Overview of Paleozoic–Mesozoic plutonism and related mineralisation, Aotearoa New Zealand

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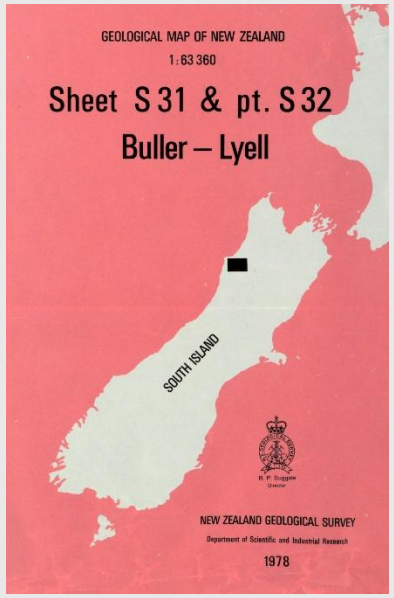
Mark Rattenbury, Kevin Faure, Matt Hill
Geologists, ESNZ

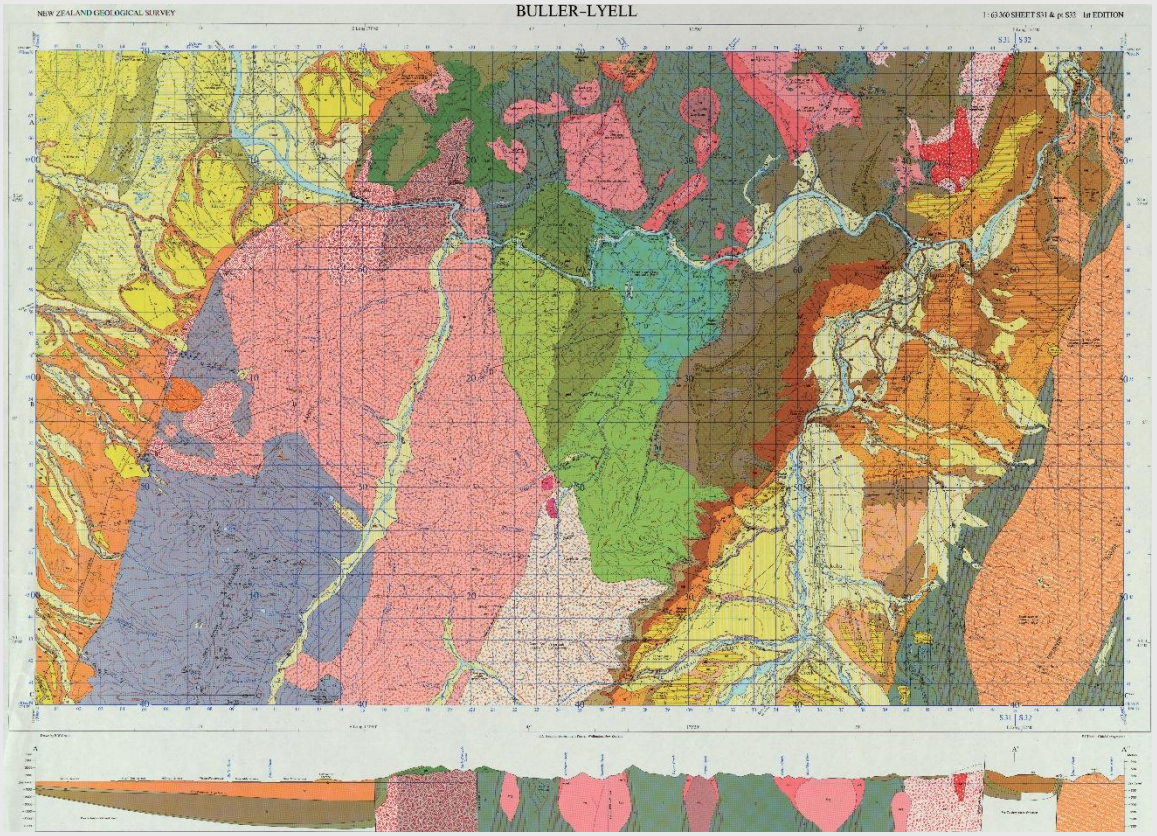


1. Acknowledgements
2. Where are the plutons?
3. Paleozoic–Mesozoic plutonism
4. Intrusion-related mineral occurrences

Acknowledgements

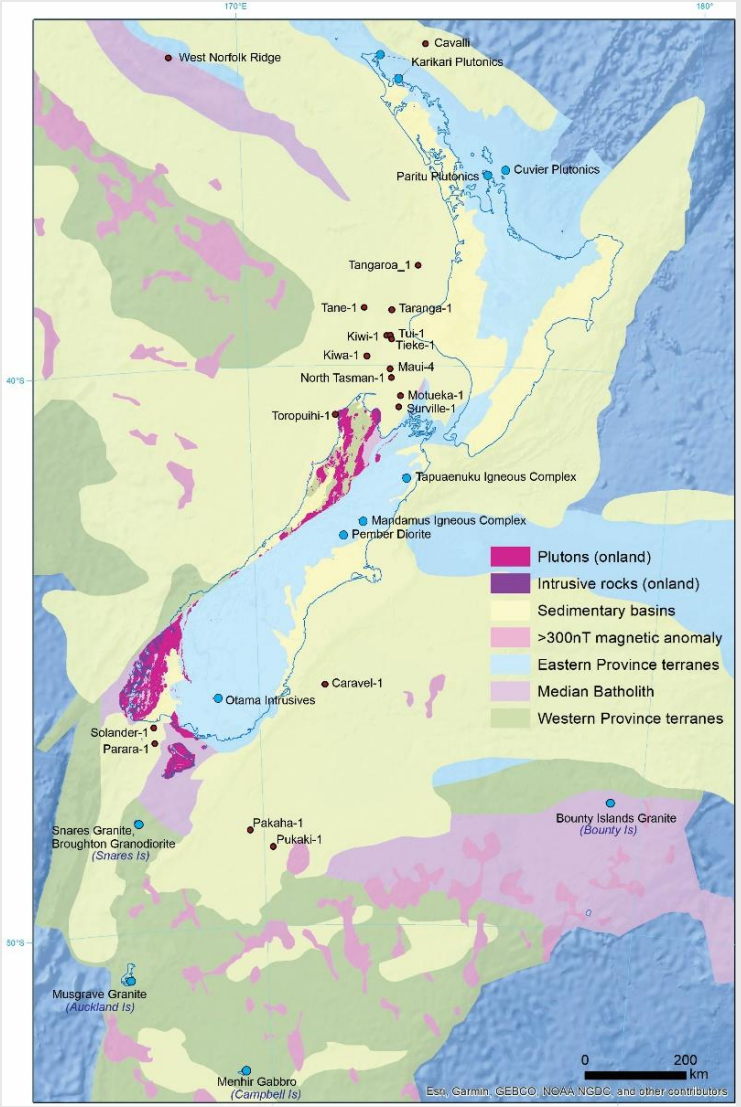
- >40 years of research
- Andy Tulloch
- Rose Turnbull
- Andrew Allibone
- Mo Turnbull
- Simon Nathan
- Richard Jongens
- George Grindley
- Nick Mortimer
- 1970s–2010s OU, UC and VUW students and post-docs
- Technicians

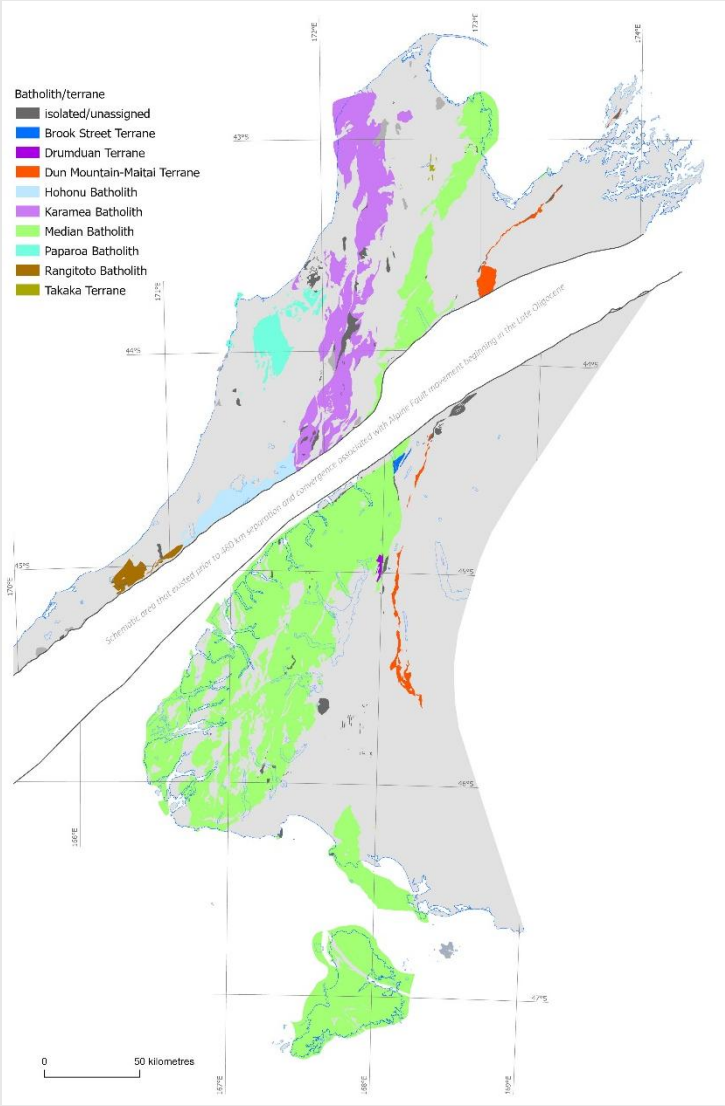




Where are the plutons?

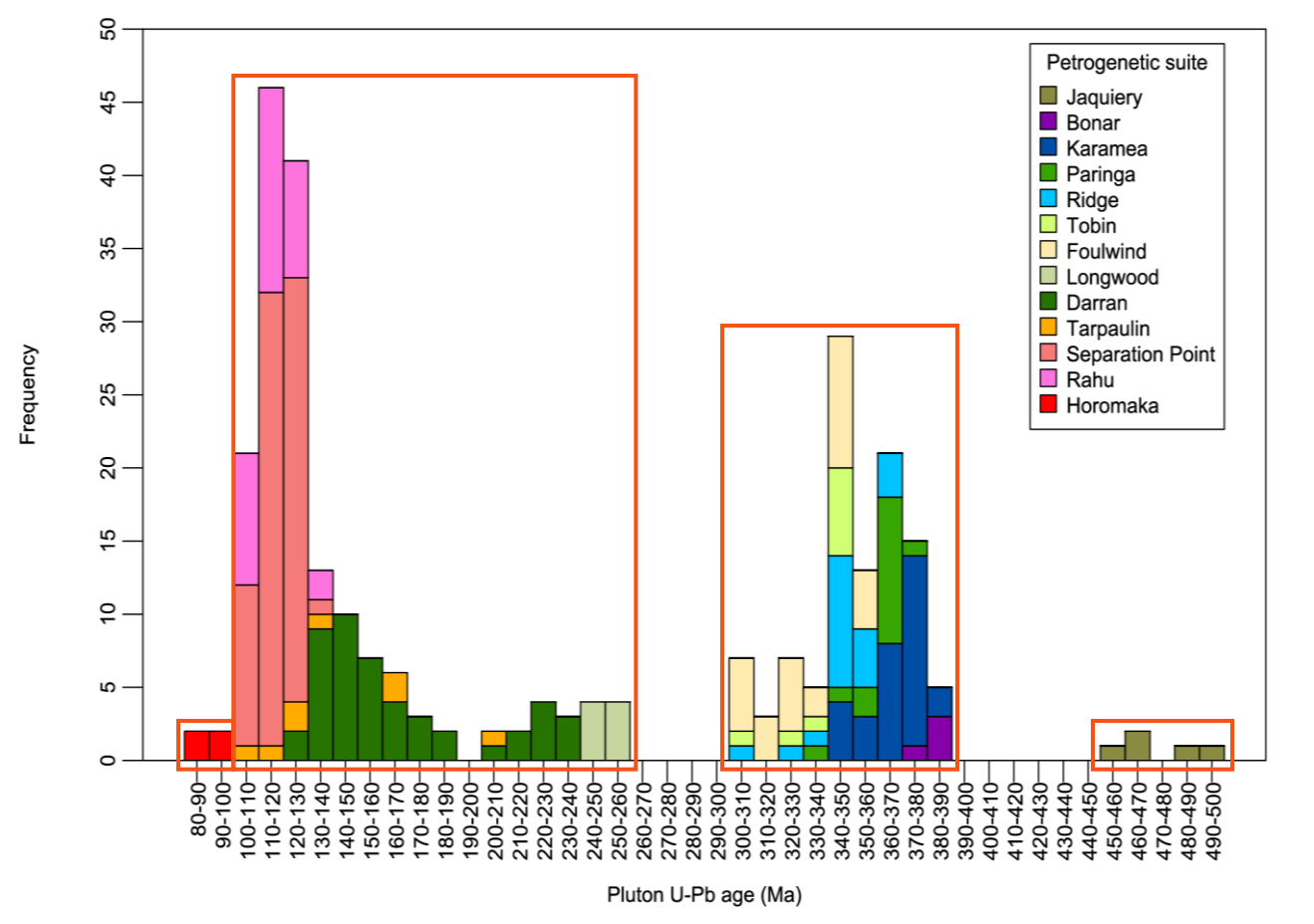
- South Island
  - Tasman/Nelson
  - West Coast
  - Fiordland
  - Southland
  - Stewart Island
  - Five batholiths
- Adjacent offshore areas
- North Island plutons





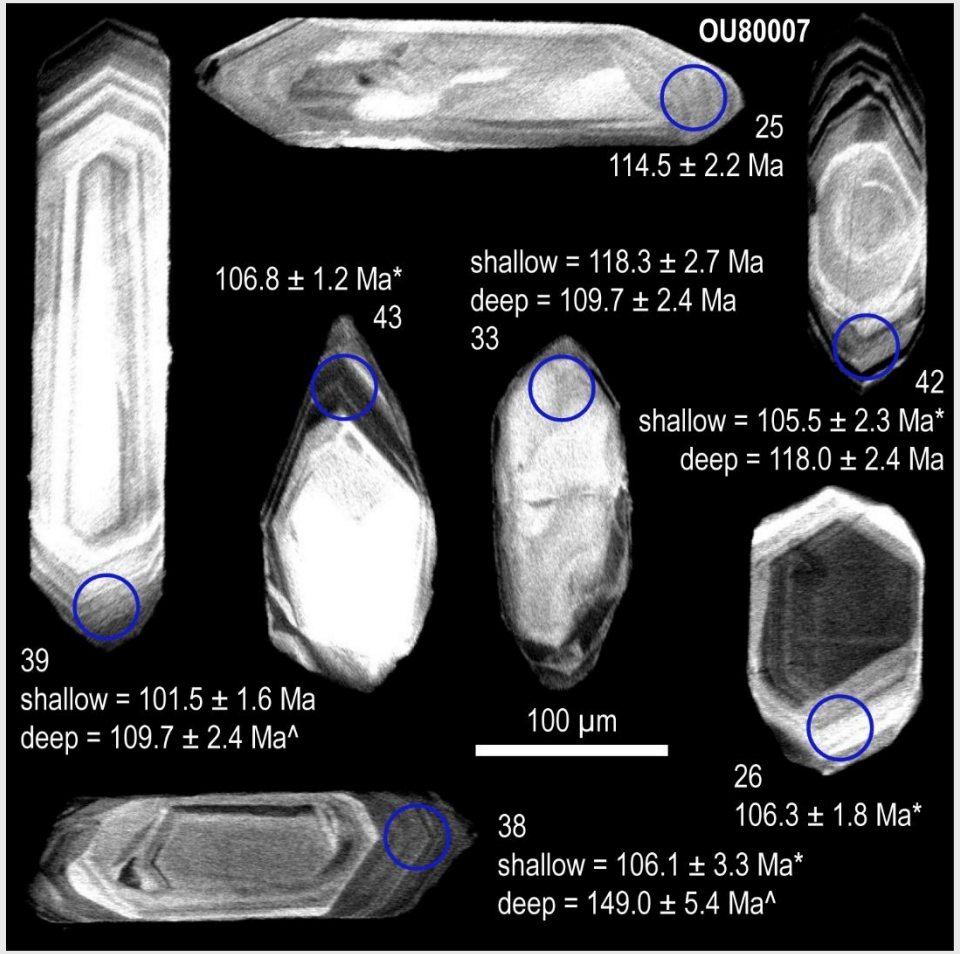
Paleozoic–Mesozoic plutonism

- Three main episodes:
  1. Early Paleozoic (~500–450 Ma)
  2. Mid-Paleozoic (~385–305 Ma)
  3. Late Permian–Early Cretaceous (~260–100 Ma)
- Collectively: *Tuhua Intrusives*



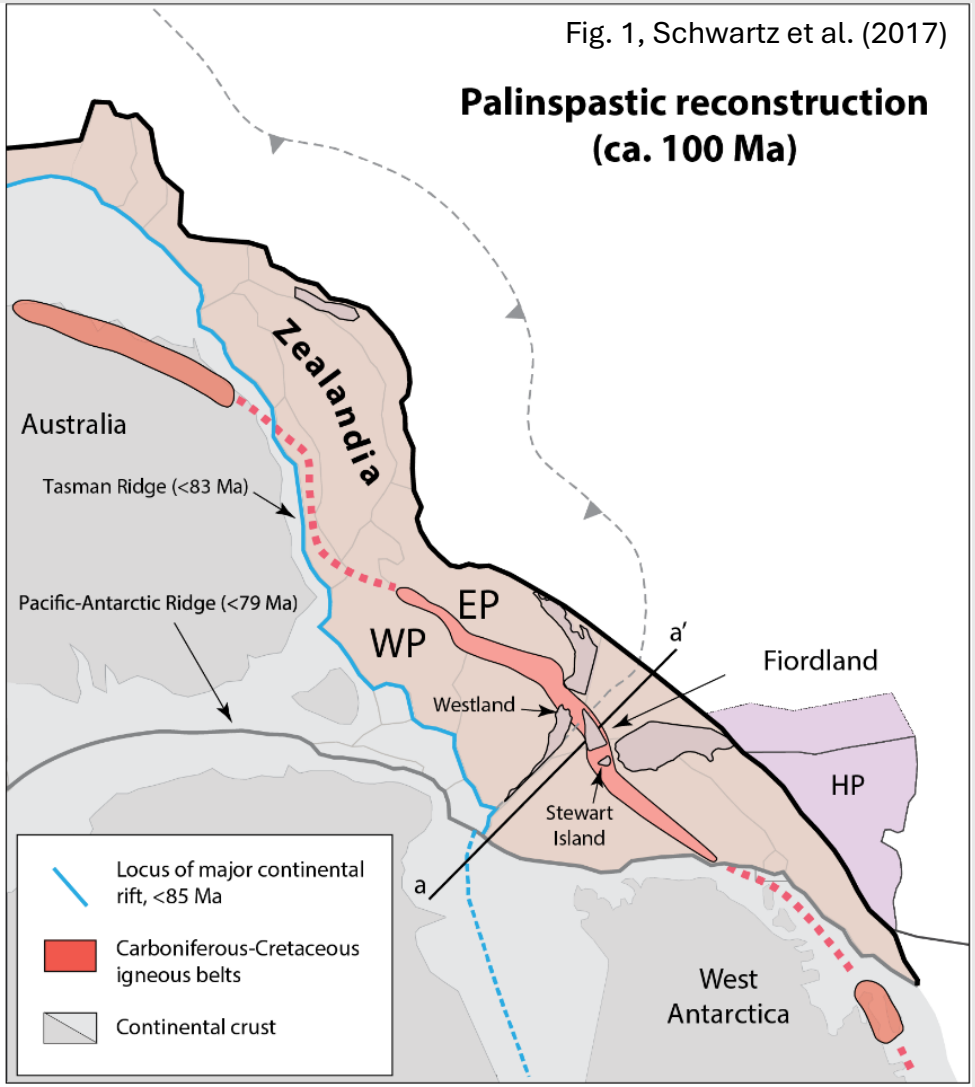
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- How do we know?
  - Radiometric dating: U–Pb geochronology



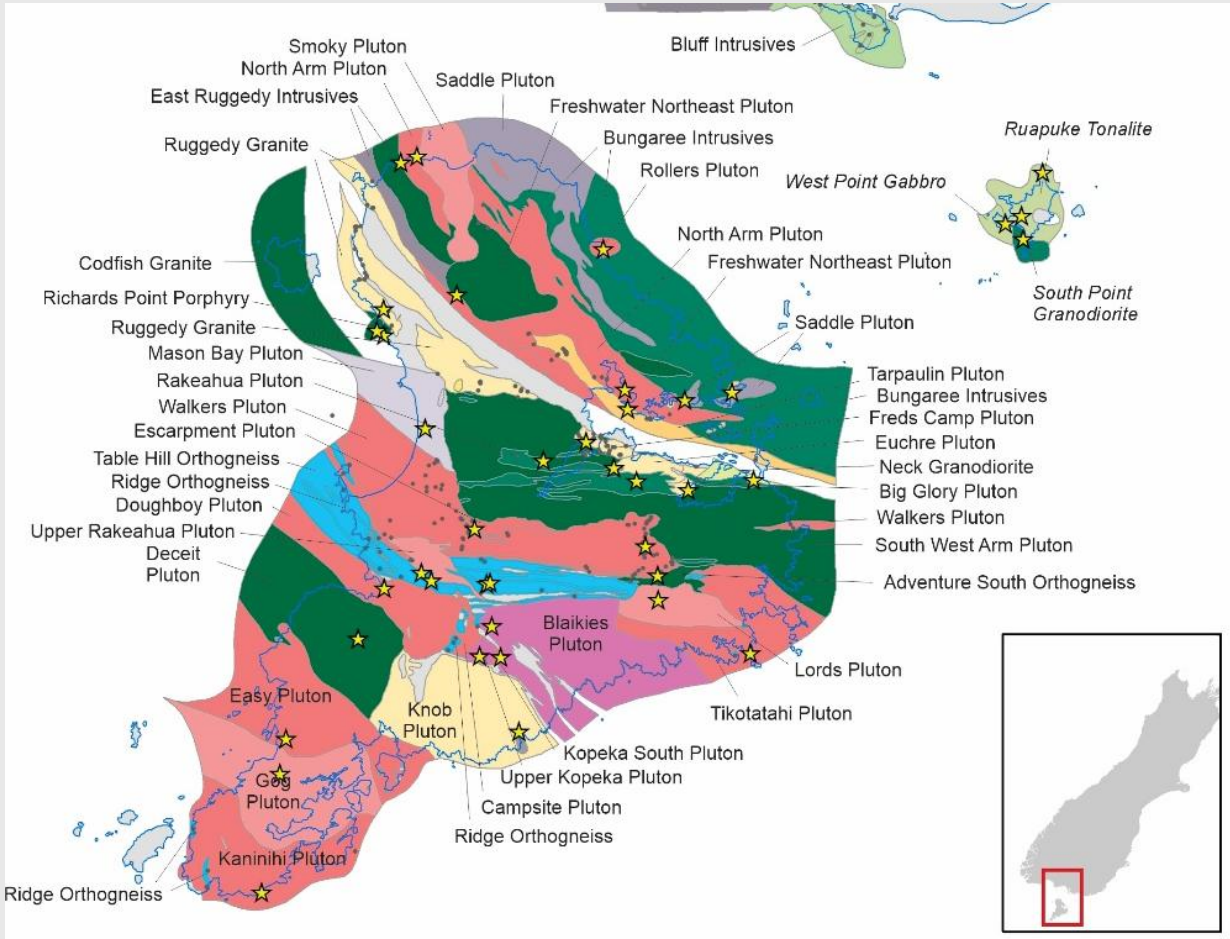
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- Eastern Gondwana margin arc
- Plutonism waned post-110 Ma
- Subduction ceased ~105 Ma
- Intra-plate plutonism ~102–84 Ma



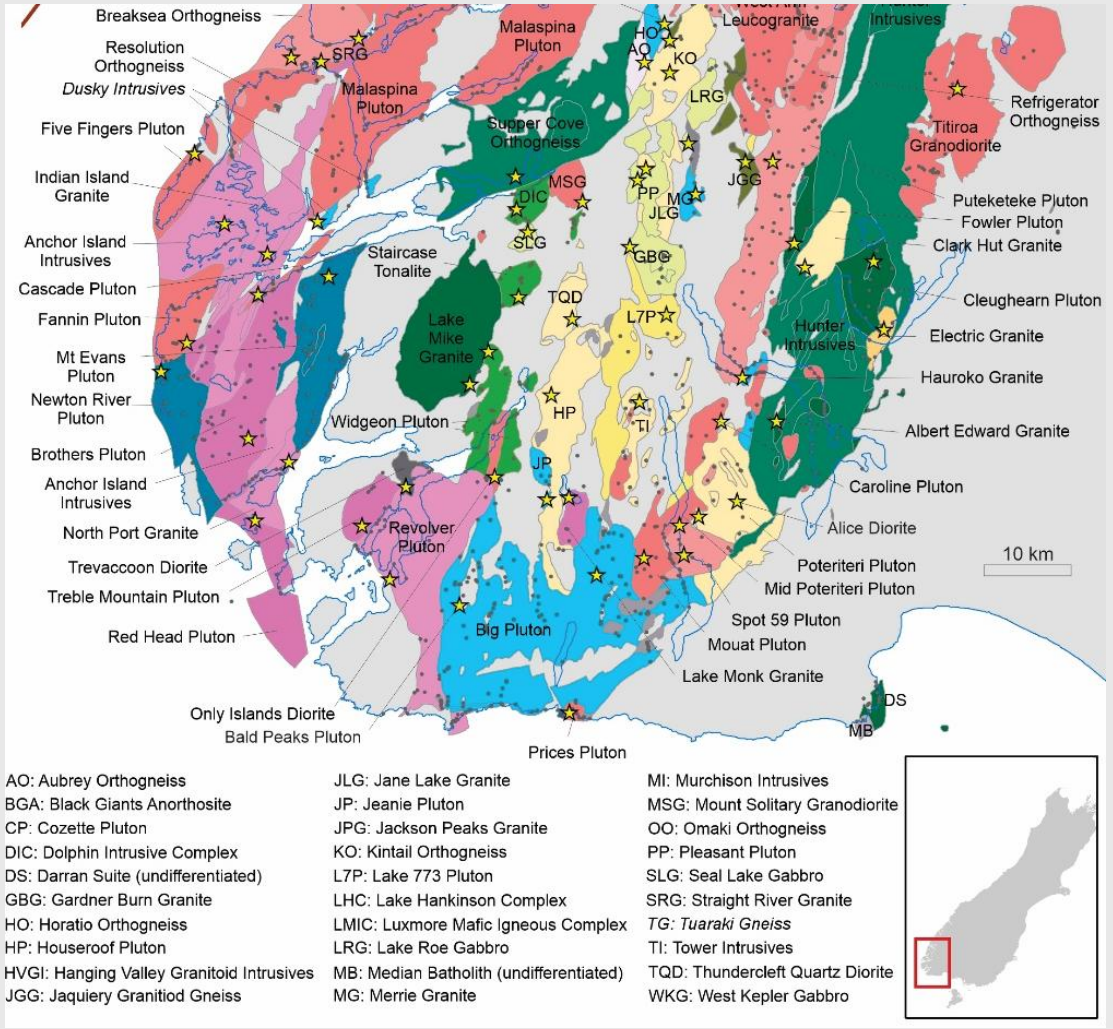
Paleozoic–Mesozoic plutonism

- Subdivided into suites
- n = 13
- Mineralogy (e.g. muscovite)
- Geochemistry (e.g. ASI, Rb/Sr)
- Age (>300 vs <300 Ma)
- S–I –A-type classification (Chappell and White et al.)
- ***Framework for understanding mineralisation***



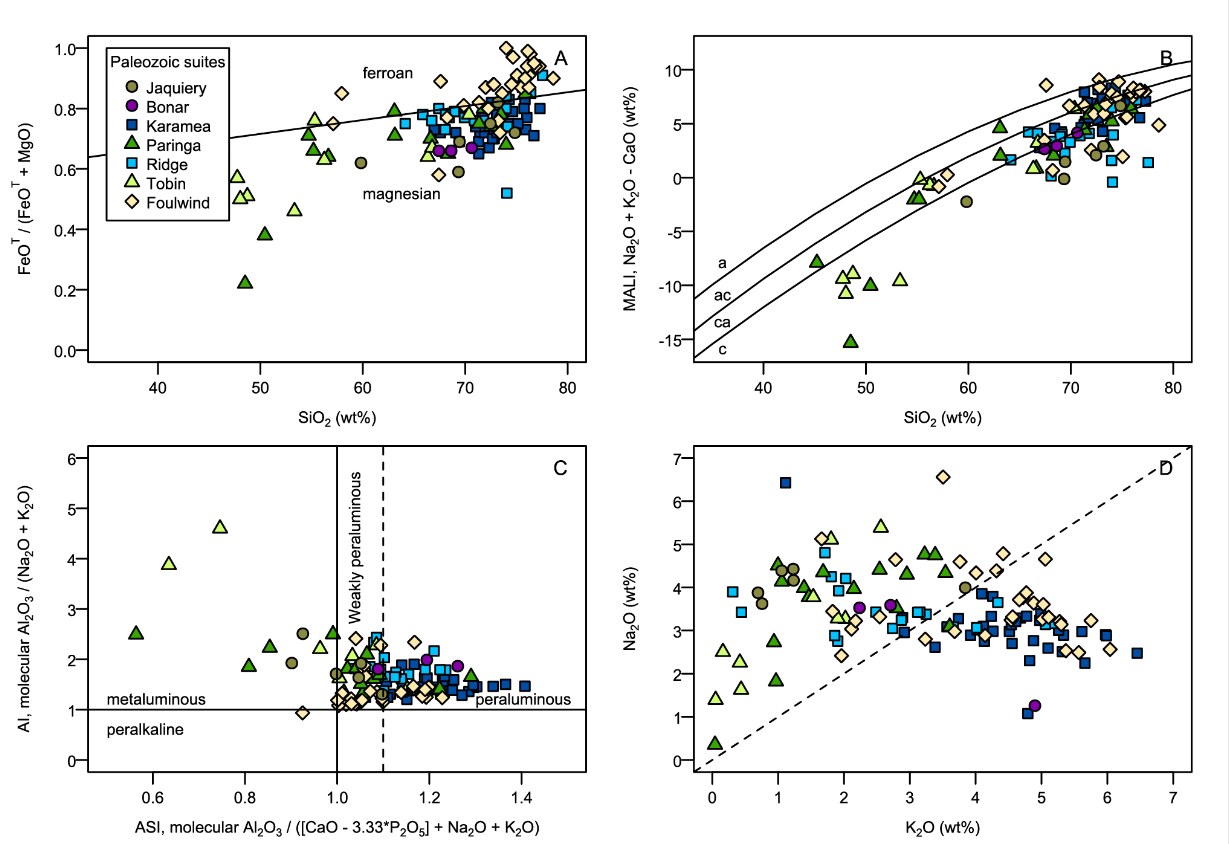
Paleozoic suites (n = 7)

- 1–2:
  - I- and S-types
  - Cambrian–Middle Devonian (~500–380 Ma)
  - Subduction-related
- 3–7:
  - Felsic S-types (e.g. Karamea)
  - Mafic–felsic I-types (e.g. Paringa)
  - Aluminous A-types (Foulwind)
  - Late Devonian–Carboniferous (~370–300 Ma)



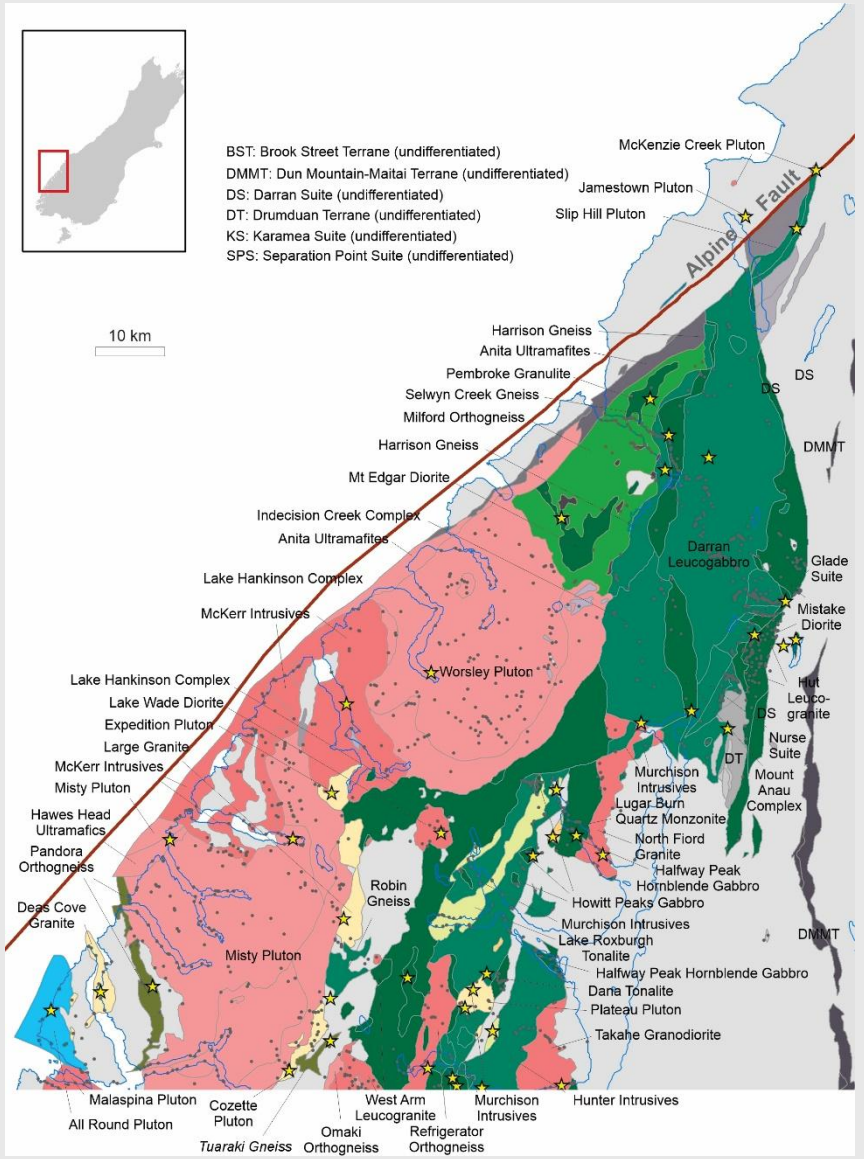
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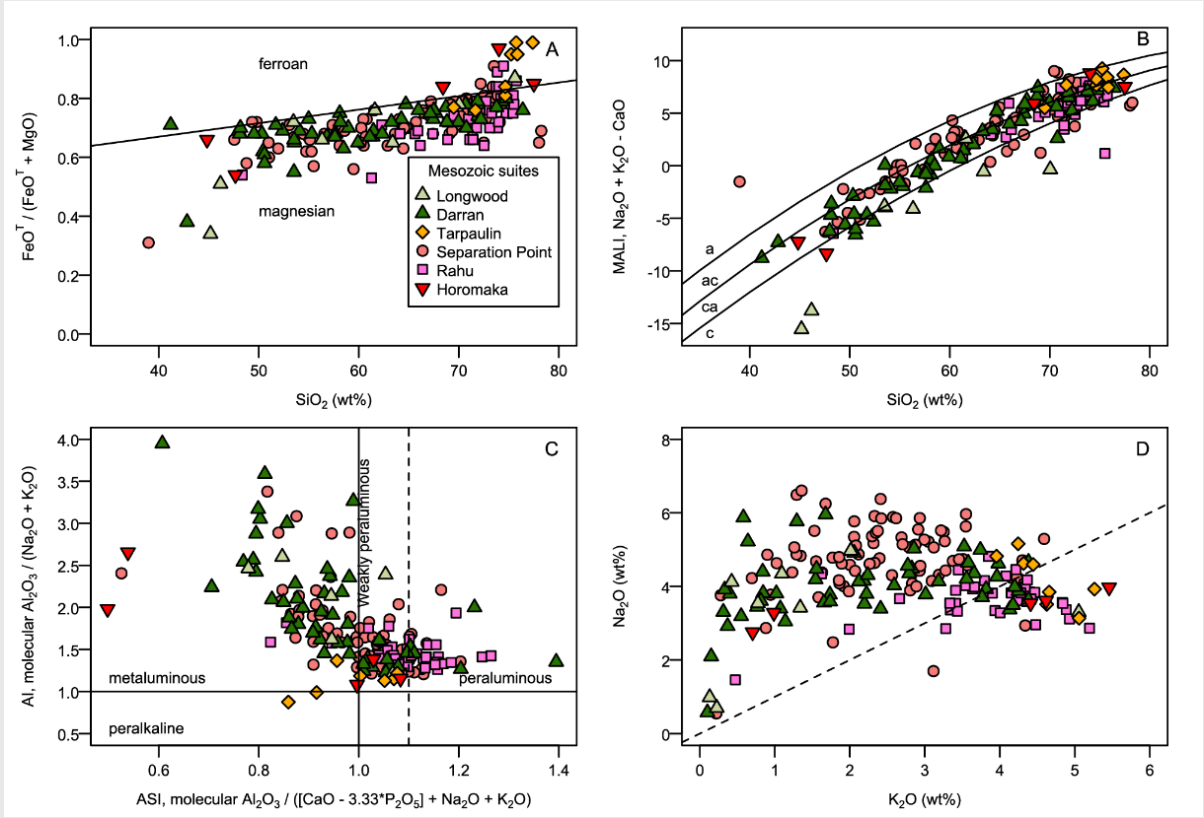
Mesozoic suites (n = 6)

- 1–5:
  - Subduction-related
  - Permian–Cretaceous (~260–100 Ma)
  - Mostly mafic–felsic I-types
  - Includes
    - high Sr/Y Separation Point Suite (red)
    - Darran Suite (green)
- 6:
  - Intra-plate
  - Oldest Horomaka Supersuite
  - Late Cretaceous (~100–84 Ma)
  - Mafic I- and felsic A-types



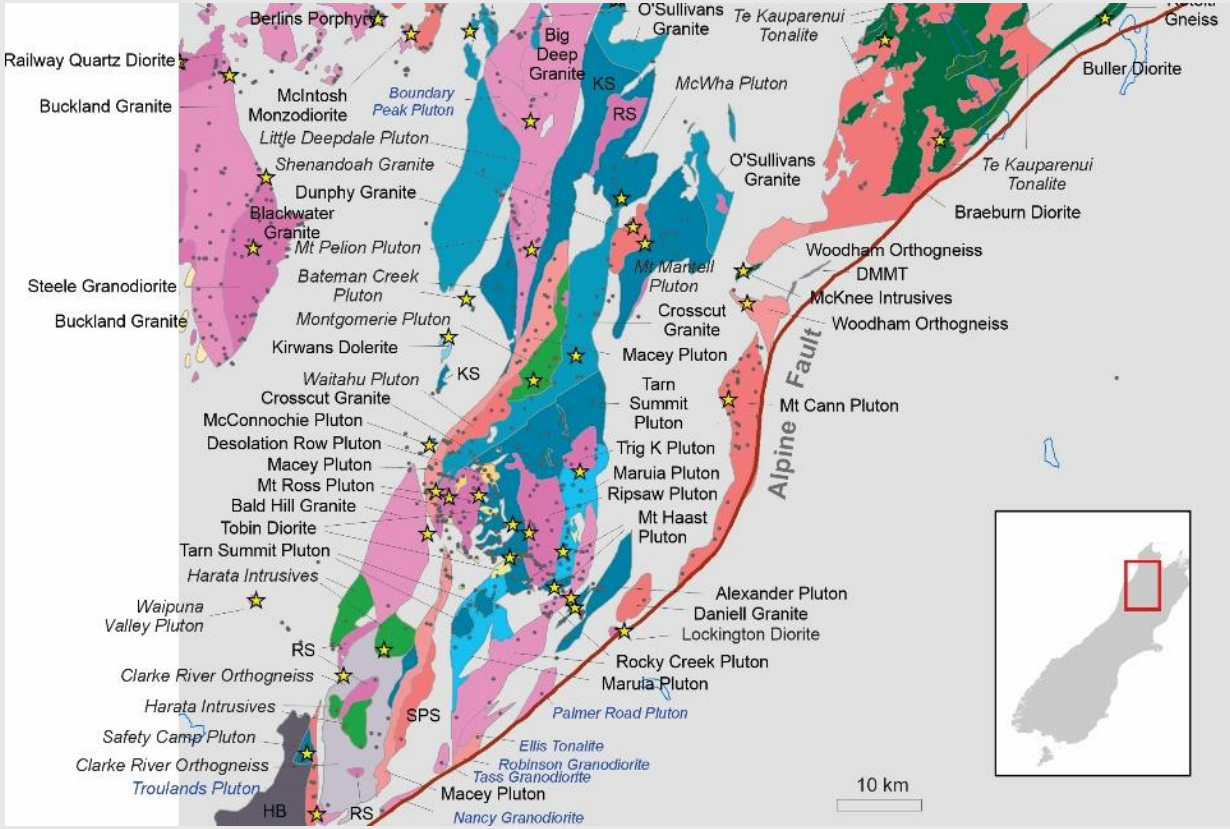
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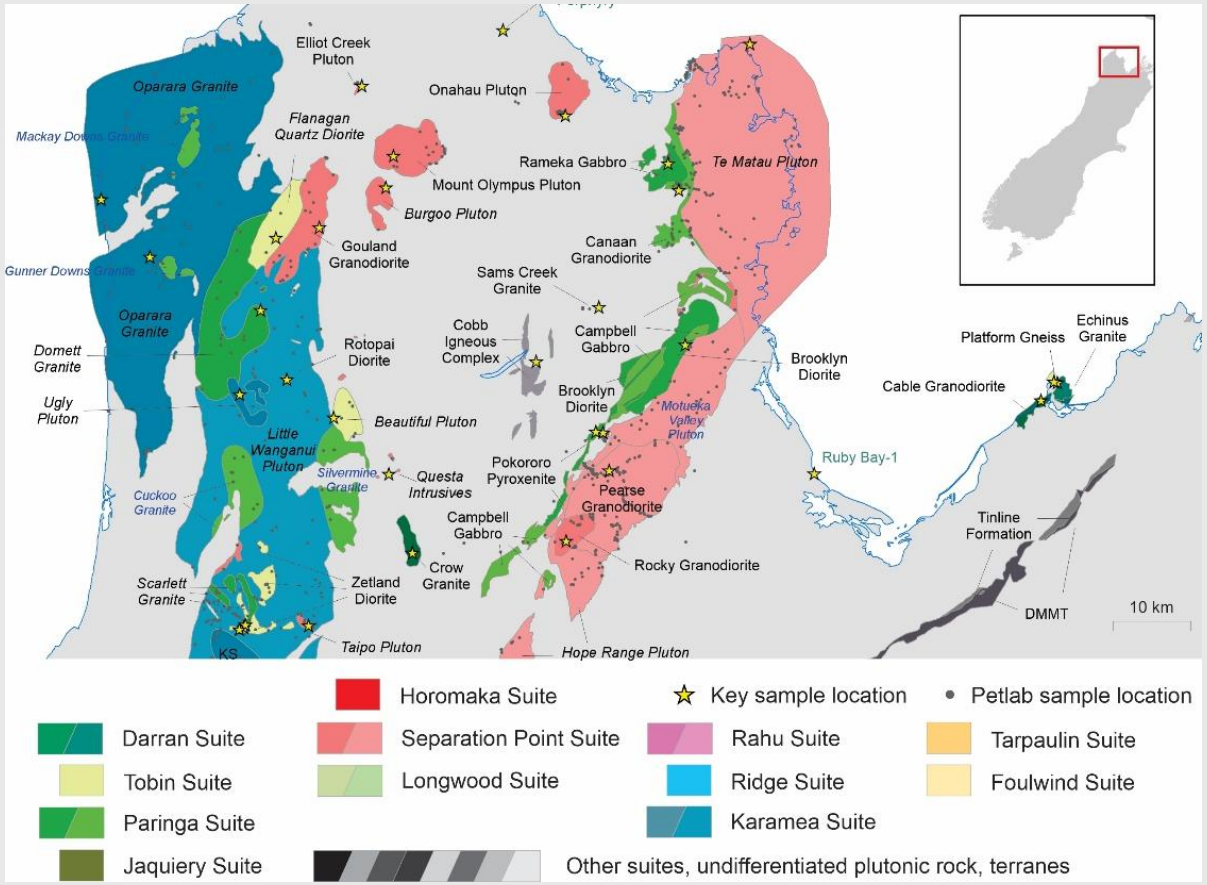
Intrusion-related mineral occurrences

- ***Suite–mineralisation-type associations***
- Opportunities for exploration
- Paleozoic S-type suites
  - Exo- and endo-granite greisen Sn–W
  - e.g. Kirwans, Barrytown
- Paleozoic–Mesozoic I-type ultramafic–mafic plutons
  - Ni–Co–Cu–PGE
  - e.g. Riwaka Complex



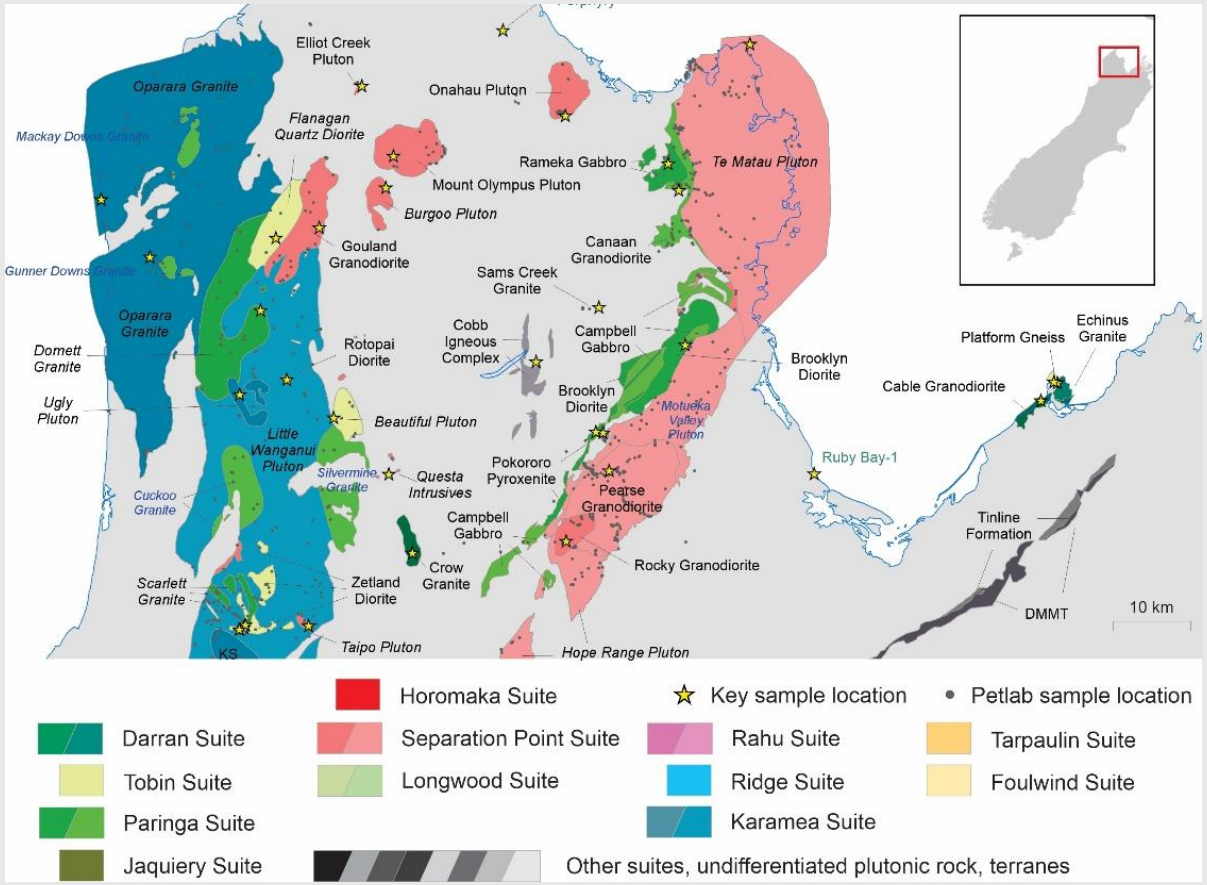
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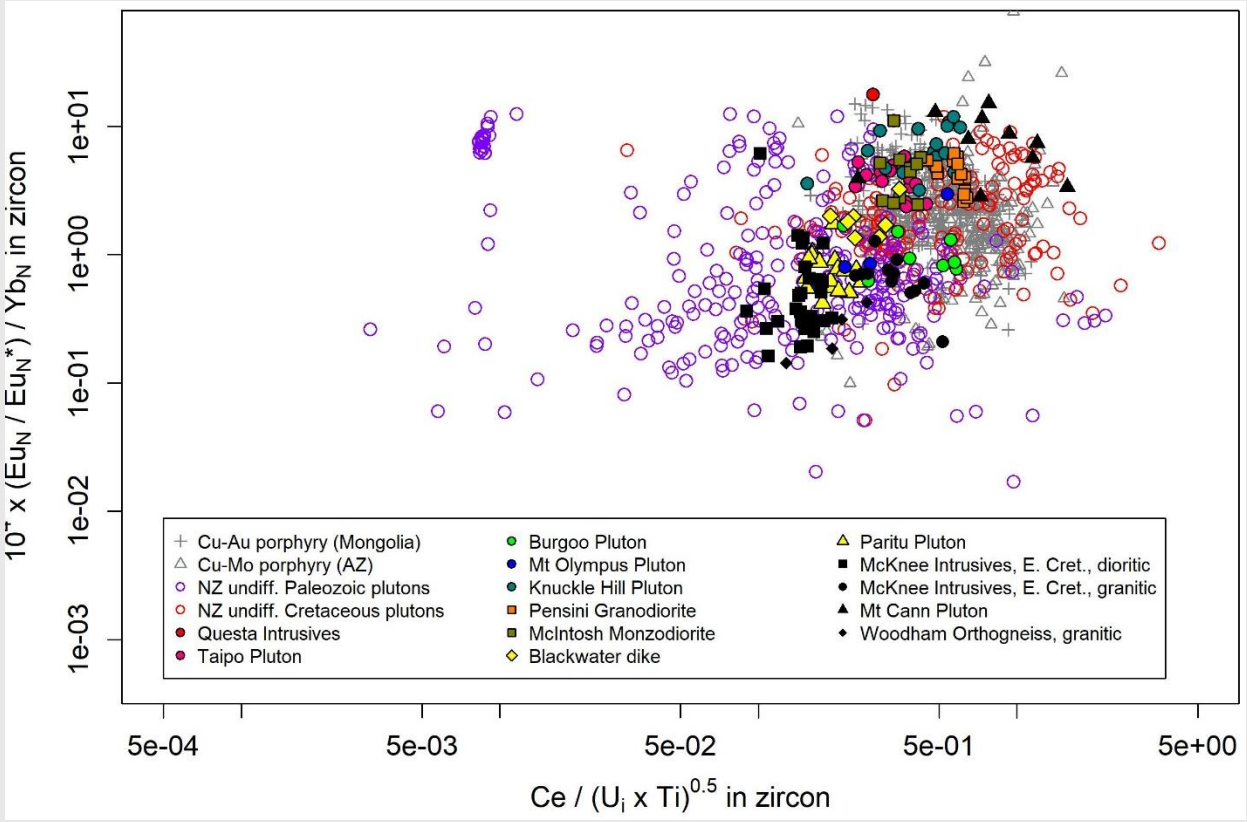
Intrusion-related mineral occurrences

- High Sr/Y Separation Point Suite
  - Mo ± Cu porphyry
  - e.g. Eliot Creek, Burgoo, Questa, Taipo
  - Traces in zircon tool
- Ferroan A-type felsic plutons
  - REE ± other critical elements
  - e.g. French Creek Granite



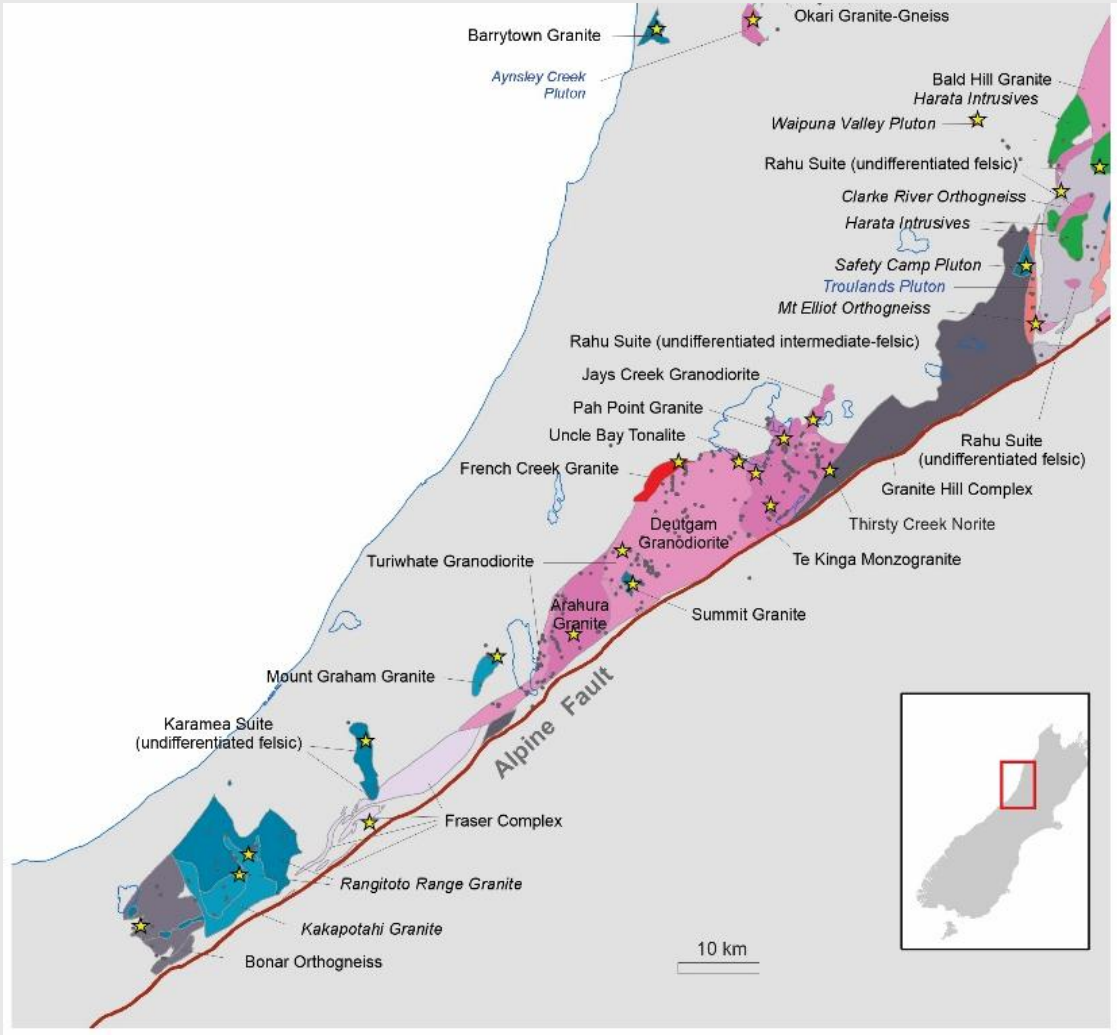
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Conclusions

- Suites = framework for understanding intrusion-related mineralisation
- Suite–mineralisation-type associations
- Range of commodities (e.g. Mo, Ni, Co, etc.)
- Opportunities for exploration
- Sagar et al. (2026). ESNZ Science Report 2025/40. https://doi.org/10.21420/W37W-6522 (live soon)
- PETLAB Database (free): https://pet.gns.cri.nz/

