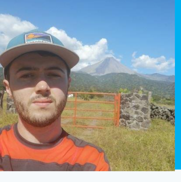

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Magmatic Controls on Eruption Potential at Mt. Taranaki

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Introduction and Objectives

Mt. Taranaki is a stratovolcano located on the North Island of New Zealand. Over the Holocene, there have been 53 volcanic deposits identified that are the result of explosive activity[1]. This project will focus on shallow volcanic processes, with three objectives in mind:

1) Determine the volatile content and degassing style that fuel large explosive eruptions at Mt. Taranaki

2) Create a conceptual model for shallow crystallisation and ascent at Mt. Taranaki.

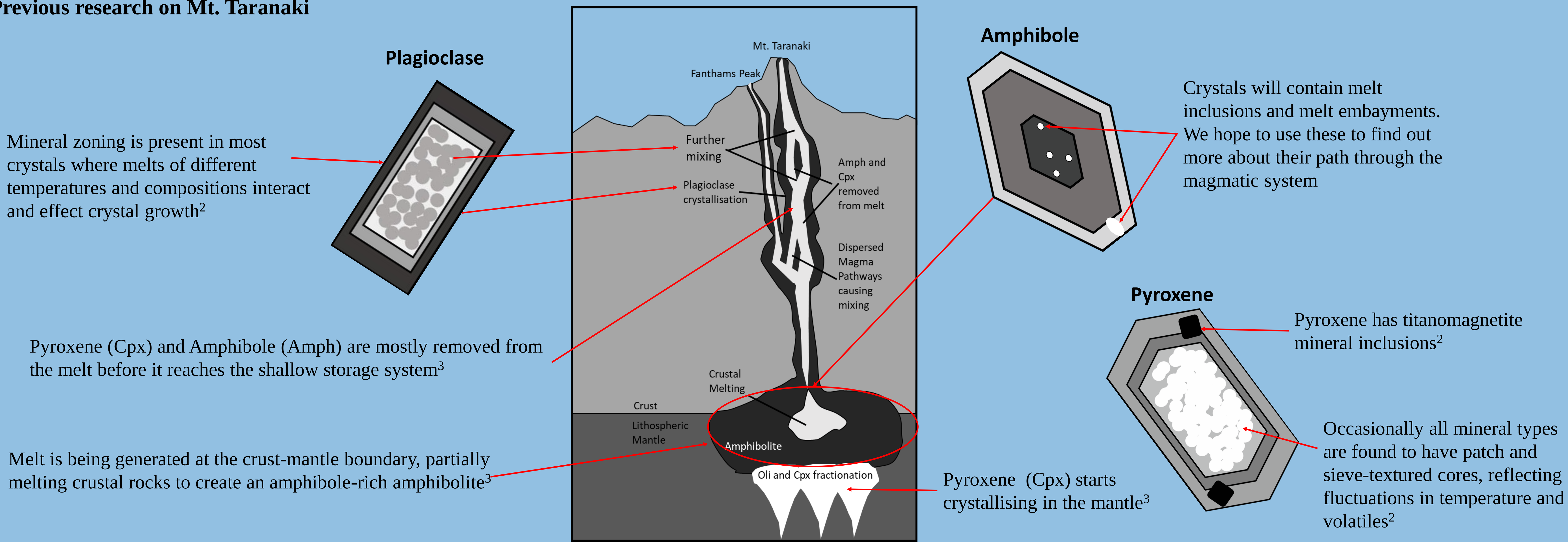
3) Understand potential magmatic controls that influence the longevity of eruption sequences

Methods

- Fourier Transform Infrared (FTIR) Spectrometry and Secondary Ion Mass Spectroscopy (SIMS) to quantify volatile content of melt inclusions and groundmass glass
- Crystal Size Distribution (CSD) analysis, X-Ray Diffraction (XRD), and Micro-Computed Tomography (MCT) to determine influence of crystallisation and bubble formation on magma ascent
- Geochemical analysis using Laser Ablation Inductively Coupled Plasma Mass Spectrometry (LA-ICP-MS) and SIMS to analyse mineral composition

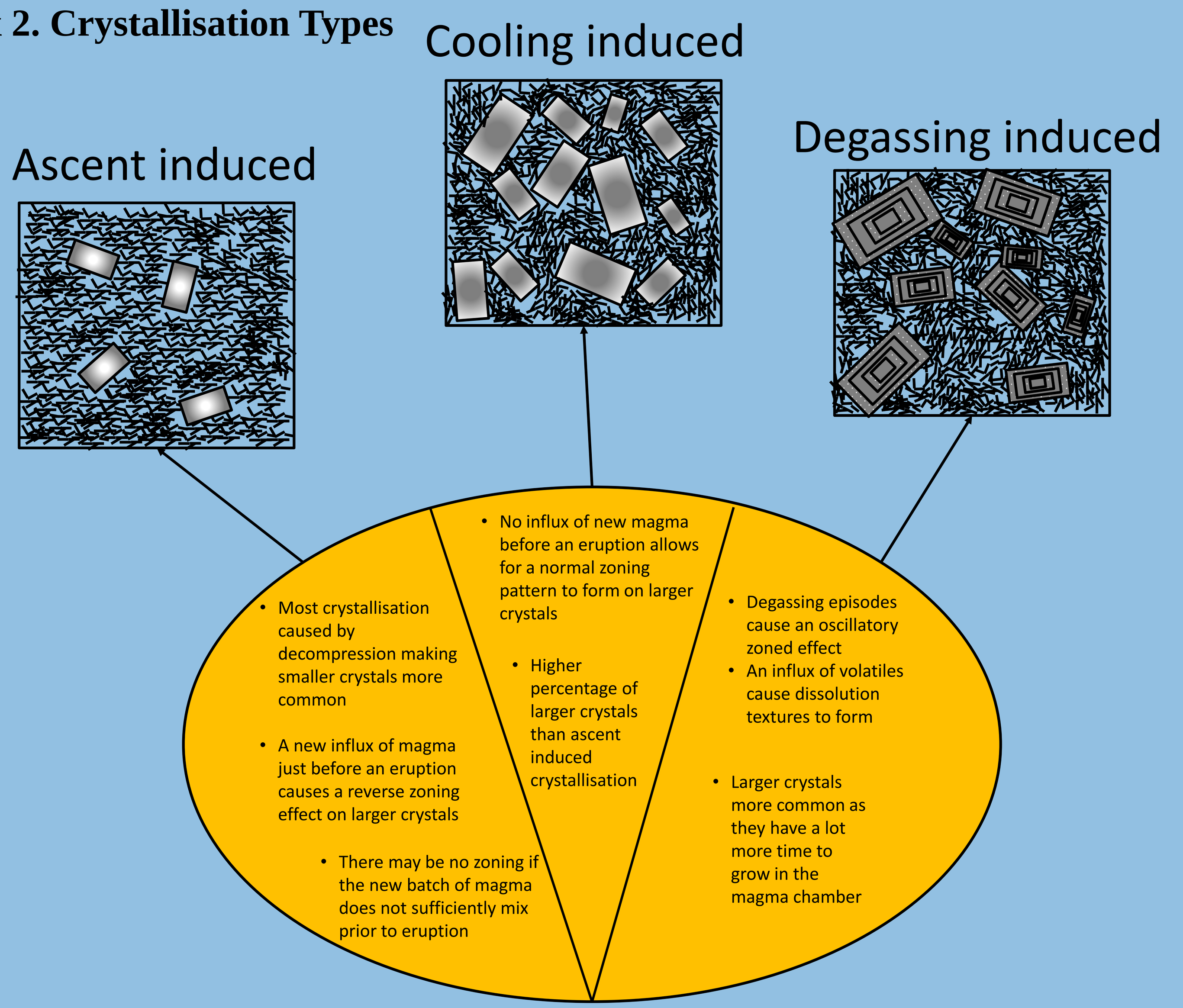
What do we know so far?

Box 1. Previous research on Mt. Taranaki



What do we expect to find?

Box 2. Crystallisation Types



Box 3. Conceptual model for Mt. Taranaki Activity

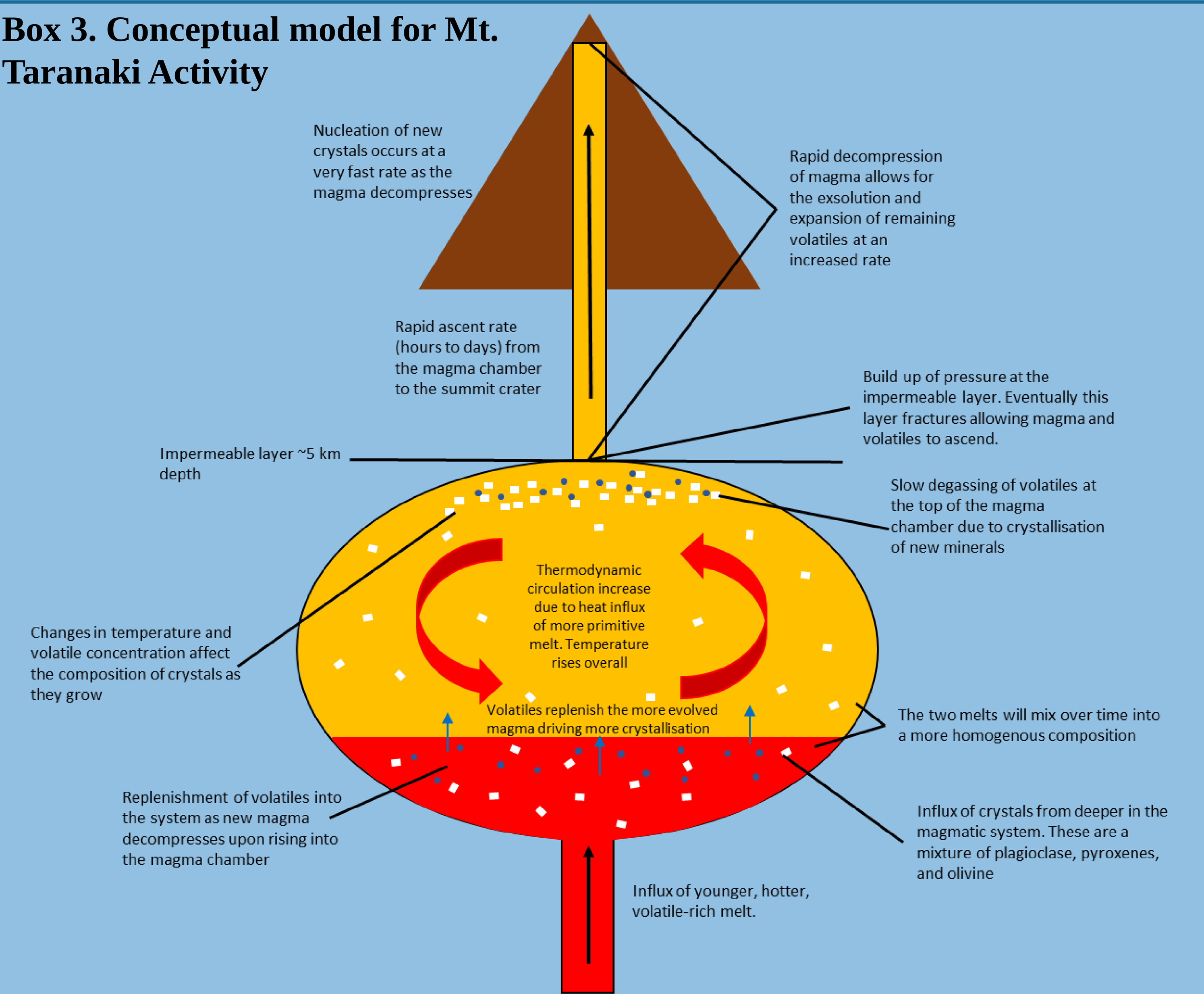


Table 1: Major Mt. Taranaki eruptions over the last 5000 years[4]

Age (cal yr B.P.)	Eruptive Episode	Column Height (km)	Min. Eruption Volume (km³)	Magnitude (VEI)	Eruption Style
300	Burrell	14-17	0.1	4.1	Subplinian
1200	Kaupokonui	14-16	0.13	4.3	Subplinian
2600	Manganui-D	25-27	0.5	4.9	Plinian
3300	Upper Inglewood	22-24	0.3	4.7	Plinian
4700-4600	Kokowai 7	21-22	0.1	4.2	Subplinian
4700-4600	Kokowai 4	27-29	1.1	5.1	Plinian

Hypothesis

- Volatile abundances from magma trapped within crystals (Olver et al. in comms) show minimal crystallization above the 5-7 km storage depth. I hypothesise diffusion at mineral boundaries will record rapid ascent rates of the magma from these depths.
- By analysing crystal size and textures we can deduce whether crystallisation is ascent, cooling, or degassing induced. This will cause different temperature and chemical regimes that will effect crystal growth. Ascent and degassing induced crystallisation will likely be the primary process in explosive eruptions.
- The longevity of eruptions are likely effected by the volume, duration, and composition of new magma into the volcano's magma chamber. I hypothesize this will be recorded in the chemical and volatile composition of minerals and in the size distribution of crystals.

Why study this?

- Volatile budgets can give an indication on possible environmental and health hazards
- If an eruption type can be modelled through crystallinity and ascent rate, it can give an indication of eruption intensity
- If an indication in the differences for triggers of singular and sequence eruptions are found, then it could be possible to predict if further eruptions are imminent from Mt. Taranaki's next eruption

References

1. Torres-Orozco et al. (2017a) New insights into Holocene eruption episodes from proximal deposit sequences at Mt. Taranaki (Egmont), New Zealand. *Bull. Volcanol.*, **79**:3.
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4. Torres-Orozco et al. (2017b) Diverse dynamics of Holocene mafic-intermediate plinian eruptions at Mt. Taranaki. *Bull. Volcanol.,* **79**:76