

Insights into the petrogenesis of Taupo Volcanic Zone basalts from U-series isotope analysis of whole rocks, groundmasses, and minerals

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The Taupo Volcanic Zone (TVZ) is a back-arc continental rift zone within the North Island of New Zealand, and extends from White Island in the Bay of Plenty southwards to the Tongariro Volcanic Centre.

Extension rates vary from $>12 \text{ mm yr}^{-1}$ in the North to $< 7 \text{ mm yr}^{-1}$ within the Tongariro graben in the south. The central TVZ is characterized by high magma production rates ($> 10,000 \text{ km}^3$ since c. 2 Ma), with 95% erupted as rhyolites and less than 1% as basalts. However, mafic magmas are thought to be the heat source for the extensive crustal melting that produces felsic eruptives, and thus the rates and processes of mafic magma production are critical in our understanding of all magmatism within the TVZ.

We have sampled 9 Late Pleistocene to Holocene basaltic eruption products from Rotokawau in the North to Ohakune in the South, and have separated groundmass, olivine, pyroxene, and plagioclase, for U-series (^{238}U - ^{234}U - ^{232}Th - ^{230}Th) isotope work, targeting the timescales of crystallisation and how these may or may not vary with extension rates within the TVZ. Preliminary U-series data provides some insights into the complex petrogenetic processes operating in the genesis of these basaltic magmas, indicating the uptake of hydrothermally altered crystal cargo in ^{234}U - ^{238}U disequilibrium into ascending basaltic arc melts prior to their eruption. Ultimately, our work will provide important insights into the timescales of mafic melt ascent from mantle source to surface within the TVZ.

Keywords: Uranium-series isotopes, Pre-eruptive crystal uptake, Rapid magma ascent