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The effects of growth and collapse on the magmatic system below Mt Taranaki, New Zealand.

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Mt. Taranaki exhibits one of the best long-term records of volcanic growth and destruction of any volcano worldwide, making it ideal for understanding the long-term effects of changing lithostatic pressure, or loading and unloading, on the magma chamber and magma supply. The ring-plain around Mt. Taranaki houses volcaniclastic deposits that provide a near continuous record of the evolution of the volcano, yet these records have remained relatively unexploited when investigating the interrelated cyclical phases of volcano collapse and growth, the geochemical evolution of the centre, and the consequent time-varying hazard potential. In this study, we systematically sampled pumice-rich tephra and pumice-rich mass flow deposits that were stratigraphically immediately before and after the 24,801 $\pm$ 268 years BP Pungarehu Formation debris avalanche ($\sim$ 7.5 km3). Crystals (clinopyroxene and plagioclase) were characterised in detail. Mg and Fe zoning across selected crystals from samples pre-and post-debris avalanche were found to have completely equilibrated, yet zoning patterns in Al remained intact and showed major differences in their formation, allowing for the calculation of diffusion rates. These have enabled the determination of maximum residence times (depths and pressure regimes) of the magma system. It is intended that this technique will be applied across the stratigraphic record, which contains 14 collapse events. This will provide insights into crustal magma transport and residence times, and the propagation of fissures and the buoyancy of the magma pre- and post-collapse, in order to characterise the evolution of the centre and quantify the long-term relationship between magmatic rise and volcano growth and destruction.