**UBC/SFU**

**Model sensitivity**
1) UBC - Heather
Can the model be applied to obsidian dome eruptions? Would this be just one end member case?

How difficult would it be to add an additional "chemical composition" variable? How accurately do the current models represent changing composition (from a possible zoned magma chamber) eruptions?

2) SFU – Terry
Slide #2: Explain long term deformation as shown in the parentheses - ground deformation (deflation during growth/inflation during repose) in terms of the edifice vs. dome. Active seems to include a variety of phases -quiescent, active with measurable behaviour (tilt, inflation), active with visible activity (dome building, gas), active as in erupting, active as in pulsing. How does modelling address this very changing situation?

Nature/GRL papers: Implications for monitoring & forecasting - what parameters can be monitored and how, to forecast eruptions using the model? Examples are geometry of stations for tilt, RSAM, distance, dyke detection, conduit size, gas measurement, etc.

**UNAM QUESTIONS**

**Crystallization and Viscosity**

The microlites can formed after the lava dome extrusion, principally in the zones away of the external sectors and not uniquely during the ascent of magma. Could the percentage of microlites formed before and after lava dome extrusion is quantified? How would it affect the nonlinear model? **(Hugo Murcia)**

**Modeling periodic behavior in lava domes (Barmin et al, 2002)**

The model can calculate the size of a magma chamber based on the time between eruptions; can we calculate when the next eruption would be if we estimate the size of the magma chamber through other means like seismology? **(Alejandro)**

Why in the model behavior do you use properties of a Newtonian substance instead of a Bingham substance that is closer to the magma properties? **(Hugo Murcia)**

**Extras**

**Slide 11**
According to the diagram showed in slide 11, in what stage is the dome more vulnerable to suffer zonal or complete destruction and how this could affect the conditions in the system? **(Victor)**

**Melnik and Sparks, 1999:**
It is possible to quantify the amount of gas lost across conduit walls? **(Nacho)**

**MICHIGAN TECH UNIVERSITY:**

This week suggested topics:

1. **Slide 18.** What is the meaning of “steady state” in the model? What is the variable that is “steady” through time?

2. **Barmin et al 2002 EPSL, p. 182**: Based on the 1980-87 Mt. St. Helens dome growth they modeled the system. Could the renewed activity (2004 to present) be considered as a new cycle (maybe as part of a long period behaviour), or could these two episodes be considered as different (non-related) stages? In the first case, how would this affect the model (e. g. the estimation of the magma chamber size)?

3. **Barmin et al 2002 EPSL, p. 182**: At Santiaguito the lava chemistry has changed through time, with a decrease in SiO2 content since the 70’s. Two explanations have been suggested: the eruption of a zoned magma body and the input (and mixing/hybridization) of less silicic magma to the magma chamber. What would be the effect on the model if these changes would be considered?

4. **Barmin et al 2002 EPSL, p. 178-79**: What would be the effects of variations in magma chamber input rate on the model? In the extreme case of supply shutoff (as could be the case for Santiaguito): would it still show damped oscillations, and decrease with time? Could this be fit to the observed behaviour of the dome?

5. How close are scientists to predicting eruptions?

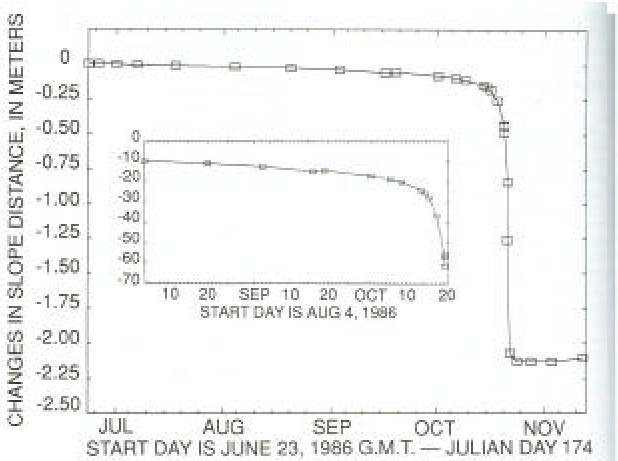


Figure 6.15. Distance changes for a typical dome station during quiet and eruptive periods. This station, located on northeast side of dome, was measured from an instrument station on north crater floor. Inset is a closer view of data leading up to October 1986 dome-building episode. By observing curve as episode nears, onset of activity can be predicted. A new lobe on dome was first observed on the morning of October 22 (vertical line).

*From:*
*Monitoring Volcanoes: Techniques and Strategies Used by the Staff of CVO, 1980-1990*
*USGS Bulletin 1966*

**MCGILL**

At what timescales can you neglect deformation of the conduit walls? If the eruptions are occurring on hourly cycles vs. weekly cycles, wouldn't the longer periodicity cycles be affected more? Could elastic deformation of the conduit walls due to changing pressures be related to the cyclic nature of these systems?

Where do you define the conduit wall? If there is a crystal mush on the edge of the walls, how do you define the wall? Is it simply where the horizontal velocity is zero?

Since the walls of the conduit behave elastically, is it appropriate to assume that the conduit is a cylindrical pipe (slide 15)? Wouldn't you expect irregularities in deformation?

When can you neglect lateral viscosity gradient in the conduit in a model? In the 1999 Nature paper, it is said that gas loss to the conduit walls is negligible, but wouldn't you expect to have a significant difference in viscosity in the centre vs. the edges of the conduit? Isn't it important to consider this when discussing rheology?

**OREGON**

There are many parameters within the model. Is there one in particular that dominates or controls the behaviour/periodicity of the system or is it simply a combination of many parameters? What does this tell us about the current and future activity?

**BUFFALO**

How do the steady states described in the models relate to steady states that we can observe at the surface, for example at Montserrat? (Marc)

In the Costa et al., 1999 paper, the first paragraph of the Results and Discussion section mentions that the average magma volume extruded during one cycle at SHV was much less than the estimated volume (0.02-0.03 km3 vs. 4-5 km3). In your experience, have you found this to be true in many other cases? And, if so, why? What are your thoughts on this? (Leila)

**COLIMA**

Support for the models:

Has any work been done to compare parameters (such as porosity and permeability or melt volatile content) that influence magma viscosity in dome rocks extruded during periods of both high and low extrusion rate.

Differentiating between the models:

The models all appeal to changes in magma viscosity and conduit pressure to explain the cyclical variations in extrusion rate at domes. Are there models out there that test a different theory (e.g. variable influx into the lower part of the conduit)?

Question to be combined with McGill's:

Based on the work of Heather Wright and Kathy Cashman on dome rocks from various volcanoes including Tungurahua, there appears to be a heterogeneity in the permeability (and therefore the ability for gas to escape from the magma) of dome rocks from the same vent/same event. This could be due to heterogeneities within the conduit (laterally). Would these lateral variations have any effect on the system as described by the models?