Understanding the largest-scale explosive volcanism at Mt. Taranaki, New Zealand

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“In solitude we find ourselves, defeat our ego, discover our worst, our best, love, real life and real friends” Photo: Sharks Tooth from the summit of Mt. Taranaki, Jul/2016.

Dedicated to my mother - the strongest person I’ve ever met,
and to my beloved adopted sisters and brothers

Abstract

Over the last 5000 years B.P., at least 53 explosive eruption episodes occurred at Mt. Taranaki, (western North Island, New Zealand) from either the summit-crater (2500 m), or a satellite vent on Fanthams Peak (1966 m). These eruptions are represented in well-preserved pyroclastic successions on the upper volcano flanks. At least 16 episodes produced deposits with lithostratigraphic characteristics comparable to those of the last sub-Plinian eruption at AD 1655, suggesting an average recurrence of one Plinian/sub-Plinian eruption episode every 300 years. Several large-scale mafic-intermediate (~48-60 wt.% SiO_2) eruption episodes sourced from the two vents were studied in detail to determine the "maximum" intensity, magnitude and eruptive styles from this volcano. These episodes comprised climactic phases with sustained and steady, 14-29 km-high eruption columns, often starting and ending with unsteady pulsating, oscillating and collapsing plumes. The columns erupted 0.1-0.5 km^3 DRE at mass and volume discharge rates of 10^7-10^8 kg/s and 10^3-10^4 m^3/s, respectively, indicating magnitudes of 4.1-5.1. The unsteady initial, pre- and post-climactic eruptive phases were dominated by dome-collapse, column-collapse and lateral-blast pyroclastic density currents (PDCs), with run-out distances of 3-19 km and volumes of up to 0.02 km^3 DRE. The steadiest phases were associated with eruption of rheologically homogeneous magmas producing homogenous pumice textures. Unsteady phases produced density and porosity pumice gradients by magma stalling in upper conduit levels. Three eruption onset scenarios were developed from this work: a) initial closed-conduit decompression by vent unroofing and dome-collapse, b) transient open and clogged conduits produced by repeated plugging-and-bursting of chilled or gas-depleted magma, and c) rapid conduit opening with more mafic eruptives. In all scenarios, the climactic phases are comparable, with pyroclastic fallouts covering 1500-2500 km^2. The most violent phases of these events, however, are lateral-blast PDCs that could reach a broad arc between 14-19 km from source. This reappraisal of the hazardscape at Mt. Taranaki integrates many new details that enable a more realistic hazard management and provides a range of findings that can be applied to other similar andesitic volcanoes prior to reawakening.

Acknowledgements

The first time I heard about New Zealand was in 2009 during an outstanding poster presentation about Mt. Ruapehu at the Jorullo conference in Mexico, by PhD student Natalia Pardo. The next thing I discovered was an incredibly beautiful, almost perfect cone-shaped stratovolcano, confusingly named both Taranaki and Egmont. This I wished to climb if I ever had the chance to go for any reason to the other side of the world. A few years later I emailed Shane Cronin inquiring about PhD opportunities and he replied by asking if I would be interested in working on explosive volcanism at Mt. Taranaki - I felt that I had just won the lottery. Doing fieldwork in this volcano has been challenging, slow, and at times frustrating due to the multiple obstacles posed by topography and vegetation and the very intricate stratigraphy. Disentangling a little part of such complexity whilst walking on its slopes has been extremely rewarding, and I would never choose differently, even if I could.

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