# In-situ $^{10}$Be in pyroxene

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Over the past decades, beryllium-10 has become the workhorse of the cosmogenic nuclides for geologic applications. One reason for this is the widespread occurrence of quartz (a key target mineral for $^{10}$Be) and its relatively straightforward chemistry. In-situ produced $^{10}$Be in quartz has been used globally to determine surface exposure, burial ages, and erosion rates across a wide swath of geologic and geomorphic settings.
The central North Island of New Zealand is home to the Taupo Volcanic Zone, a largely andesitic volcanic terrain that is home to Mt Ruapehu. The intermediate volcanic rocks of this region generally lack quartz with the result that little cosmogenic nuclide work has been done here. We have taken advantage of the ubiquitous presence of pyroxene in these rocks to test existing leaching protocols. Our results show that fine grained pyroxene can be successfully leached of the meteoric component, allowing reliable in-situ $^{10}$Be measurement.

Additionally, we measured $^{10}$Be concentrations in a well dated debris avalanche on the western flank of Mt Ruapehu in order to determine a local production rate for $^{10}$Be in pyroxene. Our best estimate for the $^{10}$Be production rate in pyroxene is $3.4 \pm 0.8$ atoms $g^{-1}$ $y^{-1}$ SLHL. This production rate is 8-27% lower than the empirically derived $^{10}$Be production rate in quartz.

The development of $^{10}$Be chemical procedures and production rates in pyroxene allows environments without quartz-bearing rocks to be dated using this widely used nuclide. Pairing $^{10}$Be with $^{3}$He in pyroxene would also open the door to burial dating or the determination of complex exposure histories.