

Magma fertility and tectonic evolution of the Mary Kathleen Belt

Summary:

- Introduction
- EGRU projects in Mt Isa region
- Update on the magma fertility study– new age data
- Update on the tectonic evolution study– new mapping
- Update on the Tick Hill study – new age data
- Conclusions

Introduction

EGRU (JCU) and GSQ developed a project:

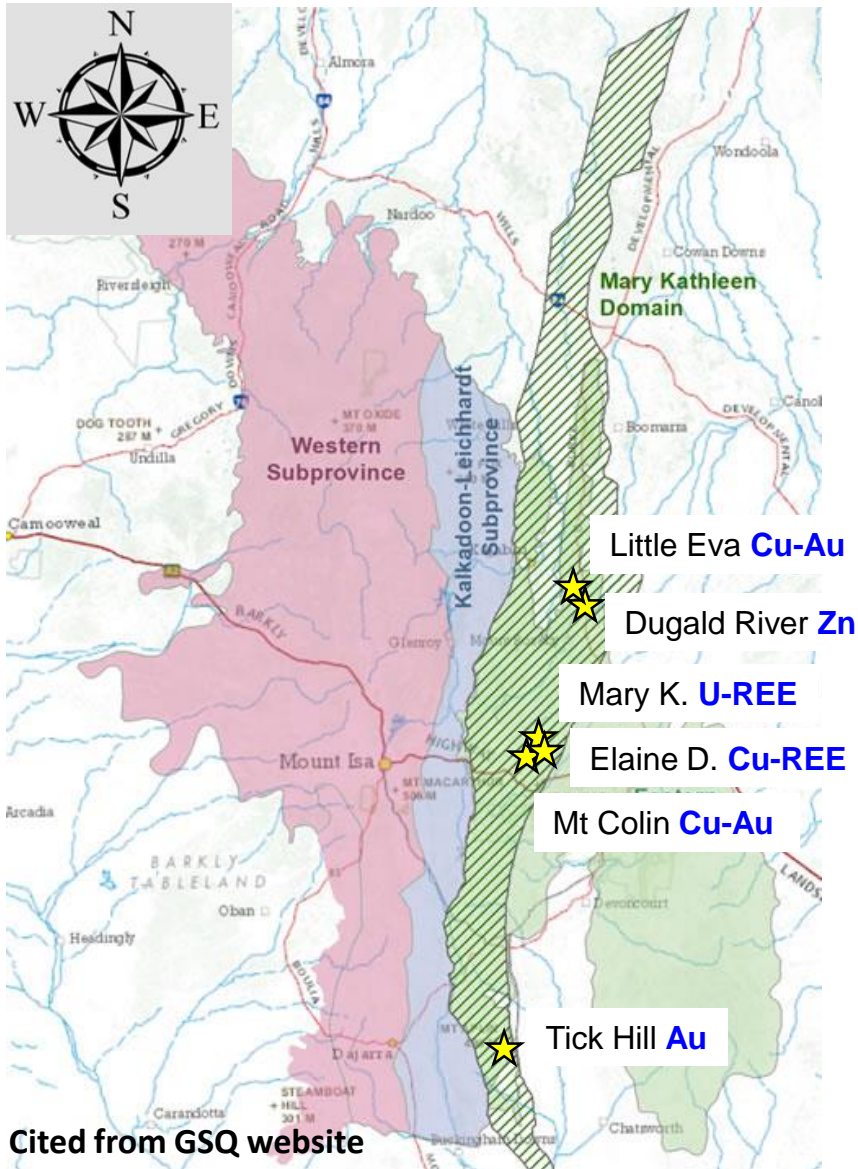
- Establish the extent, character and timing of the dominant magmatic activities in the Mary Kathleen Domain of the Mt Isa Inlier;
- Develop an understanding of the tectono-magmatic history of the Mary Kathleen Domain and its links to metallogenesis;
- Explore the applicability of magma fertility concepts as a tool for exploration for a variety of deposit types.
- Develop new concepts that can be used for exploration in the Mary Kathleen Domain

Collaborate with the GSQ team

(David Purdy, Bob Bultitude, Dominic Brown, Derek Hoy, etc.)

Introduction

Why Mary Kathleen Belt:



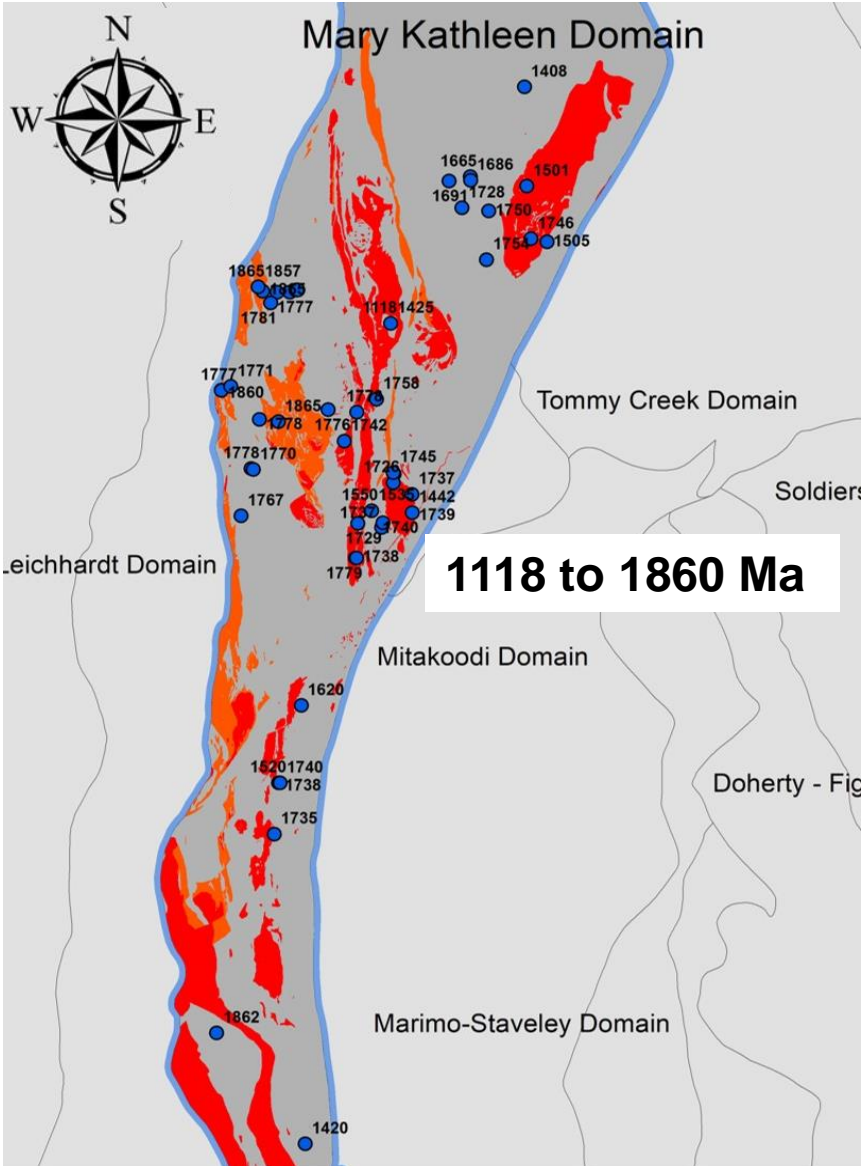
Cited from GSR website

- Numerous deposits and prospects
- A wide variety of commodities:
 - Cu, Au, Zn, Pb, Ag, U, REE
- Numerous plutons
- Complex structural history
- Intense metasomatic alteration

But:

- No big deposits
- No new discoveries
- No 1550-1500 Ma plutons

Introduction



The Cloncurry style IOCG systems:

- Strong structural control
- D₃ brittle-ductile structures
- Early sodic alteration
- Late potassic alteration
- **Link to 1550-1500 Ma plutons**
- Wide range of metals
- **Late Isan Orogeny**

But :

- **MKB is not Isan Orogeny**

Introduction

Main points from previous workshop:

- MKB is not an extensional belt
- MKB was metamorphosed, deformed and intruded by plutons during the Wonga Orogeny (1800-1680 Ma)
- Metamorphism, deformation and plutonism was diachronous across the belt
- Sedimentation was diachronous along the belt – stratigraphy is not continuous
- Mineralization is related to Isan overprinting

EGRU projects in Mt Isa region

EGRU-GSQ project – on going

Researcher	Project
Dr. Yanbo Cheng	Magma fertility in MKB
Joshua Spence (PhD - on going)	Tectonics and structure of the MKB
Truong Le (PhD – on going)	Tick Hill deposit geology
Alex Edgar (Honours - completed)	Scapolite as a vectoring tool
Travis Mackay (Honours – on going)	Major shear systems in the MKB

EGRU projects in Mt Isa region

EGRU-projects

Researcher	Project
Alex Brown (PhD – on going)	Tommy Creek Domain tectonic evolution (MIM funded)
Pieter Creus (PhD – on going)	Dugald River Deposit – structural controls on the ore body (MMG funded)
Keanu Stinson (Honours – on going)	Starra line – structure and timing (Chinova funded)
Grace Manestar (Honours – on going)	Peak metamorphic fluids

EGRU projects in Mt Isa region

New EGRU-projects

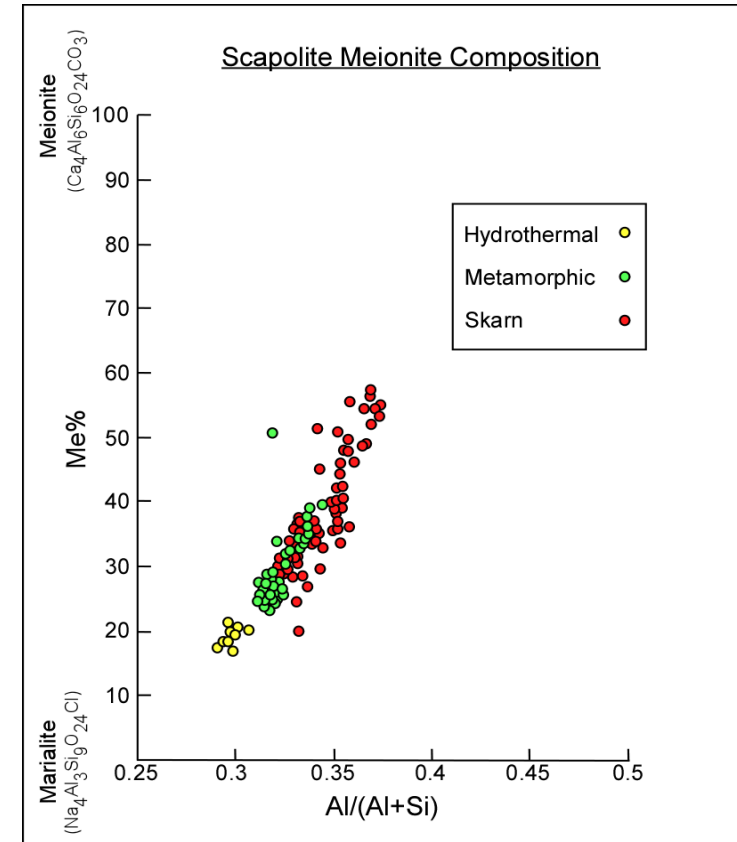
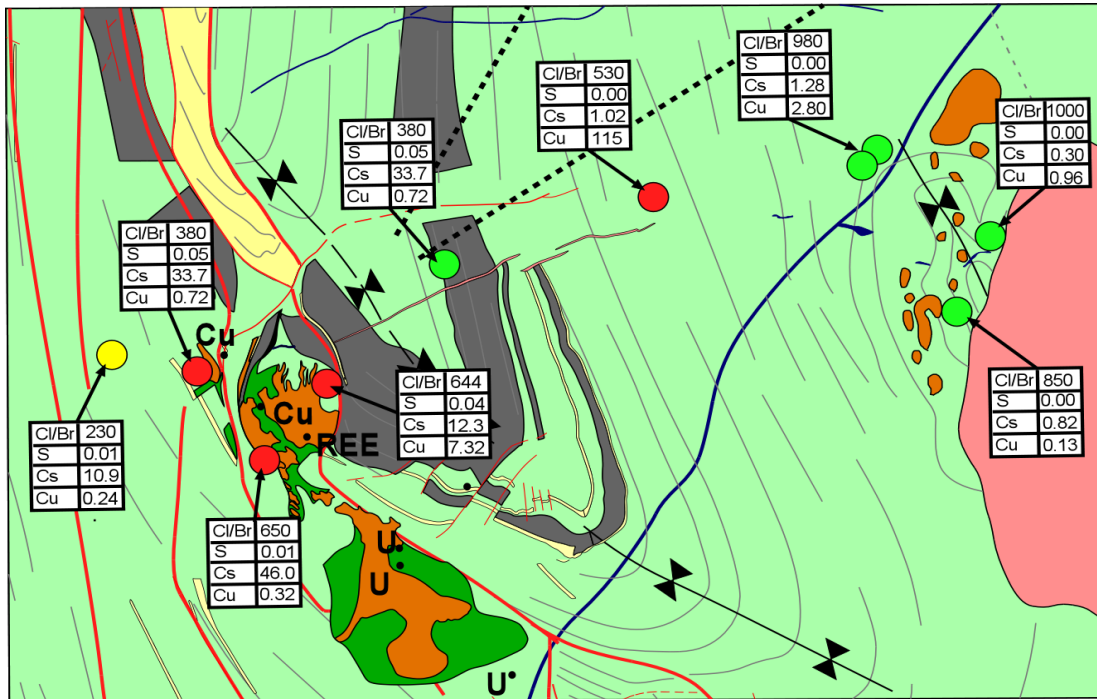
Cu-Zn isotopes applied to Mount Isa deposit

Advertised for a few PhD projects:

- Major shear/fault systems in the Eastern Fold belt
- Scapolite geochemistry as a vector towards mineralization
- Feldspar geochemistry as a vector towards mineralization
- Garnet geochemistry as a vector towards mineralization

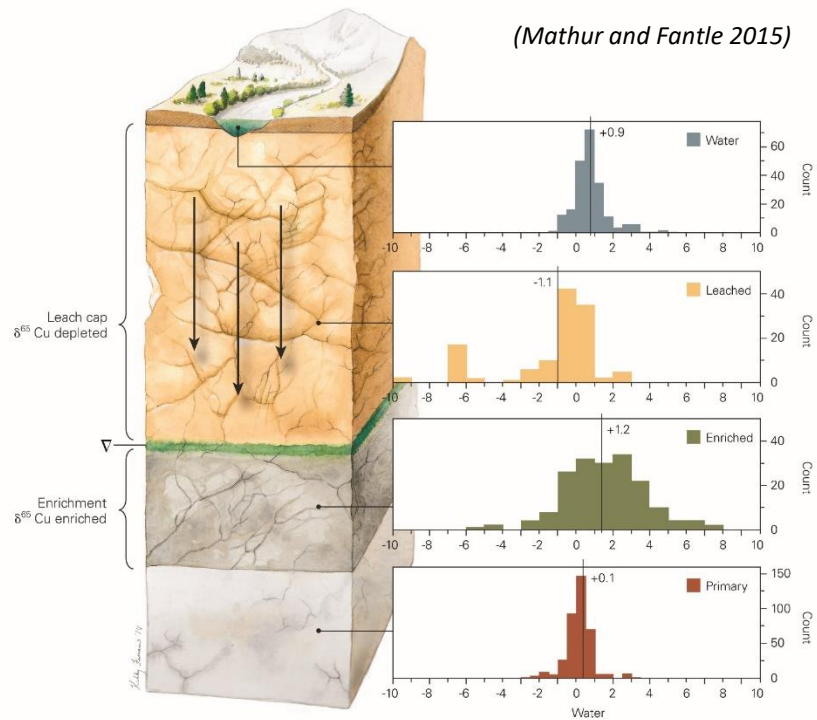
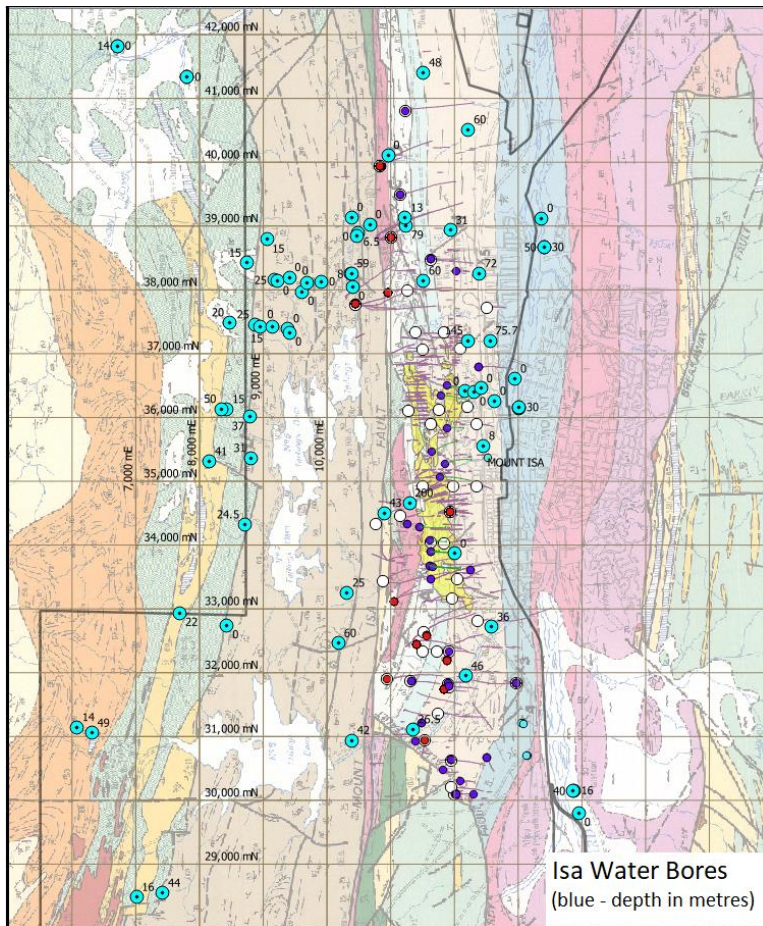
EGRU projects in Mt Isa region

- Scapolite geochemistry as a vector towards mineralization

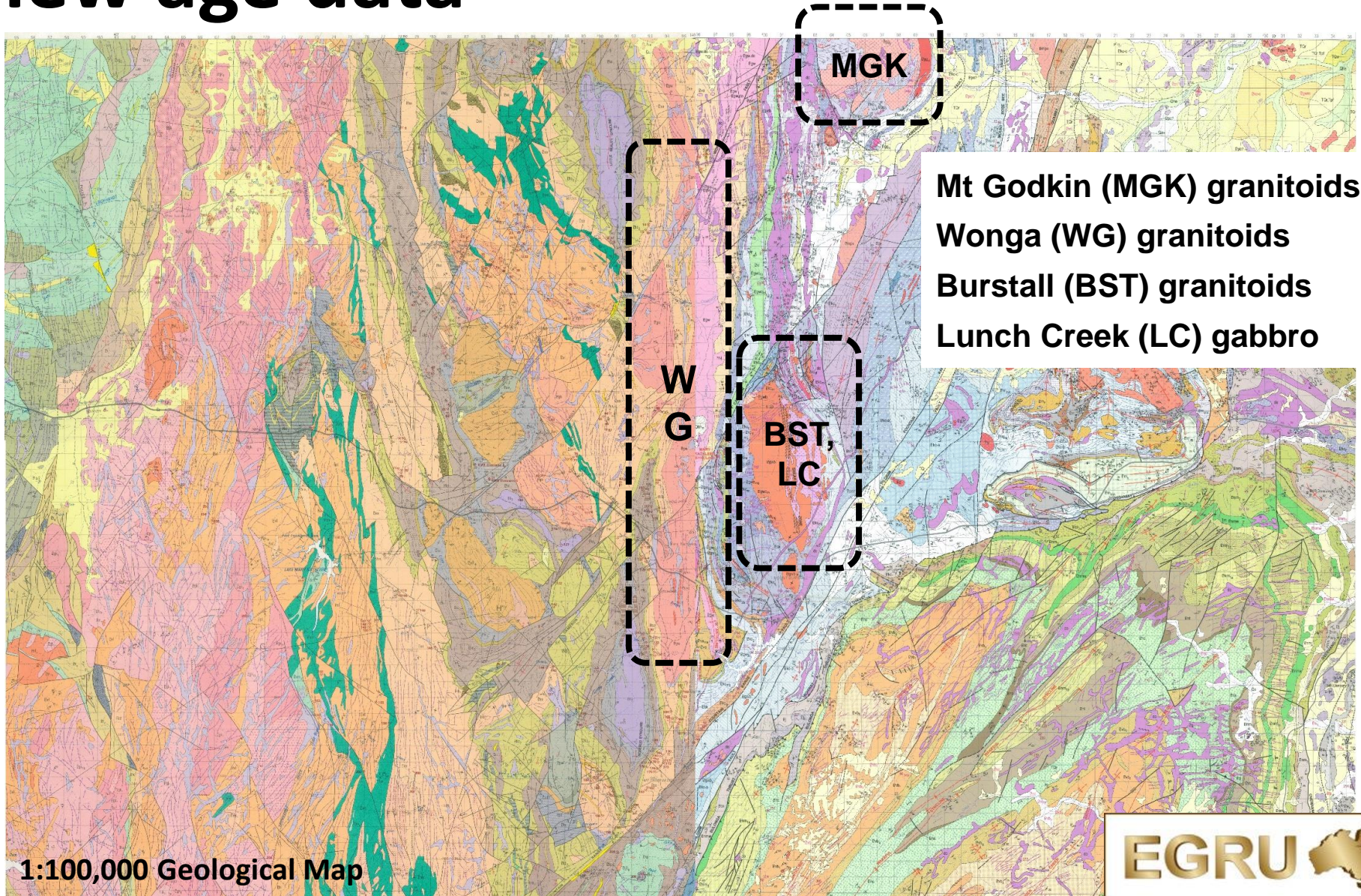


New EGRU-project

Cu-Zn isotopes applied to Mount Isa deposit



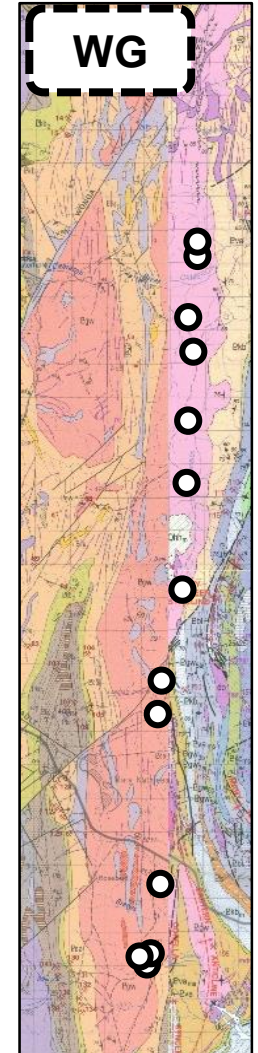
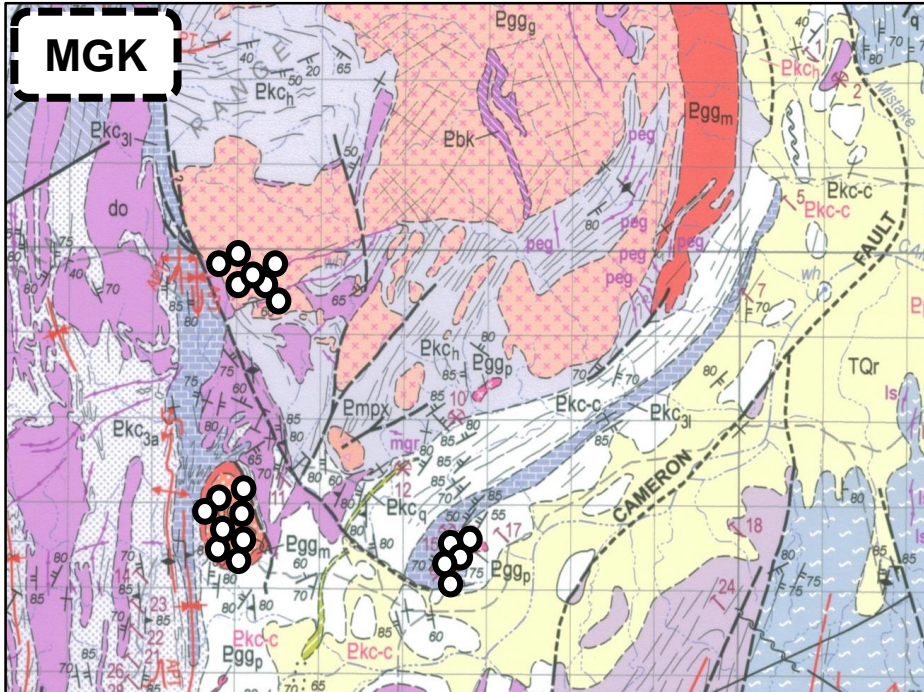
Update on the magma fertility study— new age data



1:100,000 Geological Map



Sample locations



Mt Godkin (MGK) granitoids: 20 samples

Burstal (BST) granitoids: 13 samples

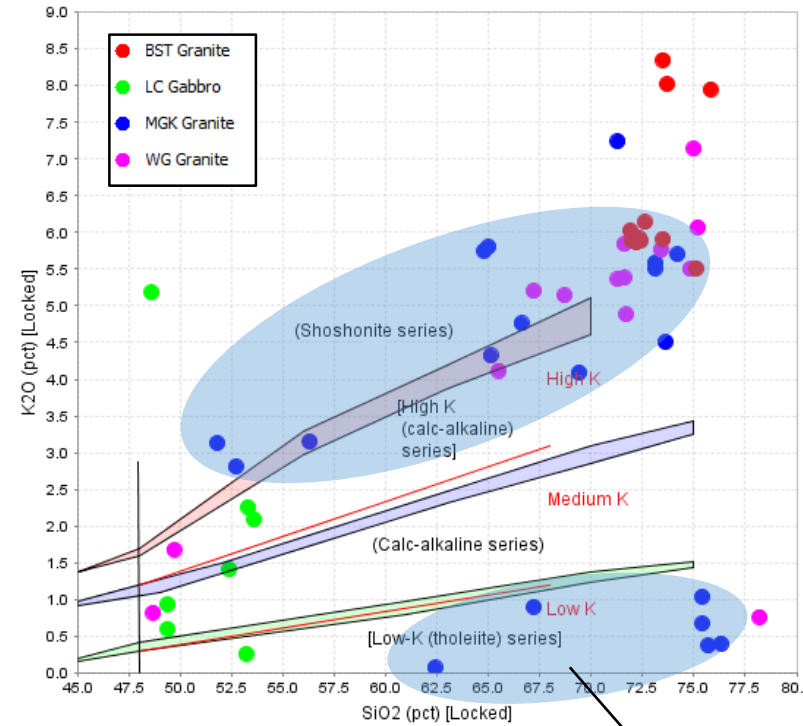
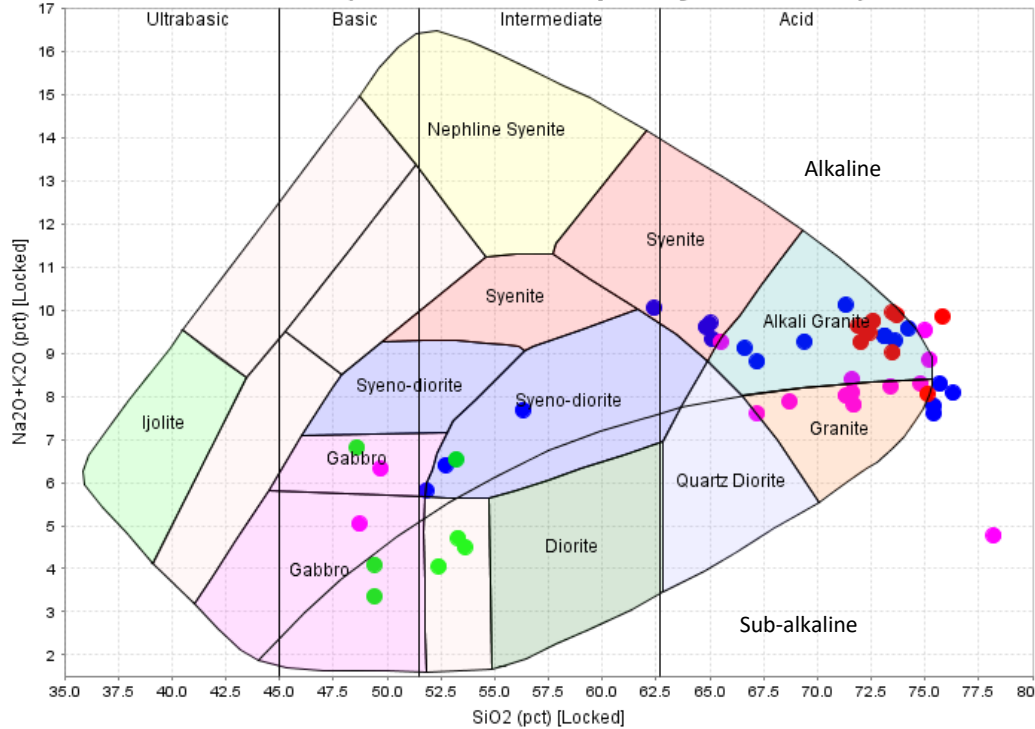
Burstal mafic / felsic dykes: 6 samples

Lunch Creek (LC) gabbro: 8 samples

Wonga (WG) granitoids: 12 samples

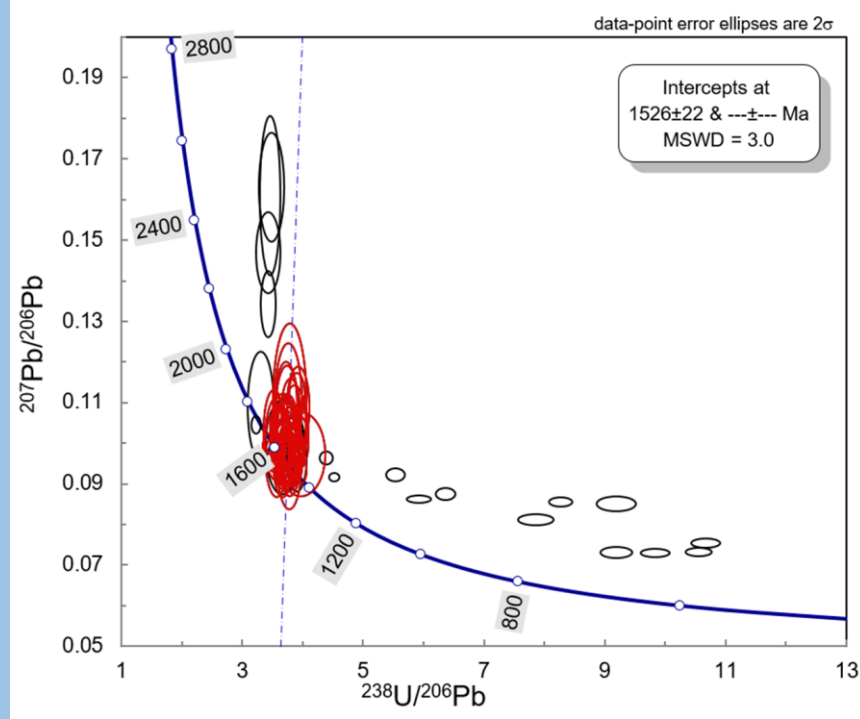
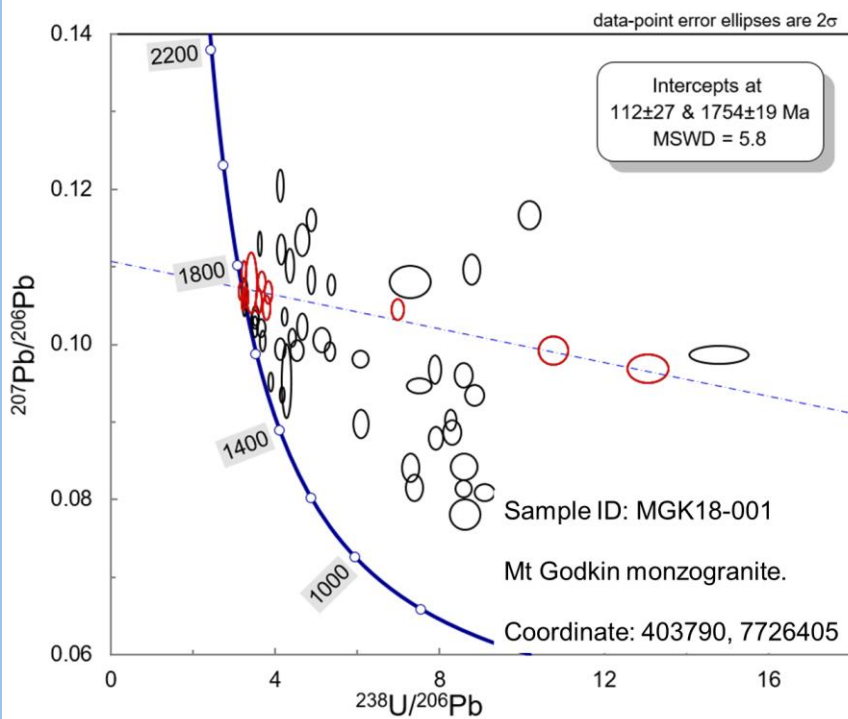
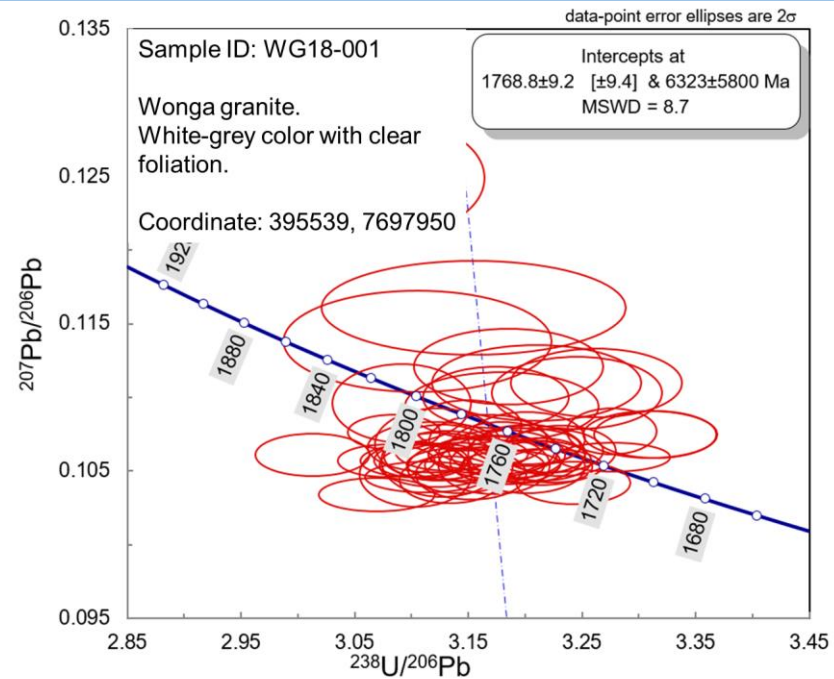
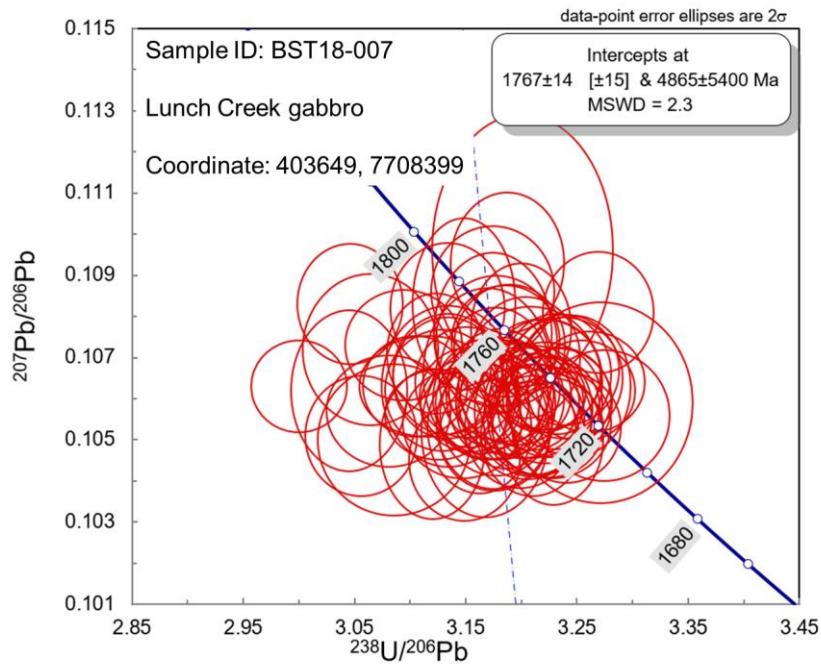
Geochemical characteristics

TAS Plutonic (Cox et al. 1979 adapted by Wilson 1989)

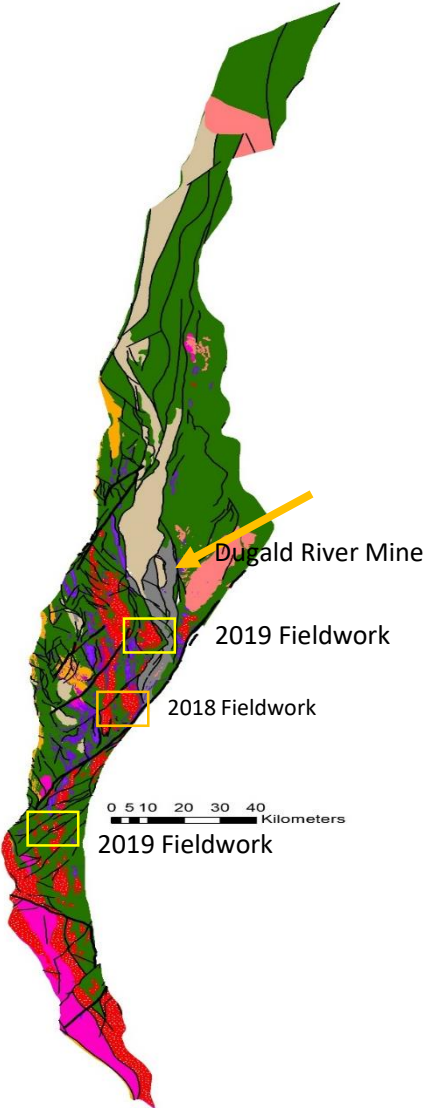


- Wide compositional range: mafic ➡ intermediate ➡ felsic
- High alkali content, especially high in K_2O concentration
- MGK granitoids: bimodal K_2O concentrations, shoshonite series vs. low-K series

pegmatite

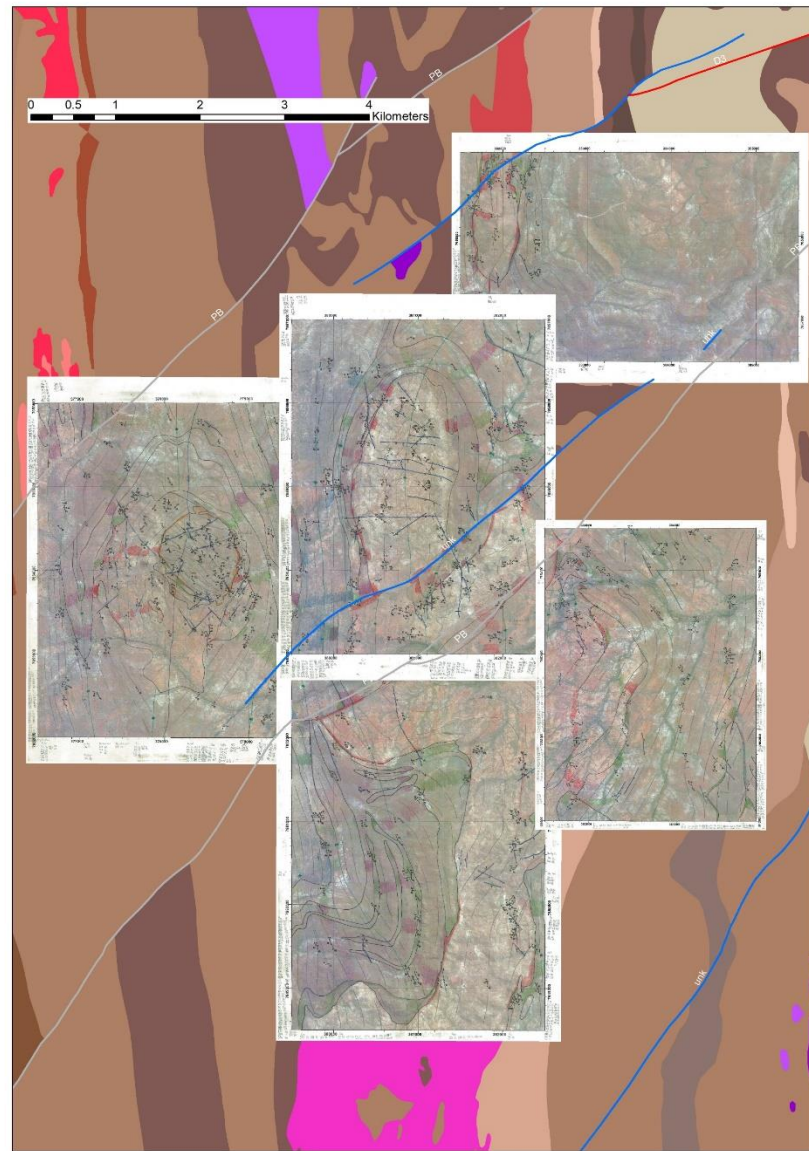
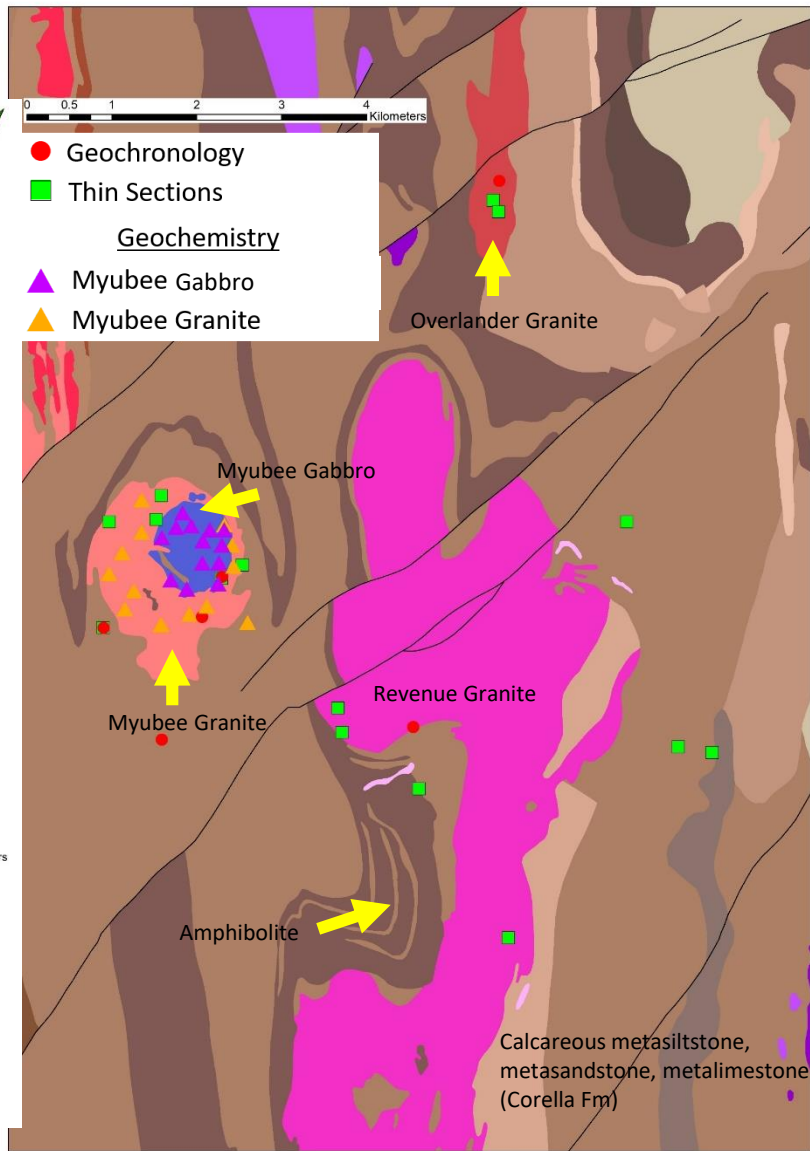


Update on the tectonic evolution study— new mapping

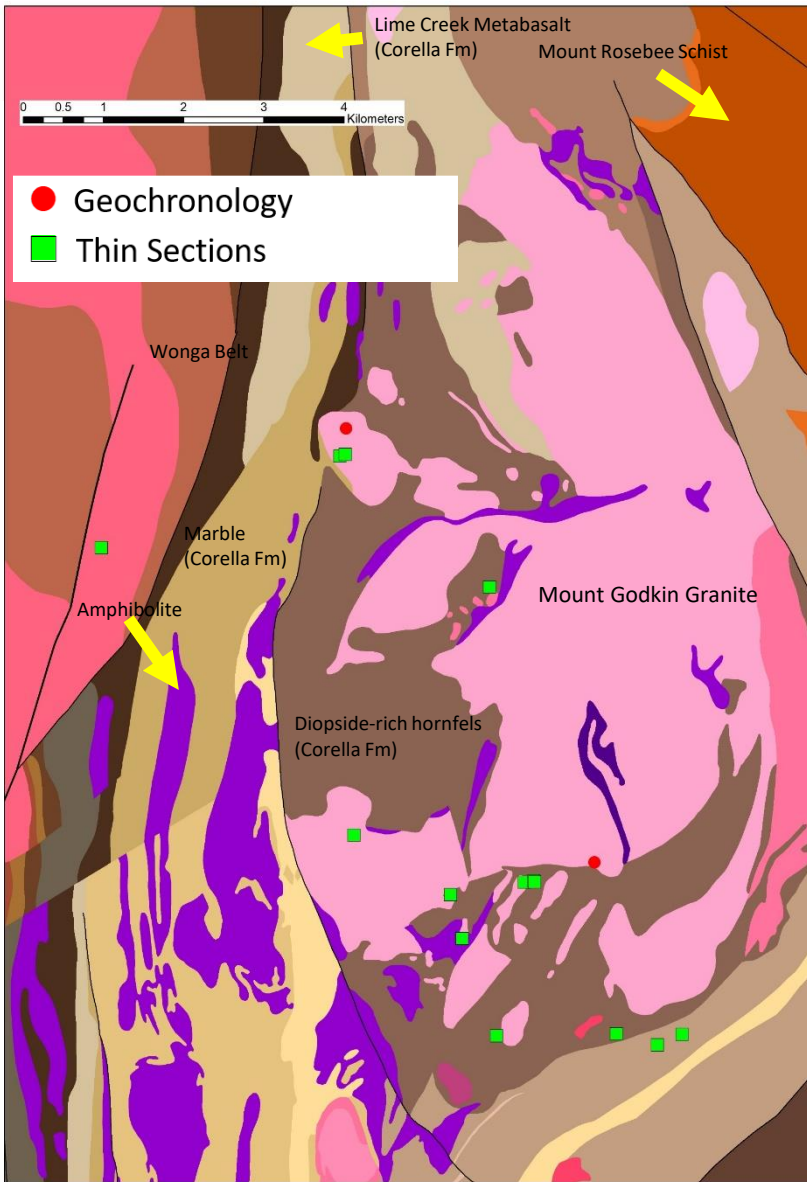
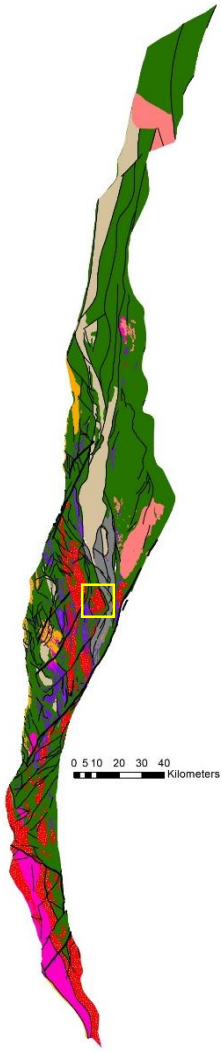


Mary Kathleen Belt

Task	Results	
Field work	48 days	
Mapping area covered	Total Duchess Mount Godkin	~79km ² 51km ² 28km ²
Samples Collected – Mount Godkin	Thin Sections U-Pb dating	17 2
Samples Collected – Duchess	Thin Sections U-Pb dating <i>Geochemistry</i> Myubee Granite Myubee Igneous Complex	20-30 6 14 13
Total samples collected	65	
Writing	Mary Kathleen – 85-90% complete Mount Godkin - ~15-20% complete Duchess – Field notes only	



Duchess area



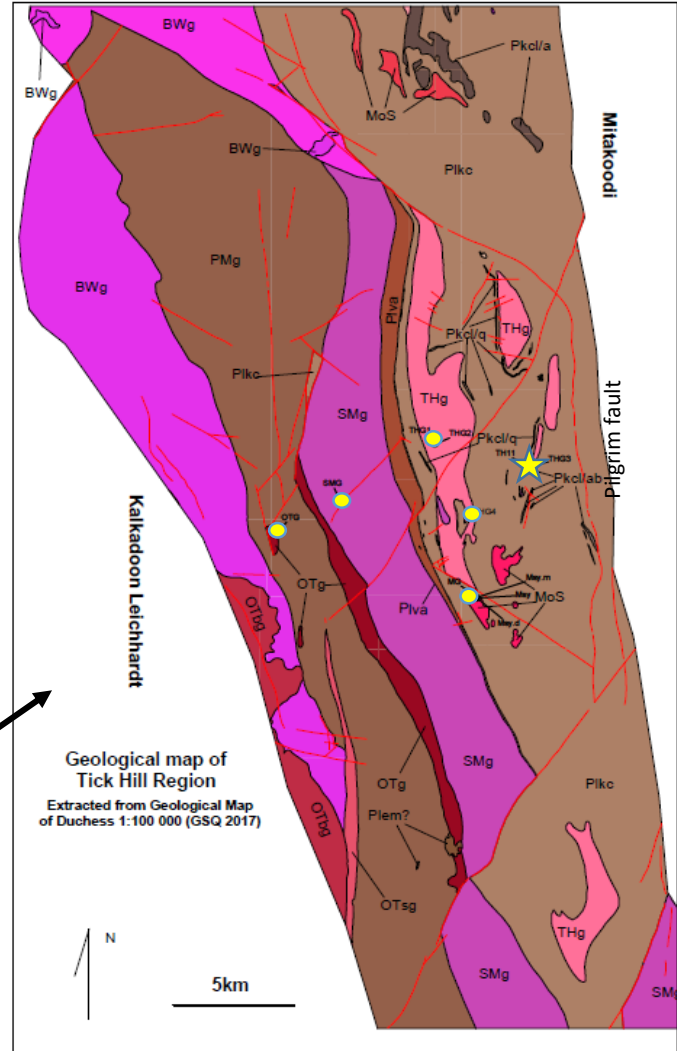
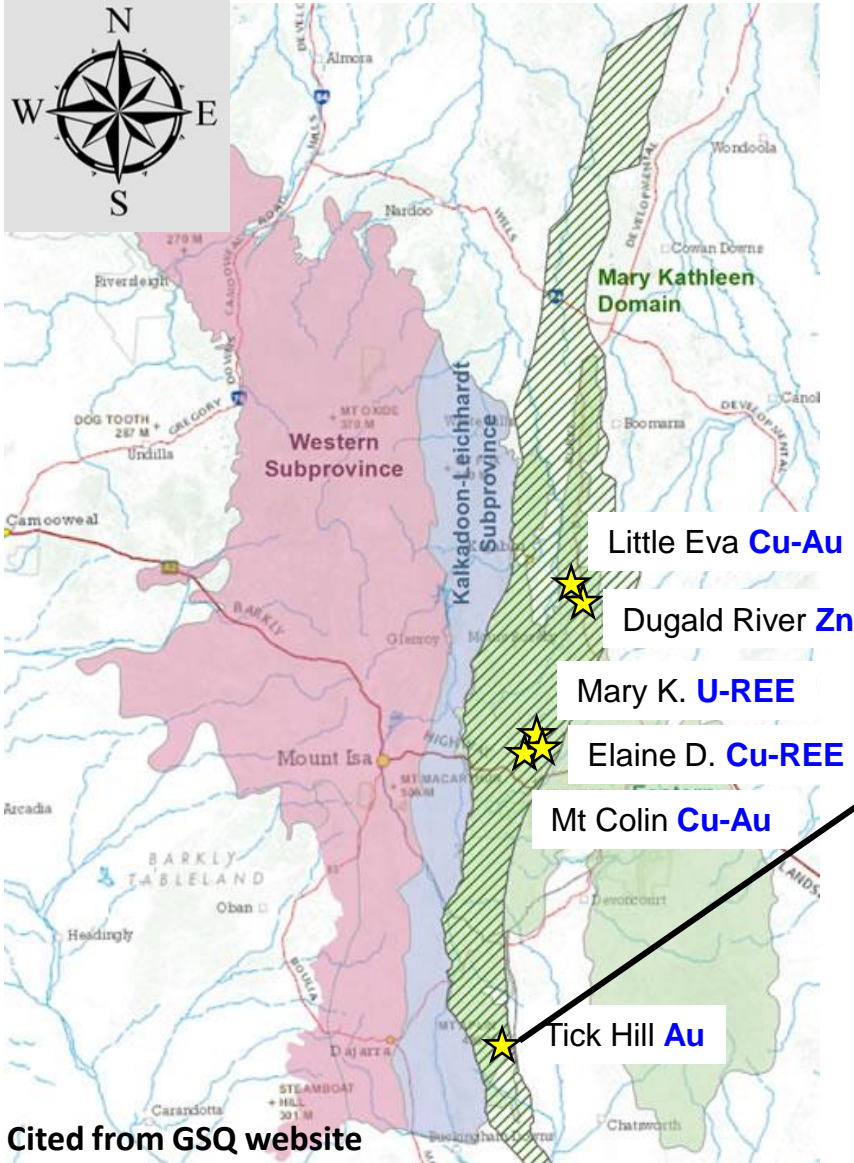
Mount Godkin area

Some important observations:

- Mt Godkin postdates at least 2 folding events
- Mt Godkin granite cuts across the West Godkin Fault
- Myubee gabbro predates the Myubee granite
- Myubee granite intruded syn to late tectonic
- Revenue granite records 2 cleavage/folding events
- Revenue granite intruded early to syn tectonic
- Overlander granite intruded syn tectonic

Overall a similar tectonic history to the Mary Kathleen Syncline suggesting deformation, metamorphism and plutonism during the Wonga Orogeny (pre 1700 Ma)

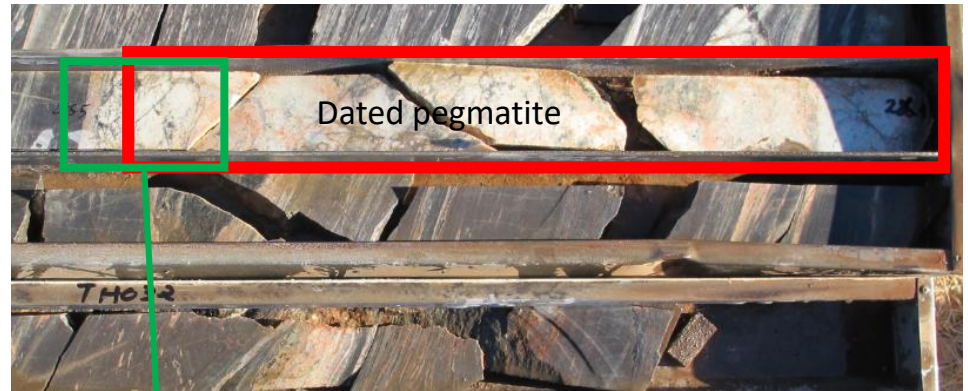
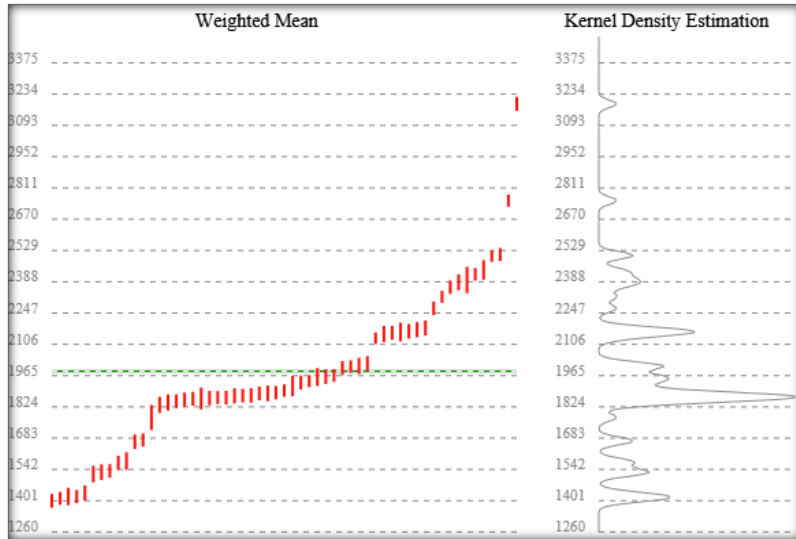
Update on the Tick Hill study– new age data



Tick Hill geology



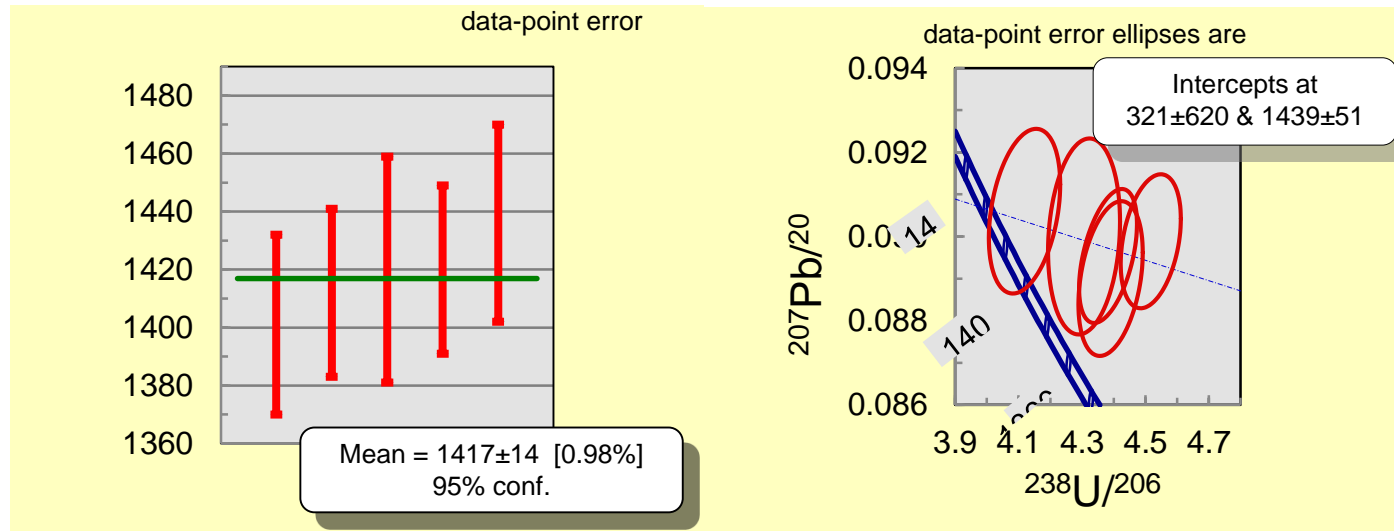
Sample TH032



Post-tectonic pegmatite underneath the Au-rich ore zone; Drill hole TH032

Sample TH032

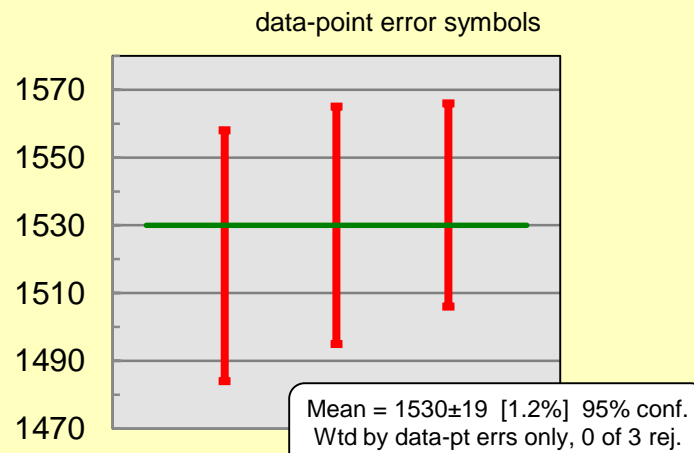
>90% concordance, zircons with very dark CL domains



Post-tectonic pegmatite underneath the Au-rich ore zone;
Drill hole TH032

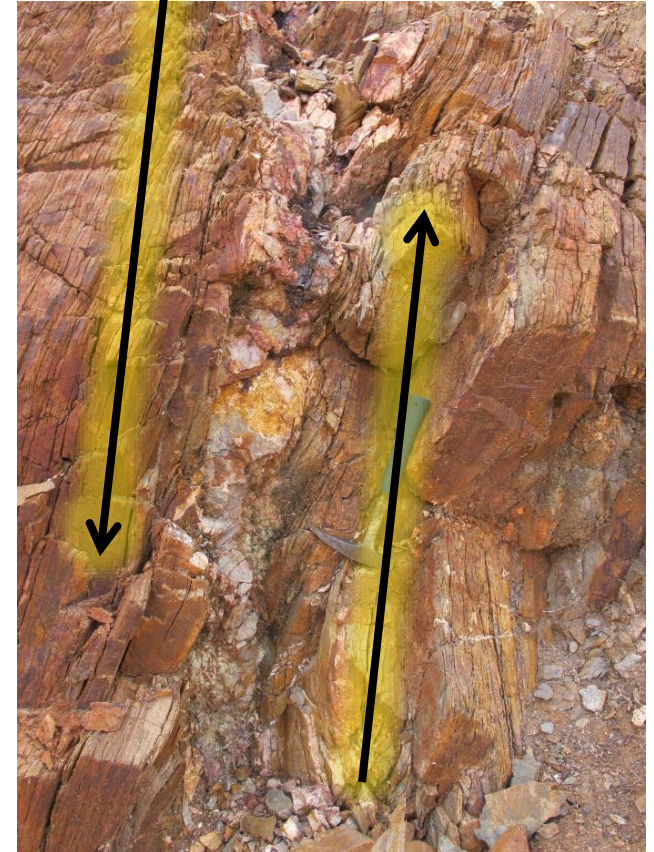
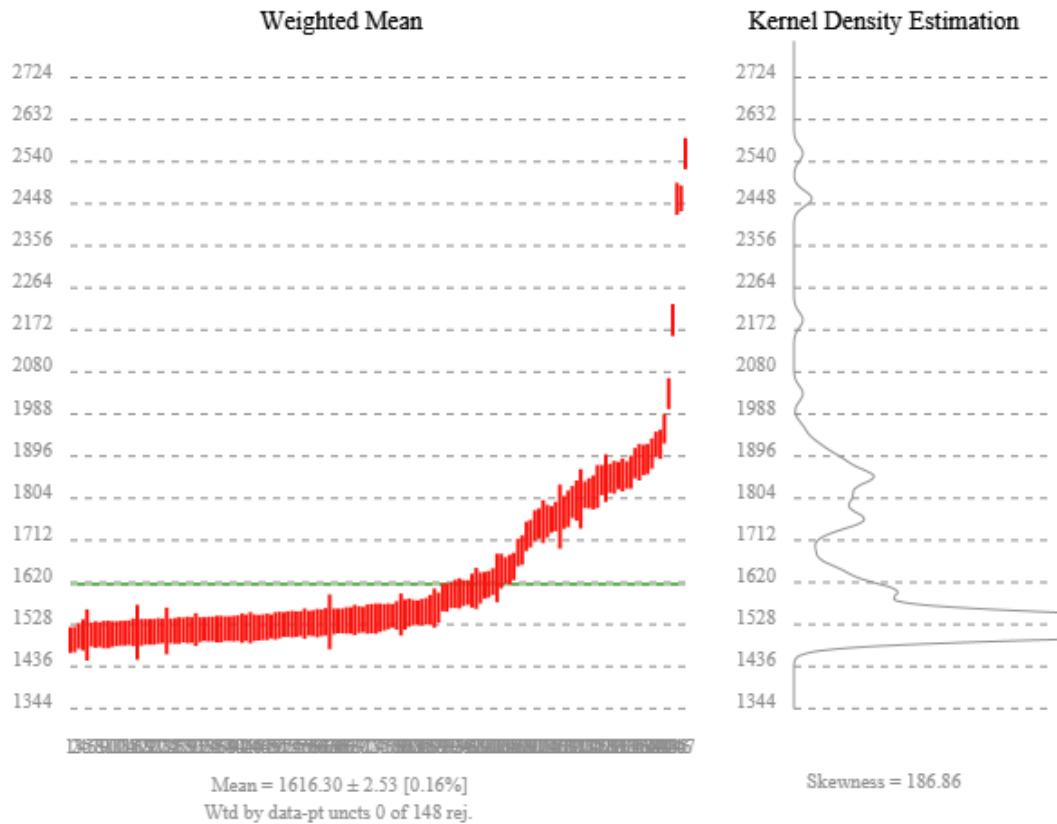
Sample TH032

>95% concordance, altered zircons under CL images



Post-tectonic pegmatite underneath the Au-rich ore zone;
Drill hole TH032

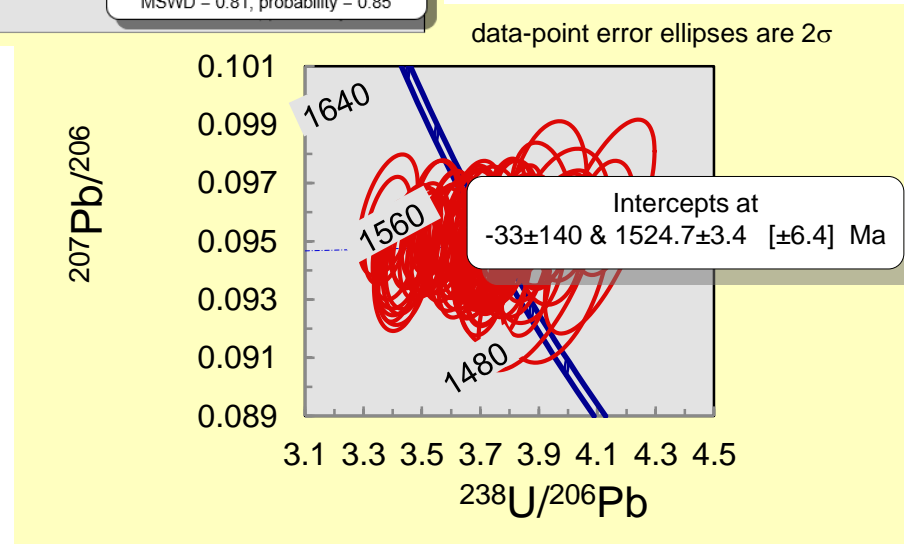
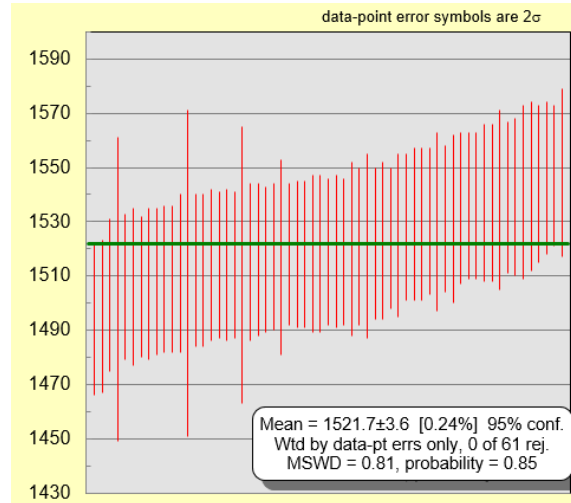
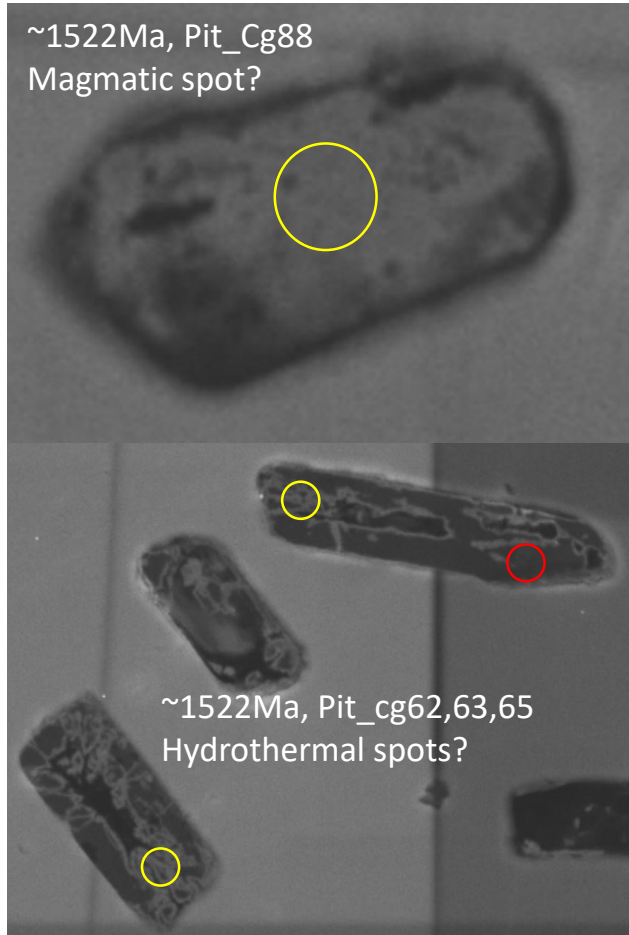
Tick Hill Pit



- Pegmatite associated with en-echelon quartz veins (and Normal-sinistral movement; N Pit wall)
- Late tectonic pegmatite crosscutting the mylonitic foliation

Tick Hill Pit

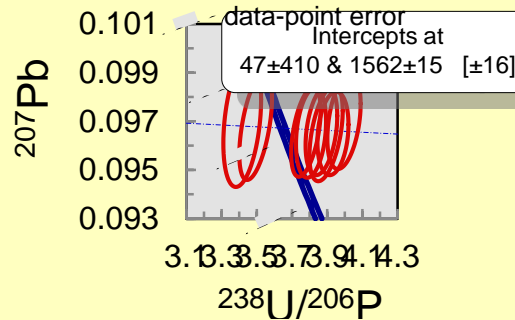
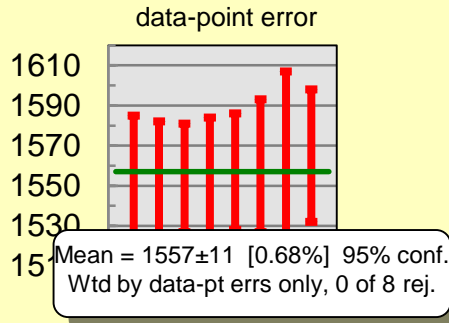
Altered zircon grains in CL images with the ages around ~ 1522 Ma



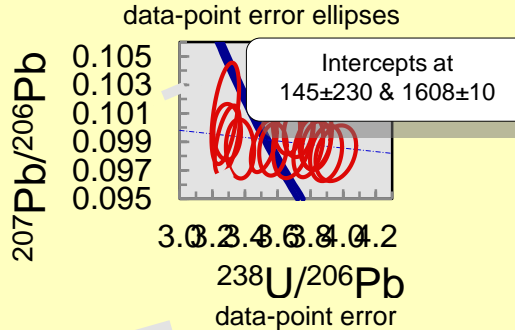
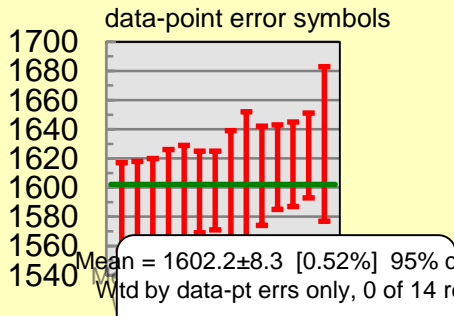
- Pegmatite associated with en-echelon quartz veins; N Pit wall
- Late tectonic pegmatite crosscutting the mylonitic foliation

Tick Hill Pit

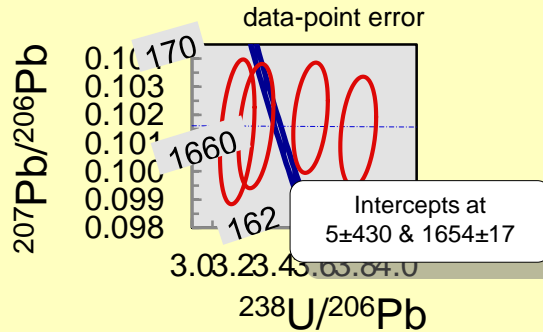
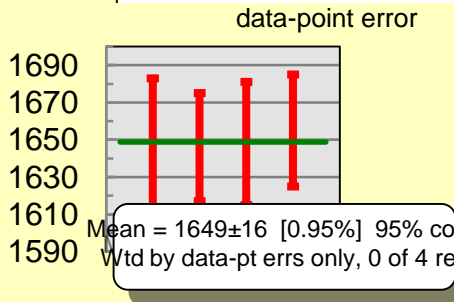
>90% concordance, older zircons, altered under CL images



1557 Ma



1602 Ma



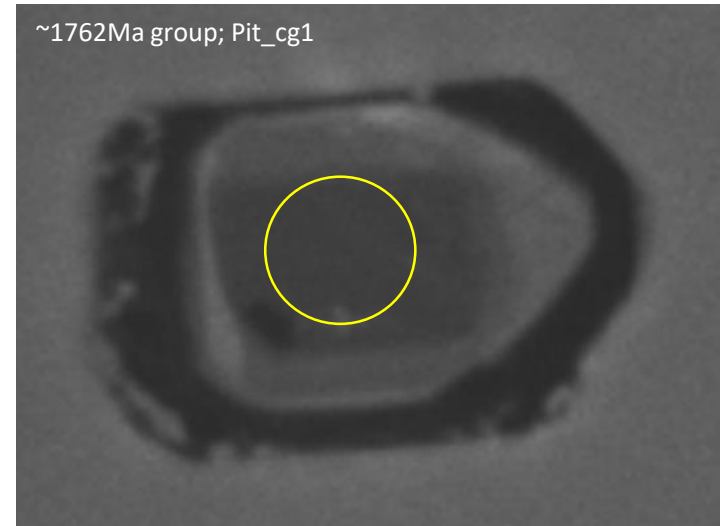
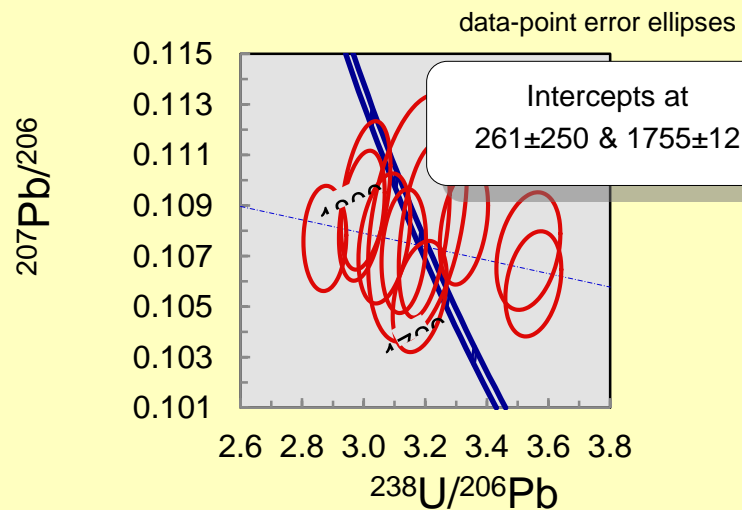
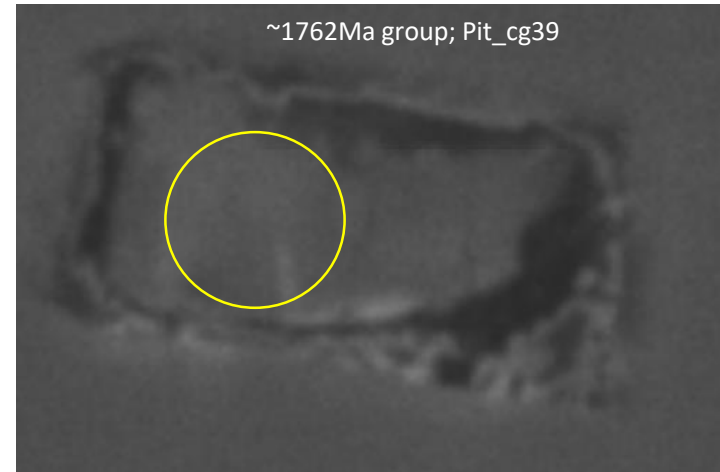
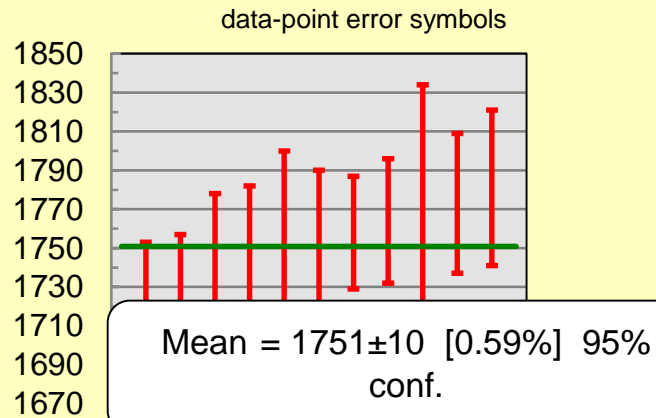
1649 Ma



- Pegmatite associated with en-echelon quartz veins; N Pit wall
- Late tectonic pegmatite crosscutting the mylonitic foliation

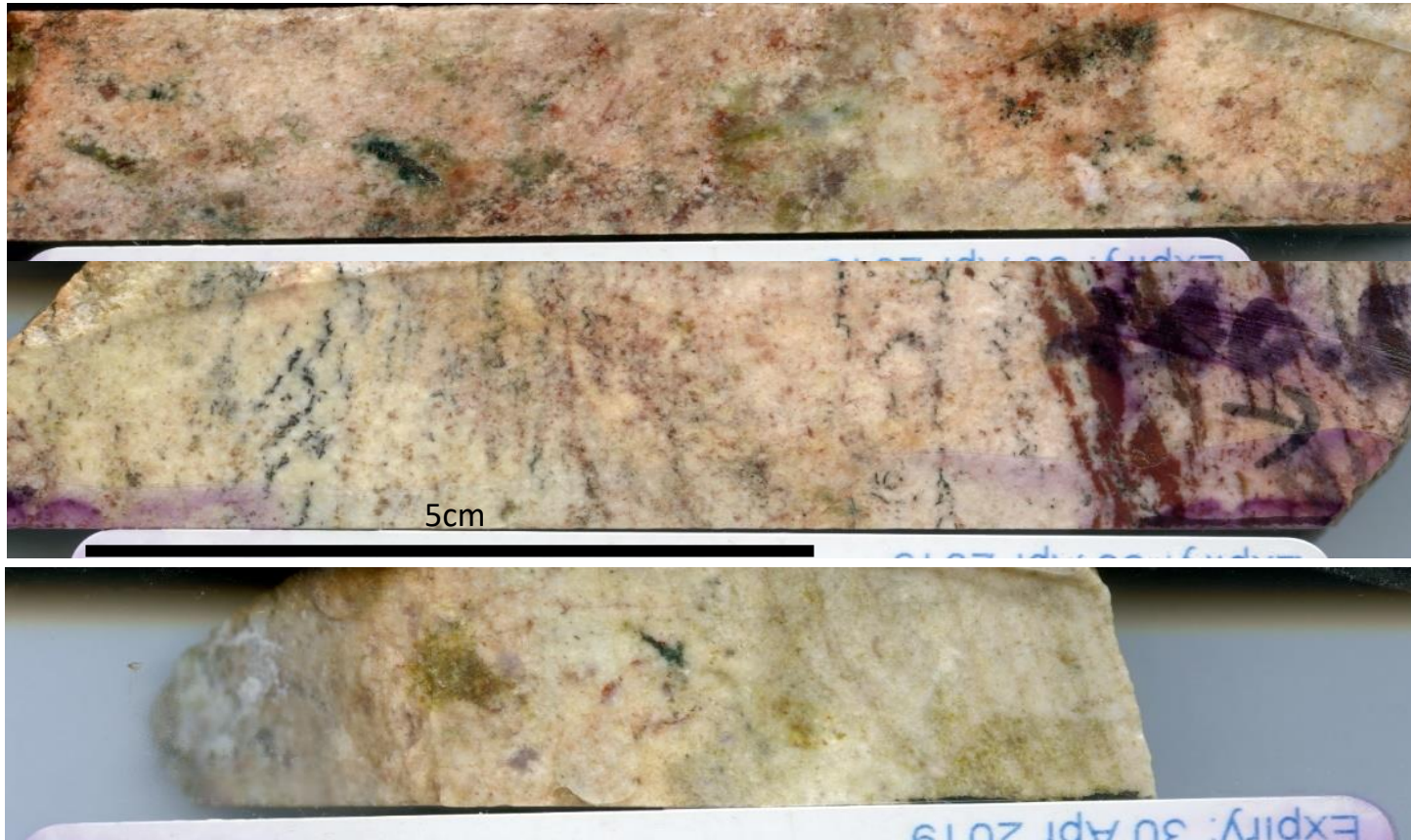
Tick Hill Pit

>90% concordance, old zircons, unaltered cores under CL images



- Pegmatite associated with en-echelon quartz veins; N Pit wall
- Late tectonic pegmatite crosscutting the mylonitic foliation

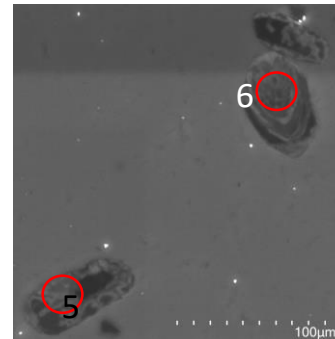
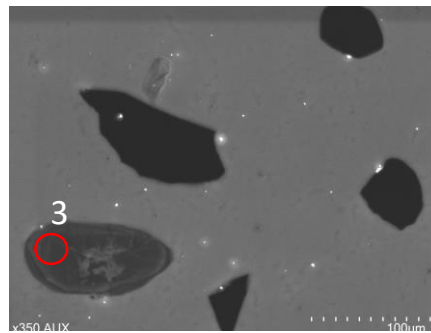
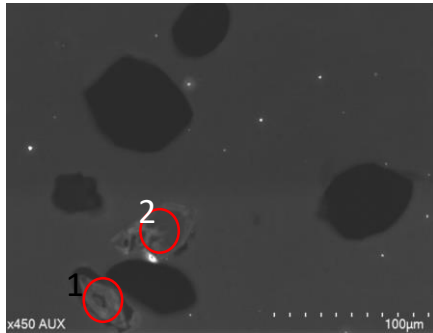
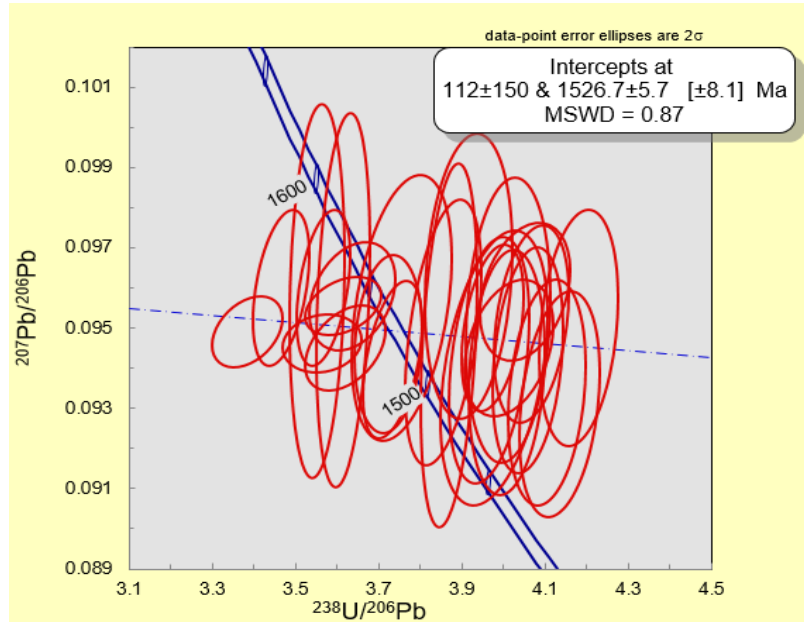
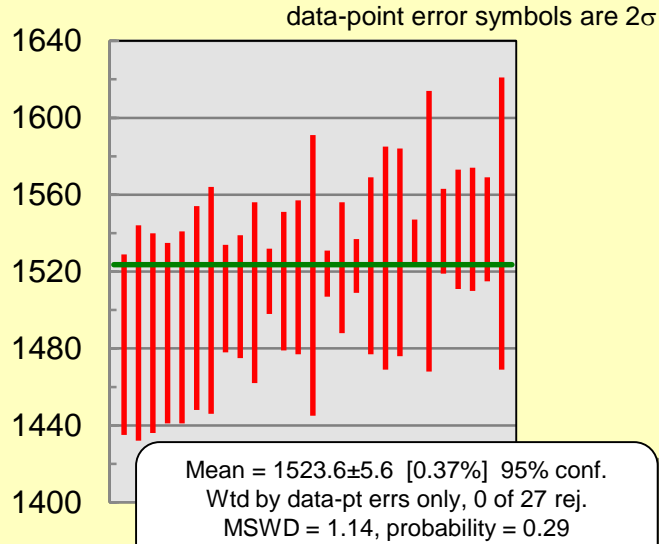
TH108



Post-tectonic pegmatite ~130m below the mineralization zone ; Drill hole
U8506-224m-236.6m-240m:
~1523 Ma

TH108

Most zircons appear altered in CL images



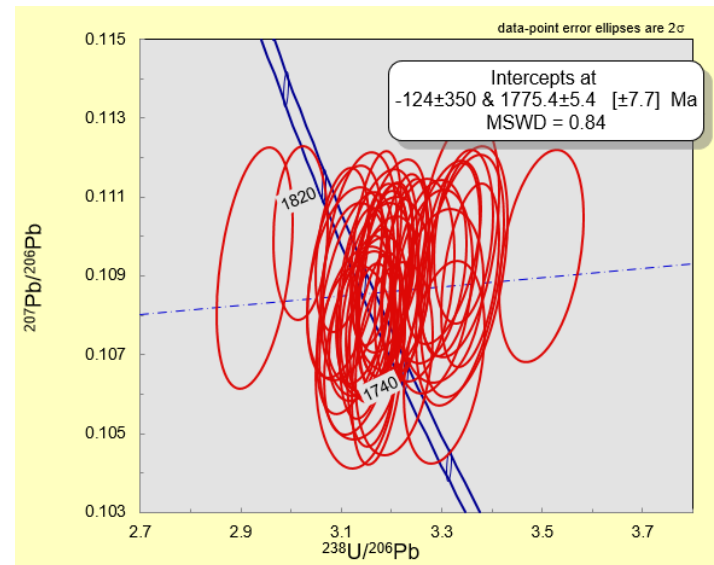
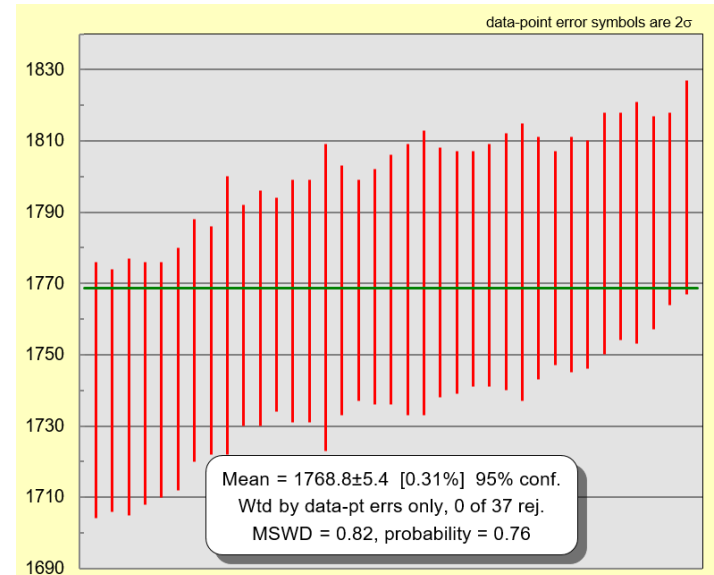
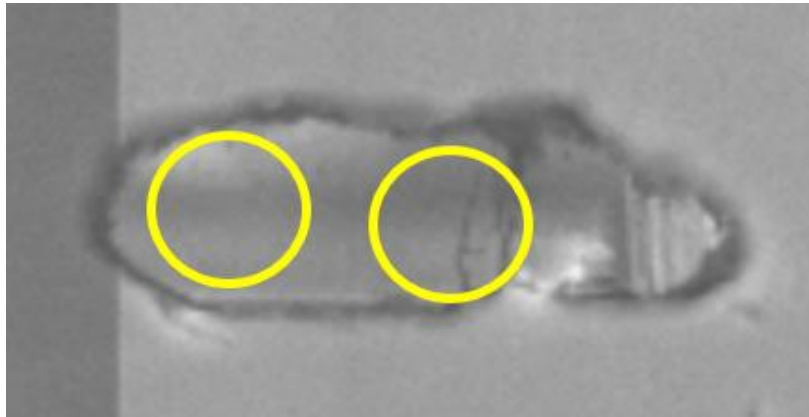
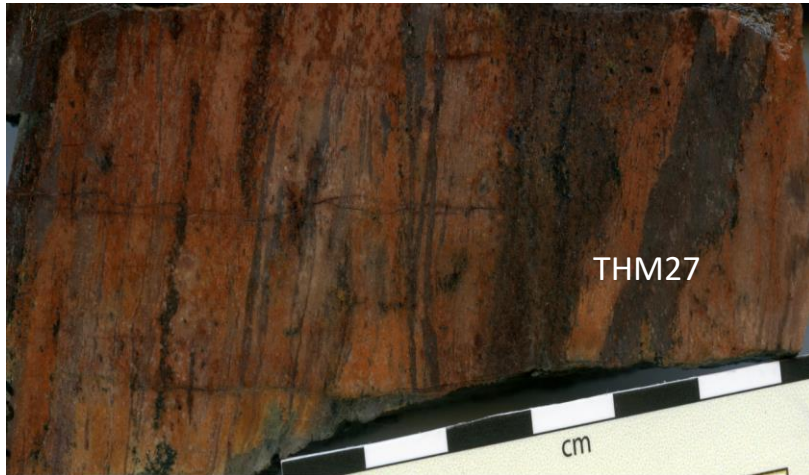
Post-tectonic pegmatite $\sim 130\text{m}$ below the mineralized zone;

Drill hole U8506-224m-236.6m-240m:

~ 1523 Ma

THM27 group

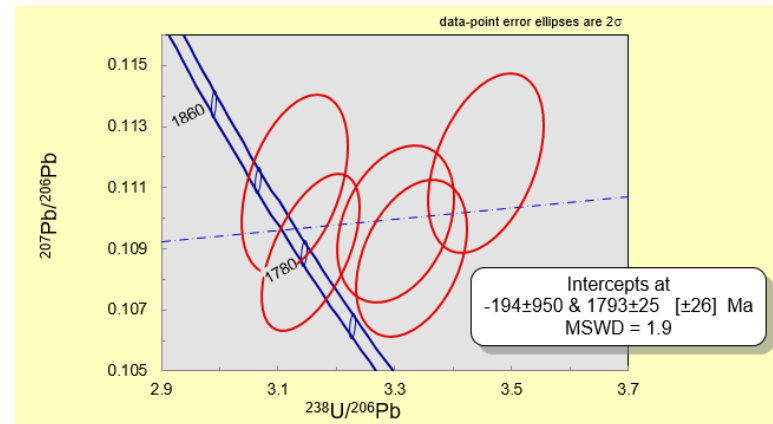
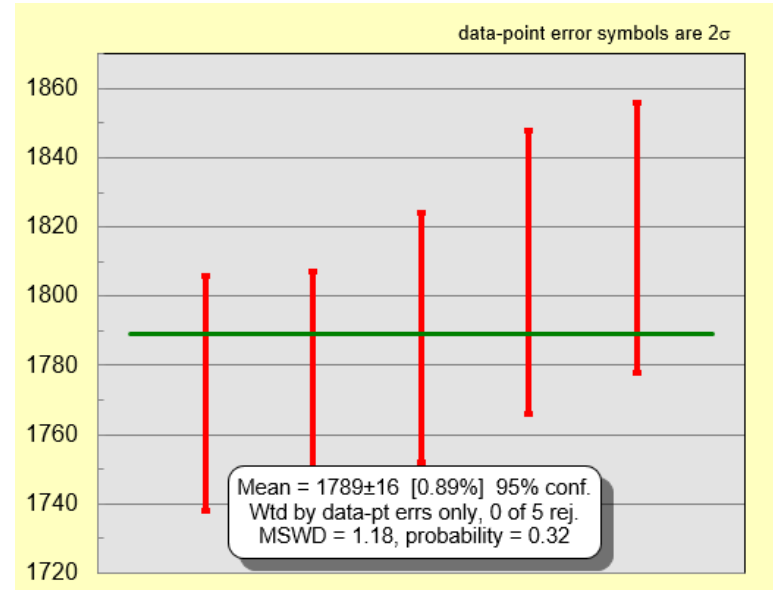
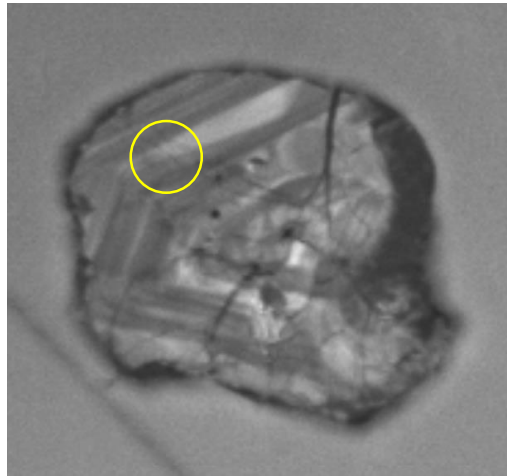
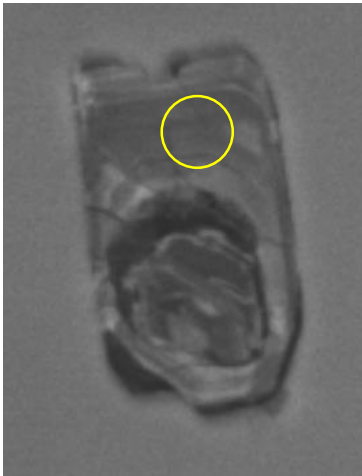
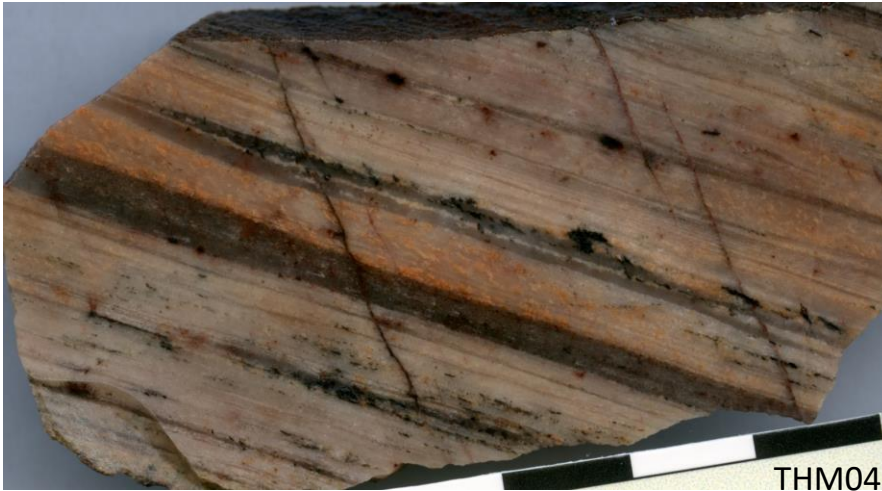
> 95% concordance, bright CL domains



Au-rich quartz-feldspar mylonite off-cuts (metasomatised?)

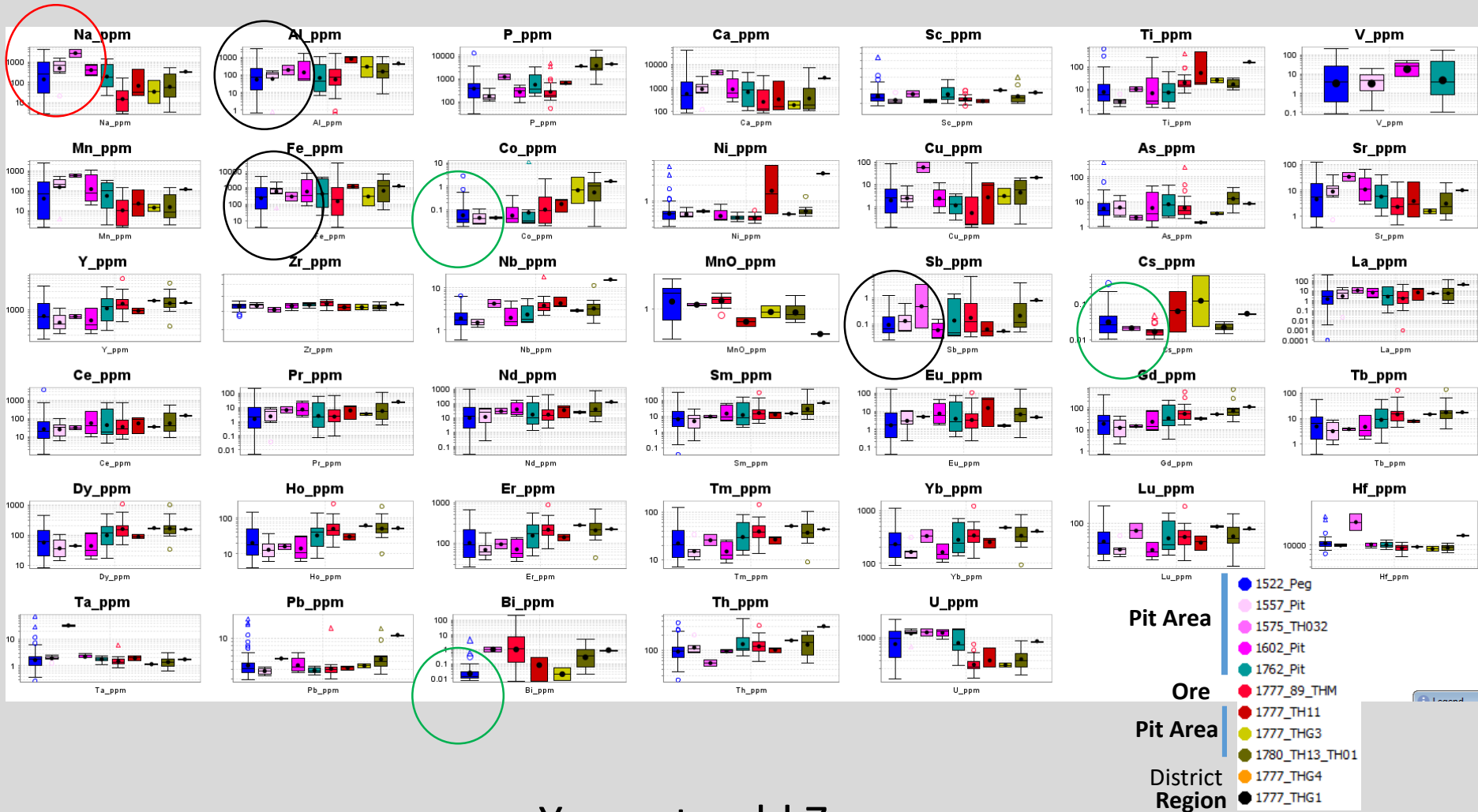
THM04 group

> 95% concordance, bright concentric CL domains



Au-rich ultra quartz-feldspar mylonite off-cuts

Zircon geochemistry changes with the age



Young to old Zr



Conclusions

- Many similarities in mineralization style with deposits in the Cloncurry area
- Deformation and plutonism in the MKB occurred during the Wonga Orogeny (pre 1700 Ma)
- There is a wide variety of intrusion types
- The mafic and felsic magmatism could be unrelated
- There is evidence of ~1530 Ma magmatic/hydrothermal activity
- There is evidence of reactivation during the Isan Orogeny
- Isan age structures could be potential targets for mineralization