Introduction

Structure
Two intertwined learning streams (see pages 2,3) using quantitative approaches to understanding ascent and eruption of magma and transport and deposition of pyroclasts.

Text

Plus additional readings from the literature, as necessary.

Course objectives
By the end of this course, students will be able to: 1) Understand physical and social effects of explosive volcanic eruptions; 2) Understand current models for processes of ascent, eruption and transport; 3) Relate characteristics of field deposits to eruption style and magnitude,

Contents
- Conduit ascent and degassing of magma
- Mechanisms of explosive eruption: Hawaiian, Strombolian, Vulcanian, subplinian, Plinian, phreatomagmatic eruption styles
- Pyroclast transport and deposition in explosive eruptions
- Water–volcaniclast mixtures: floods and lahar
Stream 1: Quantitative Modelling of Explosive Volcanism

- Lecture- and exercise-based
- Weekly classes
- Built around Fagents et al., 2013.

Content (topics)

1. Introduction to modeling volcanic processes
2. Fluid dynamics
3. Magma rheology
4. Conduit processes
5. Pyroclastic density currents
6. Plinian/subplinian eruptions
7. Vulcanian eruptions
8. Strombolian & Hawaiian eruptions
9. Explosive magma-water interactions
10. Lahars I: processes/models
Stream 2: Quantifying Pyroclastic Products and Process

- Field-and laboratory-based
- Centered on two field excursions
  - Kilaeua
  - Taupo Volcanic Zone

Content

Taught by examining well constrained data sets that include

- High-resolution eruption chronologies from high-speed imagery (in a few cases)
- Field constraints of dispersal (mass eruption rate, steadiness, eruptive mass/volume)
- Pyroclastic grain size and componentry (fragmentation, transport and deposition mechanisms)
- Vesicle number densities, and size and volume distributions (magma ascent/fragmentation)

Case Studies

**Excursion 1 (5 days)**
- Keanakāko‘i Basal Reticulite (1/2 day)
- Keanakāko‘i Unit 6 subplinian fall (1/2 day)
- Kilaeua iki 1959 high fountaining eruption
- Keanakāko‘i 1790 phreatomagmatic explosions
- Halema‘uma‘u 2007-2018 explosive eruptions
- Mystery deposits

**Excursion 2 (8 days) Spring Break**
- Taupo 1800 a Plinian-phreatoplinian-ignimbrite
- Tarawera 1886 basaltic Plinian fall
- Kaharoa 1315 subplinian-Vulcanian eruption
- Ruapehu 1996 subplinian fall
- Ruapehu 2007 lahar
- Tongariro composite-cone-forming sequences
- White Island 1976-2007 phreatomagmatic explosions
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