EGU General Assembly 2024

EGU24-7230, updated on 24 Jan 2025
https://doi.org/10.5194/egusphere-egu24-7230
EGU General Assembly 2024

Using pyroclastic textures as an index for understanding the impact edifice collapse has on the subvolcanic plumbing system.

Shannen Mills[1], **Jonathan Procter**[1], Anke Zernack[1], Stuart Mead[1], Ian Schipper[2], Andrew Stevenson[3], Benedicta Arhatatari[3], Darren Thompson[3], and Joseph Fleming[1]

[1]School of Agriculture and Environment, Massey University, Palmerston North, New Zealand (s.mills@massey.ac.nz)
[2]School of Geography, Environment and Earth Sciences, Victoria University of Wellington, New Zealand
[3]Australian Synchrotron, Australian Nuclear Science and Technology Organisation (ANSTO), Clayton, Vic, 3168, Australia

Depressurisation from edifice collapse events can impact the subvolcanic plumbing system as a propagation wave moves down through the system shifting the fragmentation zone. Understanding how this influences the eruptive behaviour at a volcano is important for understanding changes in hazards following a large edifice collapse event. Mt. Taranaki has experienced at least 16 collapse events within its > 200 kyr history. Two of the largest collapse events the 27.3 ka Ngaere and 24.8 ka Pungarehu debris avalanches occurred in close succession and were encompassed by the Poto and Paetahi tephra formations, made up of 28 subplinian eruptions over ~ 4,000 years. This eruptive period provides a unique opportunity to examine and understand the influence that edifice collapse events have on the subvolcanic plumbing system. Using 3D Micro-Computed Tomography at the Australian Synchrotron bubble textural analysis was undertaken to investigate the changes in pyroclastic textures from large explosive eruptions and how these change following an edifice collapse event. The high-resolution 3D scans indicate that the eruptive products from the Poto and Paetahi Formations are dominated by small bubbles (2.7×10^{-7} mm^3) with high bubble number densities ranging from 2.56×10^{15} cm^{-3} to 1.74×10^{16} cm^{-3}. Bubble size distributions for the Poto and Paetahi Formations indicate a range of bubble nucleation and growth processes occurring within the subvolcanic plumbing system below Mt. Taranaki initiating at different depths. Early onset of bubble nucleation and periods of magma stalling are indicated by the presence of large, coalesced bubbles within the eruptive products, while the dominance of smaller bubbles indicates a fast ascent of magma within the system with nucleation occurring higher up in the system. Changes are seen in the textural characteristics of pyroclasts produced following the 27.3 ka 5.85 km^3 Ngaere collapse which depressurized the shallow magmatic system and shifted the fragmentation zone. Following the 24.8 ka 7.5 km^3 Pungarehu collapse ~2,500 years later the same influence is not seen, due to the cone not having enough time to rebuild between edifice collapse events. The results from this study show that the depressurisation and subsequent propagation wave are dependent on the height above the plumbing system not just the mass removed and therefore two major collapses in close proximity do not show the same systematic impact on the fragmentation zone.