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Rare plutonic xenoliths from a monogenetic basalt highlight magmatic crustal roots in the Taupō Volcanic Zone, New Zealand.

LAURA K SEELIG[1], ISABELLE CHAMBEFORT[2], MICHAEL D ROSENBERG[2] AND COLIN J N WILSON[1]

[1]Victoria University of Wellington

[2]GNS Science, New Zealand

Presenting Author: laura.seelig@vuw.ac.nz

Rare plutonic xenoliths from a monogenetic basalt highlight magmatic crustal roots in the Taupō Volcanic Zone, New Zealand.

The central Taupō Volcanic Zone (TVZ) is an area of vigorous Quaternary silicic volcanism and hosts two active caldera volcanoes: Taupō and Okataina. Basaltic volcanism within the TVZ represents a volumetrically minor component but is thought to play a significant role in silicic magma genesis. Understanding the magmatic differentiation processes occurring in the TVZ is important for explaining why it is the locus of such abundant explosive rhyolitic volcanism. Textural and geochemical analyses from a suite of plutonic xenoliths erupted from the mid-Pleistocene K-Trig basaltic centre, spanning a range of gabbroic to granitic compositions, provide insights on the generation on silicic magma from lower-crustal, primitive parental magmas.

The K-Trig scoria cone is one of four basaltic centres aligned NNE, located off the NE side of Lake Taupō. K-Trig has been excavated by quarrying, exposing a complete section through the scoria cone. The plutonics collected from the quarry site include olivine-pyroxene rich gabbros and frothy, extremely silicic (≤ 80% wt% SiO_2) glass-bearing granitoids. Mafic plutonics are rarely found within the TVZ, so this suite of gabbros provides a unique opportunity to study the mafic roots of the magmatic system(s) underlying the K-Trig area. These gabbros are the most mafic rocks recorded in the TVZ (~45 wt% SiO_2) and show depleted REE patterns compared to the co-erupted basaltic scoria and other TVZ basalts. The granitoids are comprised of quartz and plagioclase phenocrysts which display disequilibrium textures and are highly fractured, sometimes fragmented. The granitoids are highly vesicular and interstitial glasses contain oxides, biotite, and rare zircon.

We propose that the gabbros are more depleted in the LREEs due to melt extraction. The frothy texture and fractured crystals in the grantoids indicate re-heating/melting and likely decompression, potentially during pre-eruptive ascent. The silica content suggests the granitoids crystallised from shallow, highly evolved melts. Geochemical investigations will be targeted at understanding the processes generating silicic magmas from their mafic parental melts and determining whether there is a genetic relationship between the K-Trig basalts and gabbroic lithics.