

Geochemical fingerprinting of magmatic behaviour throughout growth phases of Taranaki volcano, New Zealand

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Andesitic stratovolcanoes are characterized by cycles of cone growth interspersed by periods of cone collapse. The long-term record of the evolution of their magmatic system is mainly preserved in the deposits of the ring-plain surrounding an active cone. Taranaki volcano in northern New Zealand provides an unusually detailed example of these processes due to excellent coastal ring-plain and young cone exposures. In this study, we investigate the magmatic system throughout three consecutive growth phases of Taranaki volcano by sampling a detailed, stratigraphically controlled selection of pumiceous clasts from widely distributed, lithic-rich volcanoclastic hyperconcentrated flow deposits in the medial (25-30 km) ring-plain.

The clasts from the three studied growth phases (GP1 – 65-55 ka; GP2 – 55-35 ka; GP3 – 25-29 ka) differ in bulk composition and form distinct trends on variation diagrams of key element contents (e.g. SiO₂, K₂O). Further, there are compositional shifts within individual growth phases after periods of quiescence. These data reflect a number of magmatic processes operating during each individual growth phase. Initially, clast compositions of each growth phase display a restricted compositional range, which then widens during edifice growth. This is due to crustal processing becoming more prominent within each growth phase over time.

The detailed geochemical record from Taranaki volcano illustrates a cyclical sequence of magmatic processes involving recharge of primitive magmas into the crust. These alternations in the magmatic system can be correlated to the eruptive behaviour of the volcano. Ongoing crystal stratigraphic work will provide more detailed insights into magma-crust interactions within and between growth phases of Taranaki volcano.