

Zr-Nb-REE Enriched Alkaline Silicate Magmatism in Victoria

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Zr-Nb-REE-rich alkaline silicate magmatism is widespread in the Lachlan Fold Belt, Victoria, southeast Australia.

Samples were collected from five alkaline igneous fields, elevated in radiometric Th and U. Whole rock geochemical characterisation was completed on all samples. Geochronology was completed on representative samples. Mineralogy and paragenesis of mineralised samples were investigated using XRF mapping, TIMA and EPMA-CL.

Fractionation, alteration, silica saturation, alkalinity and mineralogy vary across and within the fields. Mineralization is focused on altered portions of the most fractionated units, and with late dykes.

The timing of mineralization varies between each field from primary igneous, to deturic, to magmatic-hydrothermal. Mineralization is heterogeneous and is unlikely to be effectively tested by current sampling.

A new mineralised unit was discovered following up on a regional radiometric anomaly. Similar untested anomalies exist in the public statewide airborne radiometric dataset.

New geochronology links alkaline magmatism with two periods of regional extension.

1. Triassic extension due to rollback in the New England Fold Belt, represented by the Mt Leinster Igneous Complex, Gonzaga Monzonite, Gallows Hill Phonolite and the Toongi deposit in New South Wales.
2. Jurassic initiation of Gondwana and Australia-Antarctica rifting, with the Den Hills Formation representing the distal, low-degree melt portion of the proximal, high-degree melts of the Karoo and Farrar large igneous provinces and Tasmanian dolerites.

Separation of alkaline fields from the rift axis implicates distance in producing enriched, low-degree partial melts over proximal, diluted, high-degree melts.

The mantle beneath Victorian has been fertilised by repeated Phanerozoic subduction, with evidence of enrichment recorded in mantle xenoliths. The enriched mantle is primed to produce volatile + Zr-Nb-REE rich low-degree partial melts upon decompression.

Victorian alkaline igneous fields likely have unrealised correlatives across the Tasmanides, linked by repeated Phanerozoic subduction and extension. Mineral exploration should be focused on the hangingwall of translithospheric faults.