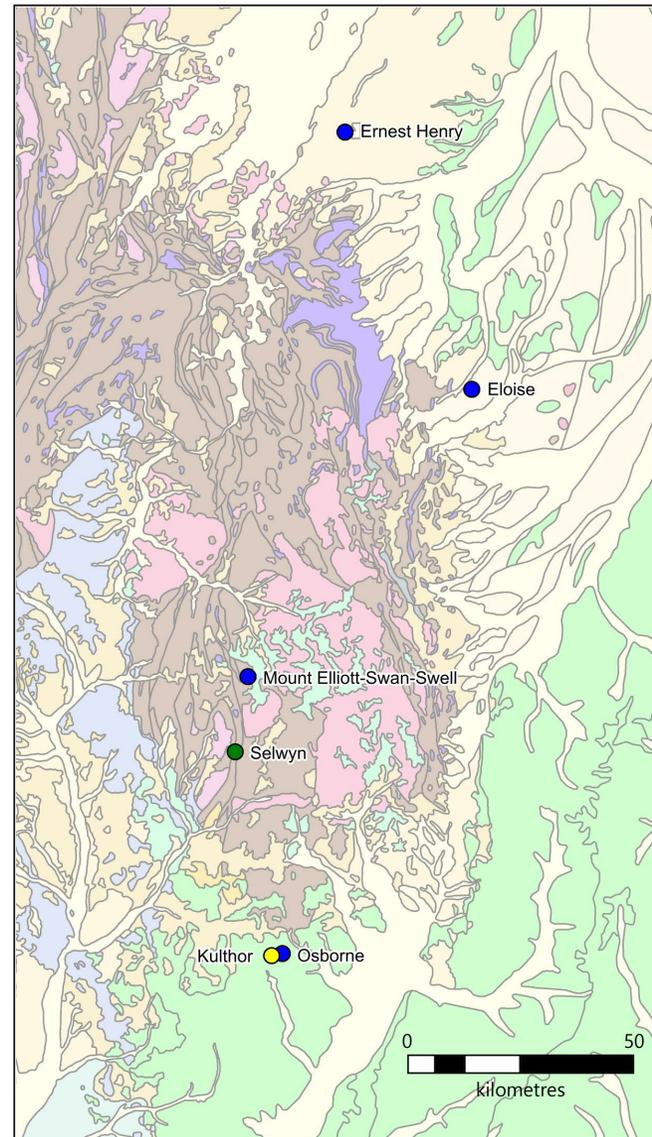
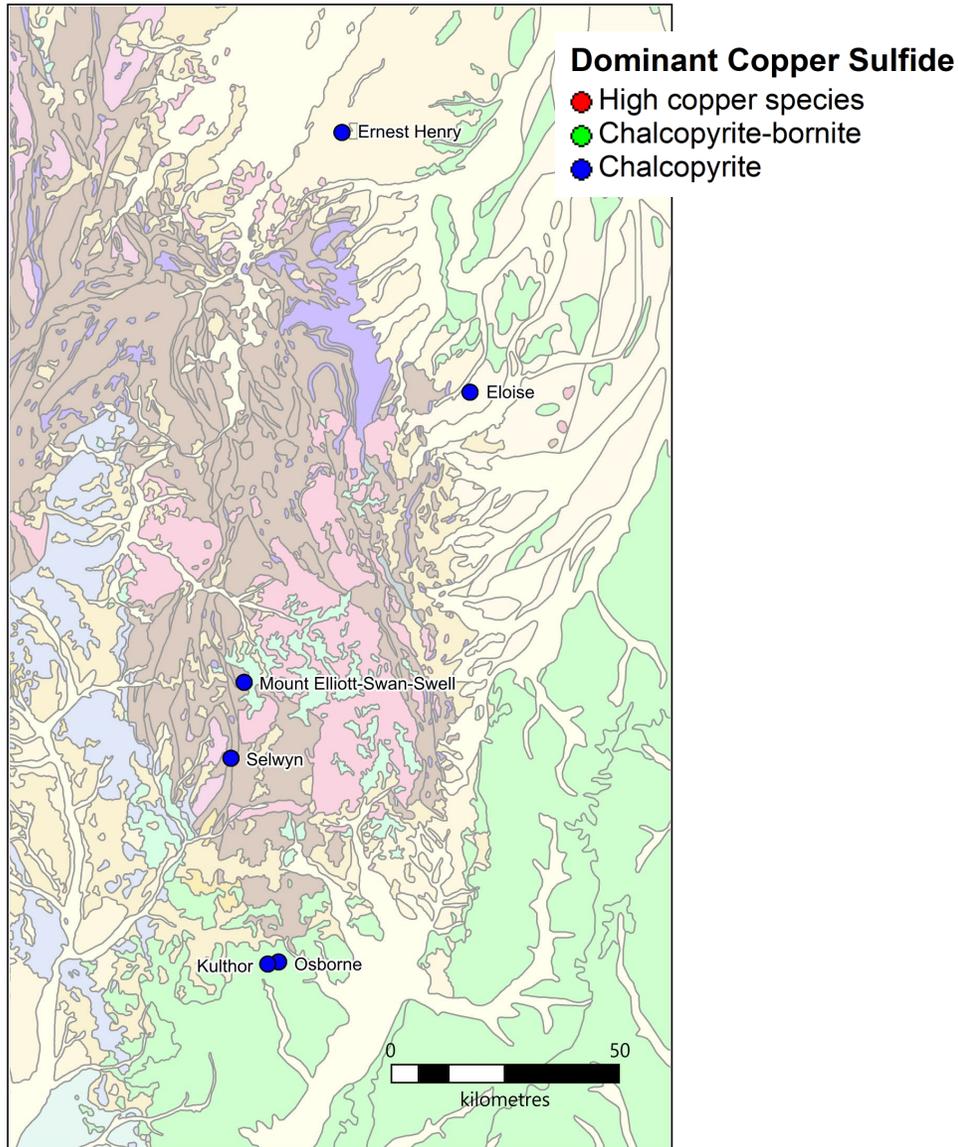
## Dominant Copper Sulfide

- High copper species
- Chalcopyrite-bornite
- Chalcopyrite



## Dominant Iron Oxide

- Hematite
- Hematite-magnetite
- Magnetite-hematite
- Magnetite
- Unknown



# Copper sulphide & iron oxide species – Cloncurry Belt

# Iron sulphide mineralogy

## **Pyrite-dominated**

Salobo

GT-46

Sossego

Pedra Branca

Boa Esperanca

Cristalino

Furnas

Gameleira

Igarape Bahia-Alemao

Olympic Dam

Carrapateena

Emmie Bluff

Hillside

Oak Dam

Prominent Hill

Wirrda Well

Candelaria

Dominga

El Espino

El Romeral

El Soldado

Mantos Blancos

Mantoverde

Michilla

Punitaqui

Santo Domingo

Ernest Henry

Selwyn

Mt Elliot

## **Pyrrhotite-dominated**

Estrela

Eloise

Jericho

## **Pyrrhotite-pyrite**

Sequierinho-Sossego

Mina Justa

Breves

Osborne

Kulthor

## Should we be paying more attention to the following in NWQ

- Manto systems
- Hematite-dominated systems
- Systems with high-copper sulphide species and with low pyrite

# Summary

To date copper production from IOCG deposits is dominated by four terranes

Those terranes span the late Archean, the Mesoproterozoic and the Jurassic-Cretaceous periods

In comparing NWQ with other belts:

- The heavily explored area (essentially exposed or shallow cover) of the Cloncurry Belt is still a restricted area compared with the Chilean Coastal Belt.
- The dominant iron oxide mineral in discoveries to date in NWQ is magnetite, and NWQ shows a smaller spread in terms of magnetite-hematite ratio than other terranes.
- Specifically, there are no significant hematite-dominated, high-copper sulphide species deposits known from NWQ. The Gawler examples typically represent a lower temperature, shallower system, can we attempt to track the NWQ Mesoproterozoic rocks under cover to lower metamorphic grade.



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# Thank you

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