



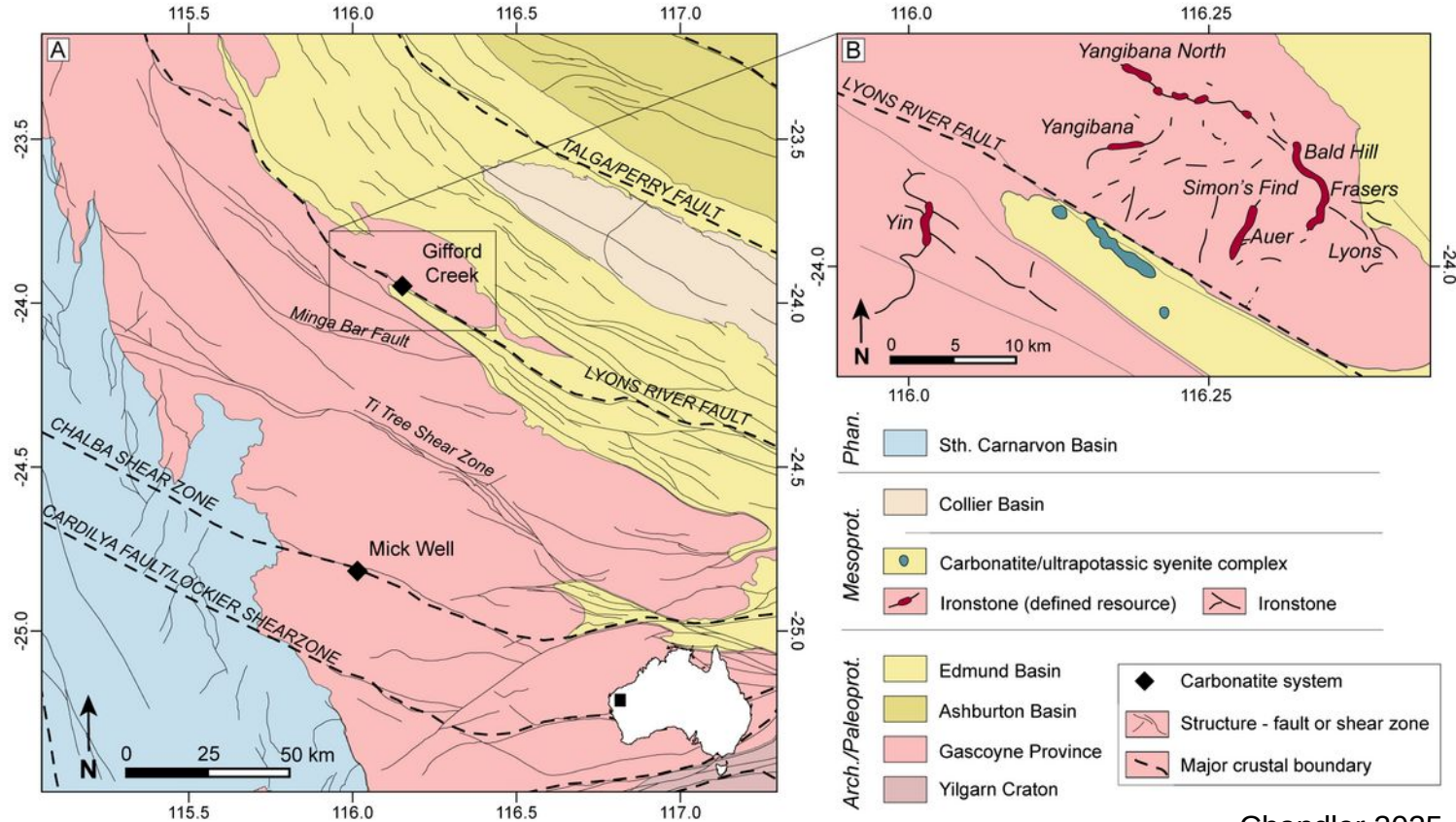
Characterising Niobium Mineralisation in the Gifford Creek Carbonatite Complex

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Background

- Nb – critical metal
- Primarily hosted in carbonatites
- Gifford Creek Carbonatite Complex - prospective REE+Nb deposit
- Divided into the central carbonatite intrusion and more evolved Yin and Yangibana dykes



Chandler 2025

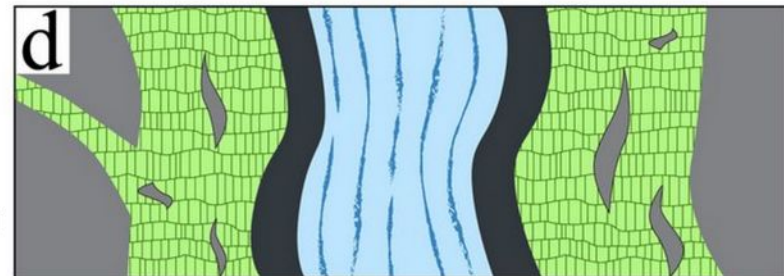
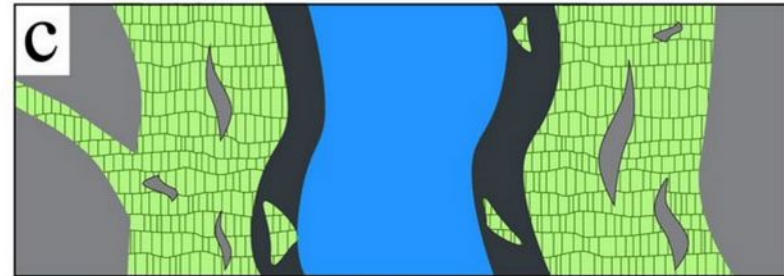
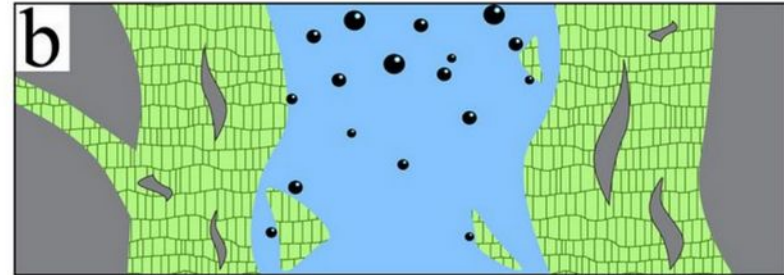
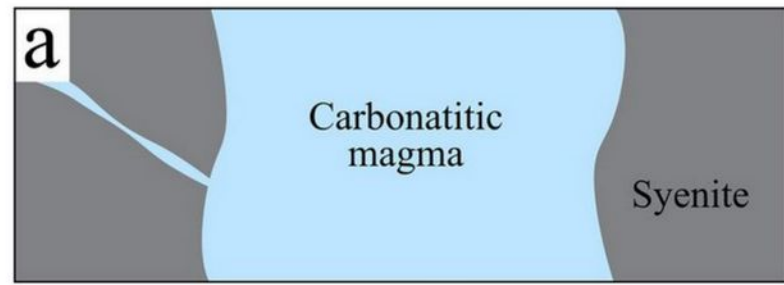
Aims and Methodology

- Research Questions
 - What are the different features of Nb minerals within the GCCC?
 - What processes drive concentration of Nb and how does this differ within the complex?
 - What is the age of primary Nb mineralisation?

Analytical Methods: reflected and transmitted light microscopy, SEM, EPMA, LA-ICP-MS, SHRIMP

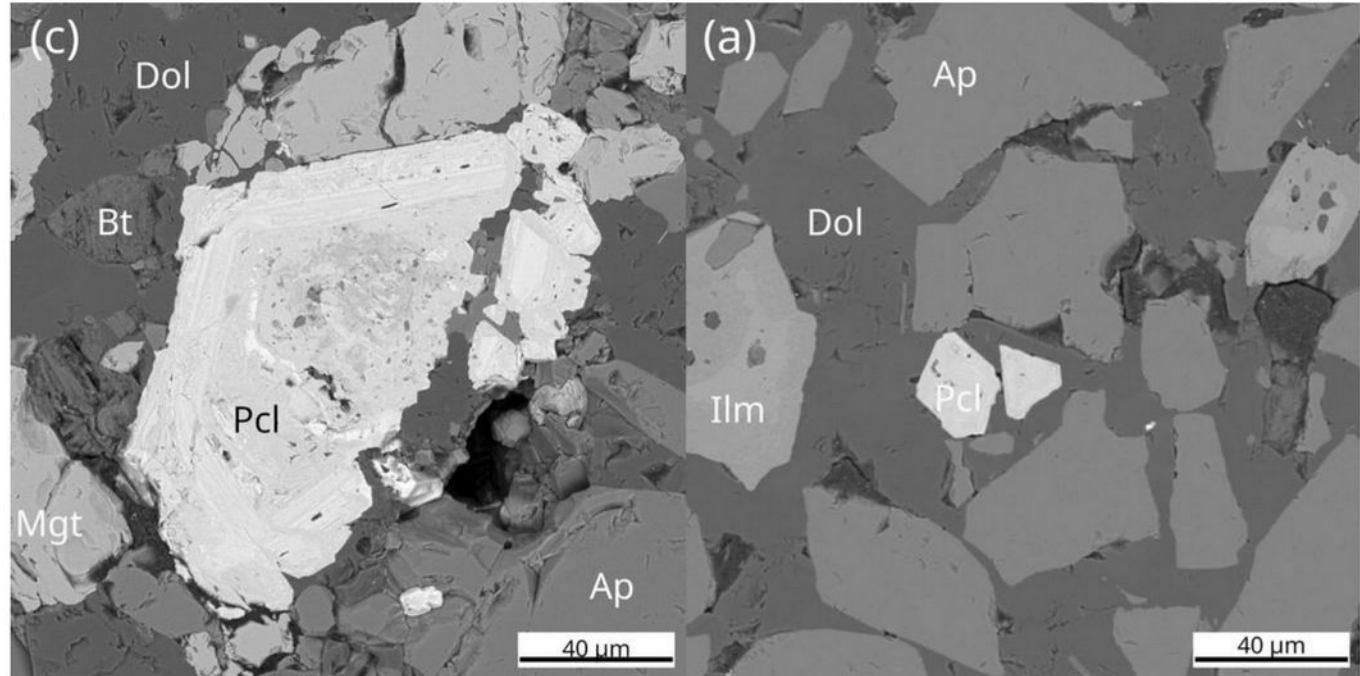
Pyrochlore

- $A_2B_2O_6X$
- Often euhedral with oscillatory to patchy zonation
- Found with apatite, biotite and magnetite
- Various models of ore formation
- Mechanical transport – driven by fluid flow and complex rheology
- Metasomatic alteration – reaction between carbonatite and K-feldspar



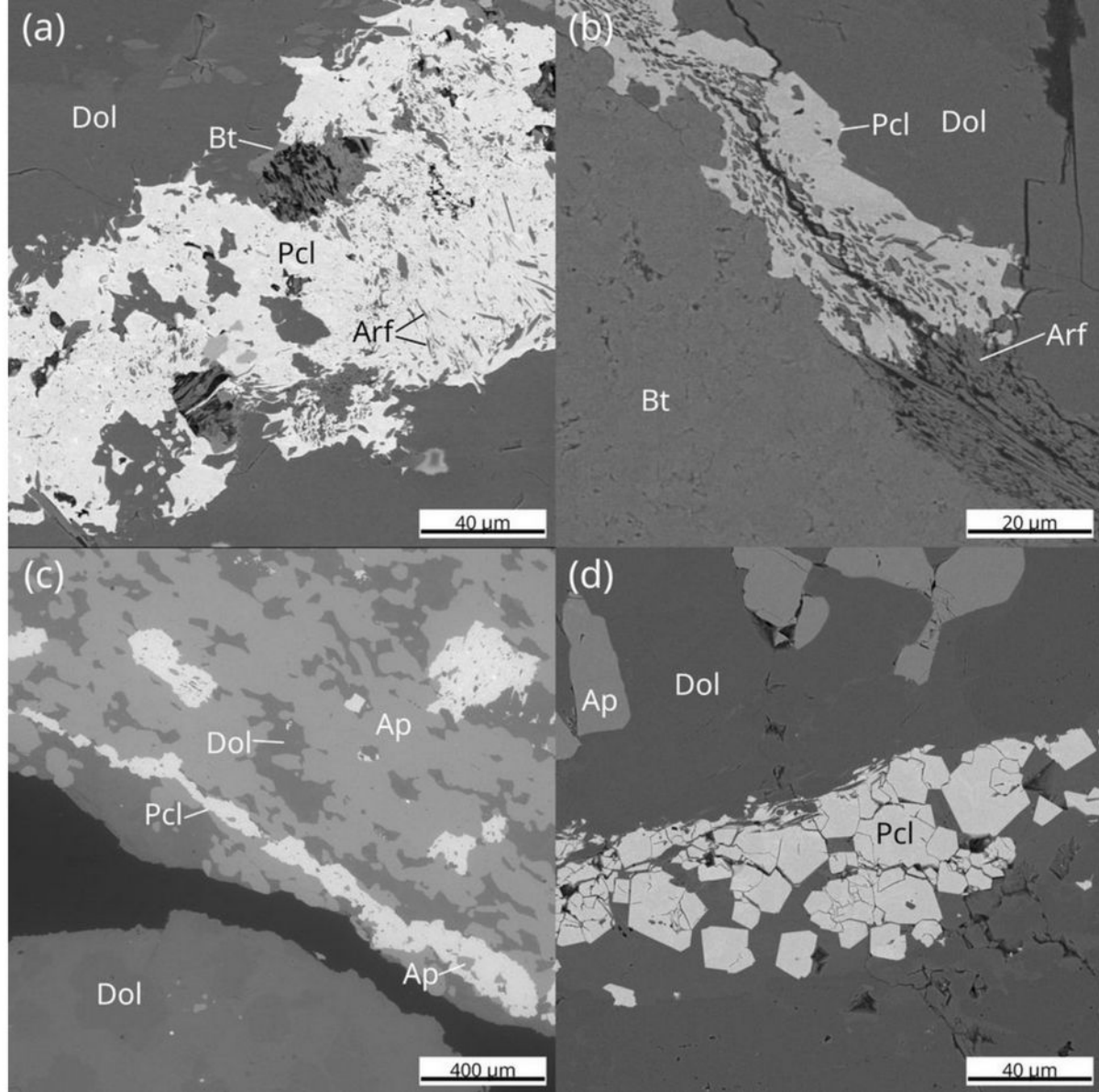
Disseminated Pyrochlore

- Euhedral, strongly zoned
- High Ta+REE
- Variable composition
- Signs of alteration – zoning, partial dissolution, inclusions
- High vacancies – indicates hydrothermal alteration of pyrochlore
- Interpreted to be primary magmatic



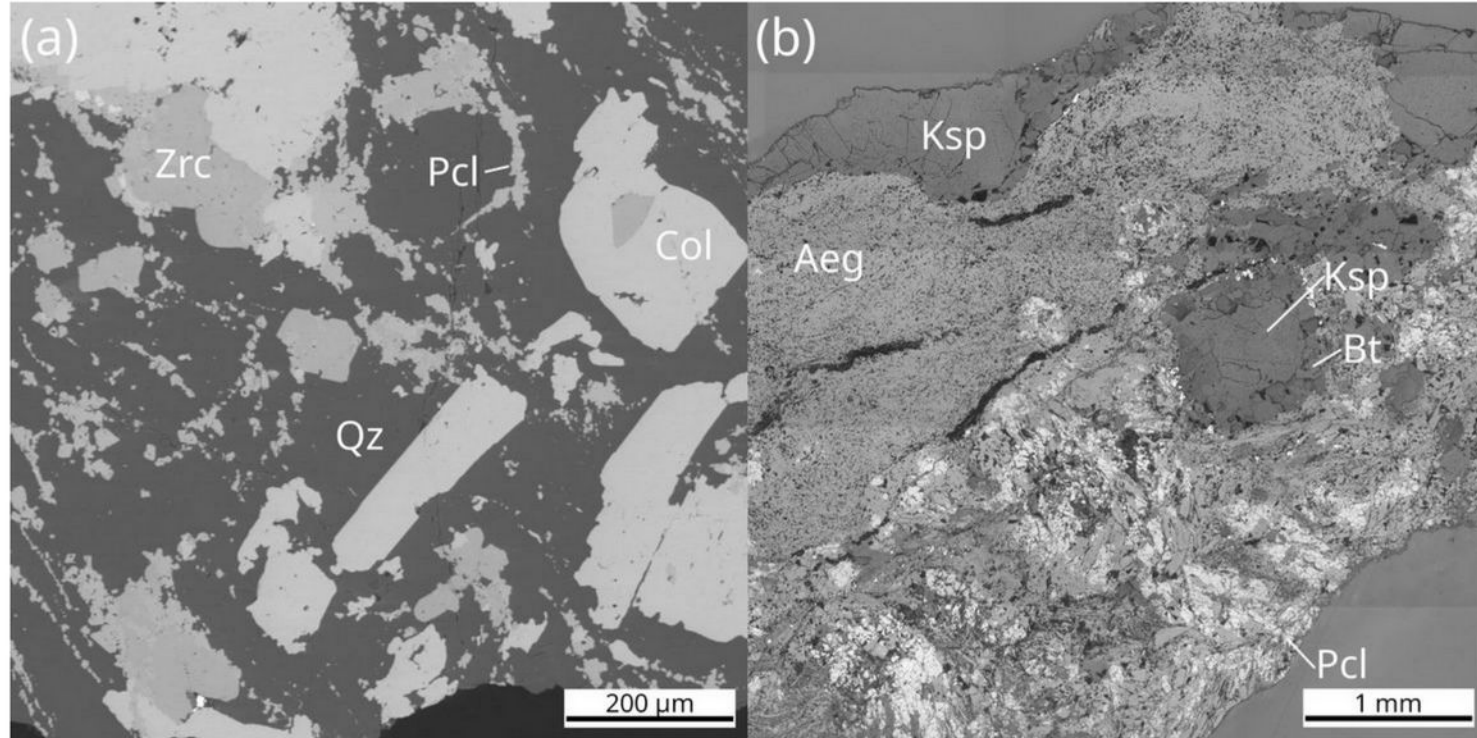
Layered Pyrochlore

- Rich in Si+K
- Anhedral to subhedral layers of pyrochlore
- Inclusions reflecting host assemblage
- Found in contact with biotite and apatite
- Interpreted to be later reworking of cumulate assemblages



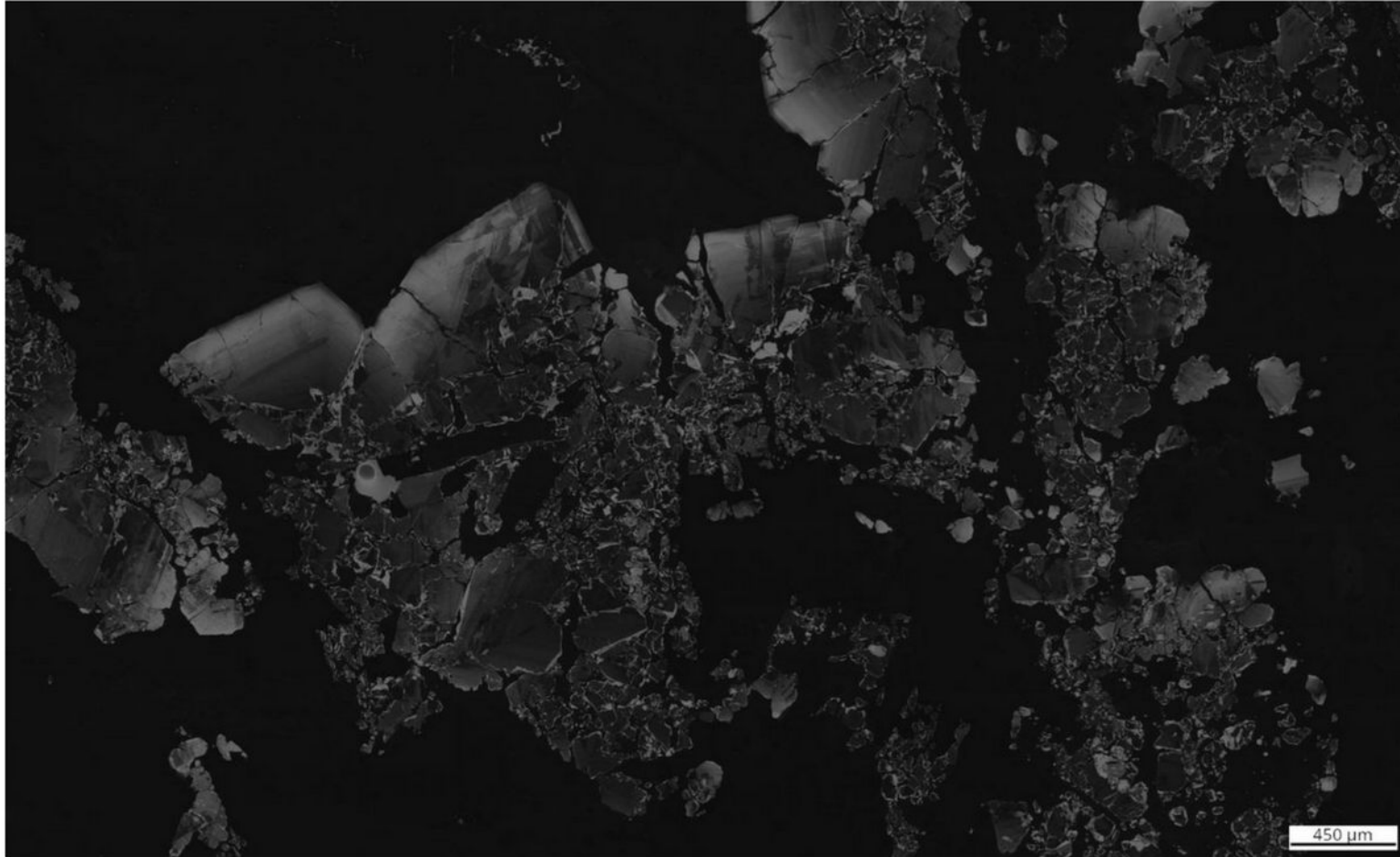
Yin Pyrochlore

- Quartz+zircon+columbite+pyrochlore
- contacts with biotite or aegirine pyroxenite
- Potentially related to metasomatic alteration
- K-feldspar partially pseudomorphed to biotite



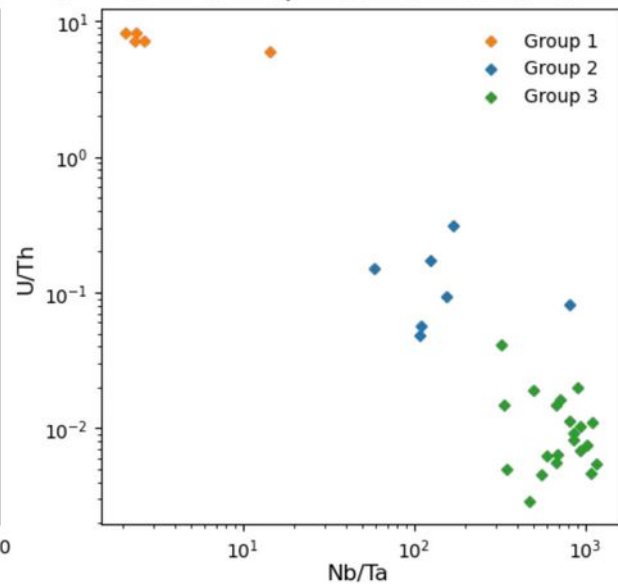
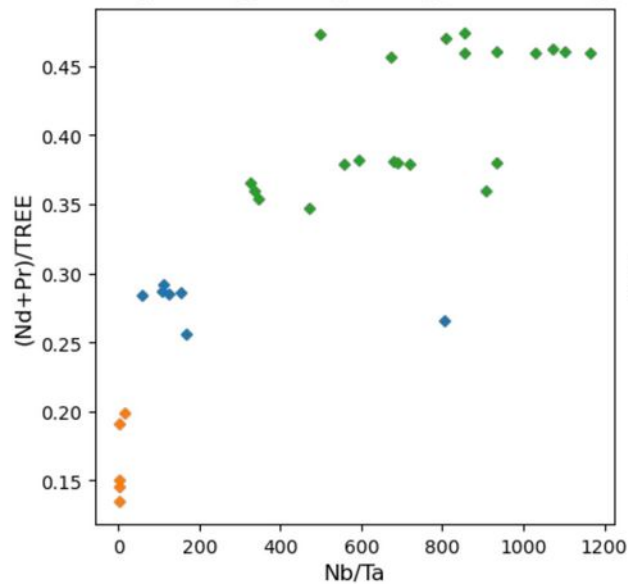
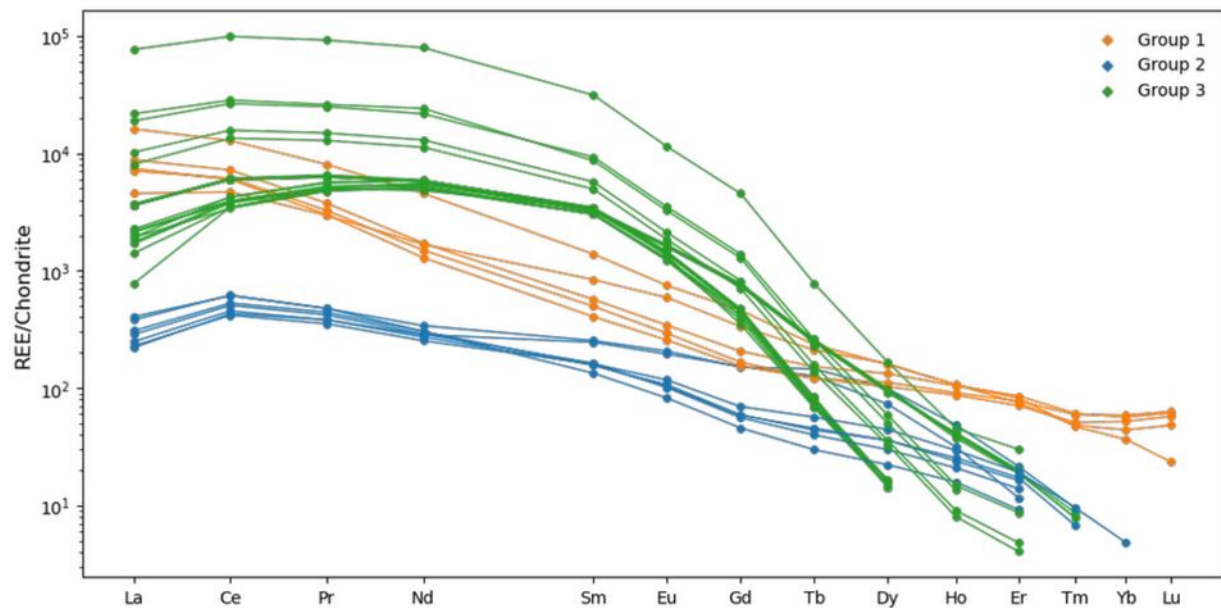
Geochronology

- U-Pb of Yin zircons
- Age of 1361 ± 11 Ma
- Consistent with previous geochronology
- Synchronous carbonatite magmatism over a 20km area
- Nb mineralisation coeval with magmatic activity



Trace Elements

- Central Carbonatite – flat REE patterns
- Yin – Curved REE patterns with high Nd and Pr
- Matches bulk rock trends
- Increasing Nb/Ta, NdPr:TREE, decreasing U/Th
- Suggests increasing degree of fractionation



Conclusions - Genetic Model

1. Initial intrusion of low Nb/Ta magma (Central Intrusion)
 - Early stage Ta-rich pyrochlore crystallisation (Group 1)
2. Subsequent magma intrusions into central carbonatite lead to metasomatism
 - Si-K rich pyrochlore crystallisation (Group 2)
3. Continued pulses of carbonatite magmatism lead to reworking of initial textures
4. Late stage highly evolved dykes radiate from central intrusion to form Yin and Yangibana
 - country rock metasomatism forms columbite and group 3 pyrochlore at 1361 ± 11 Ma

