Long Term Stability of Conduit Dynamics at Fuego Volcano, Guatemala, 2008-2015

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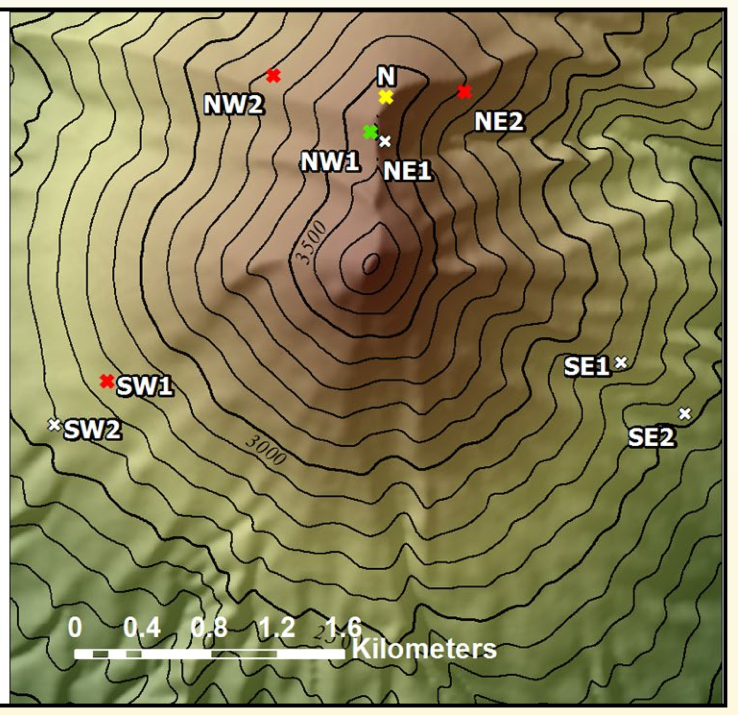
Background

Field Campaigns from 2008 - 2015

Years each site was occupied

	2008	2009	2012	2014	2015
NW1	x	x	x	x	x
NW2		x	x		
NE1			x		
NE2		x	x		
SW1		x	x		
SW2			x		
SE1			x		
SE2			x		
N*	x	x	x		

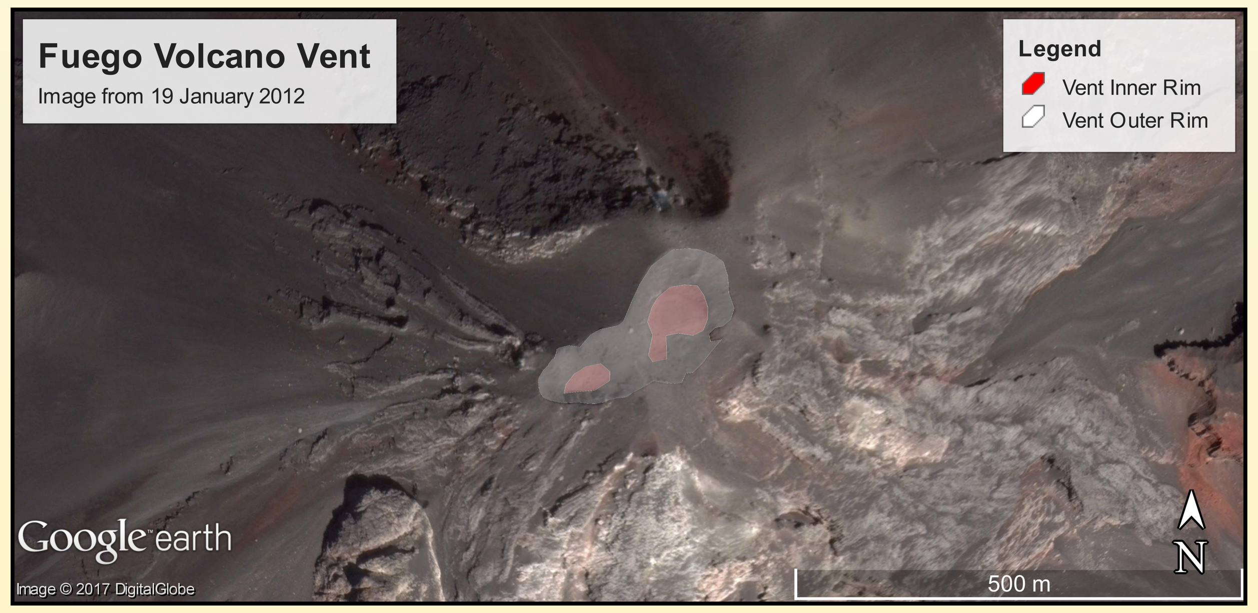
*Collocated video, FLIR, and UV camera



Overall energy of system varied, but examples of persistent behavior:

Vent location constant within 200 m radius

- Often two vents



Very Long Period (60 sec-10 sec) Seismic Events

- Sub-vertical dike feeding a dipping sill[1]
- Different emission styles with different waveforms[2]
- Large range of amplitudes
- SO_2 emissions linked to seismicity[3]

Long Period (0.5 – 2 Hz) Seismic Events

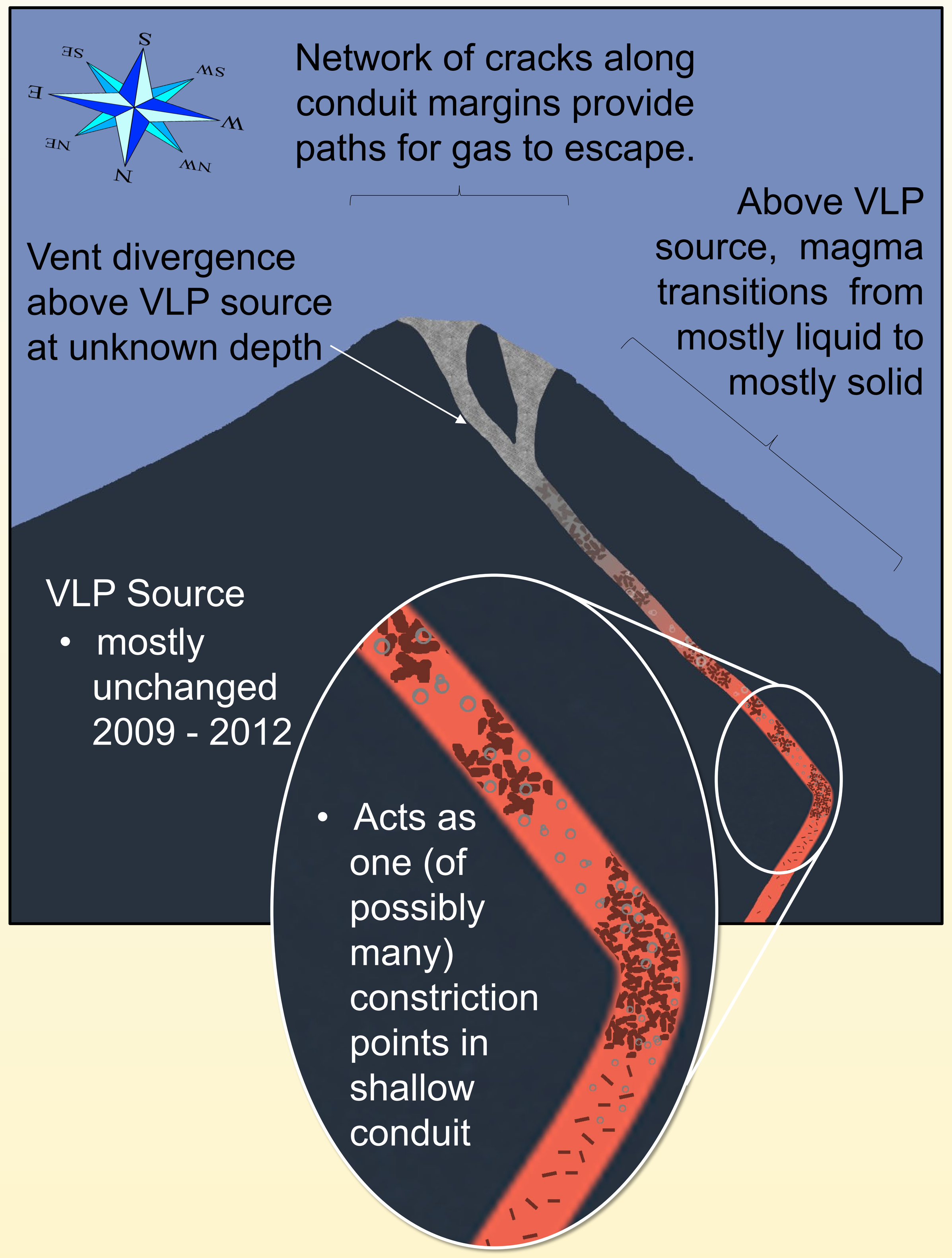
- Series of cracks around conduit margin[4]
- No visible emissions associated

Consistent Average Annual Gas Emission Rates

- Harmonic and broadband tremor with visible plumes[5]
- Also aseismic interevent degassing

Clustered (C_v>1) Repose Periods for Seismicity

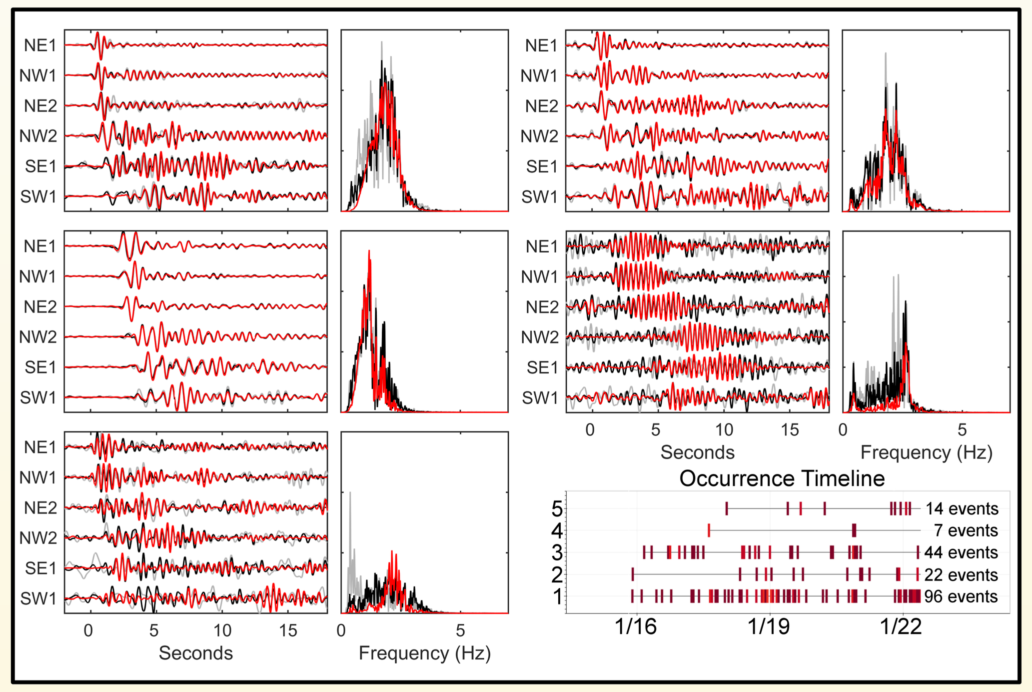
Model

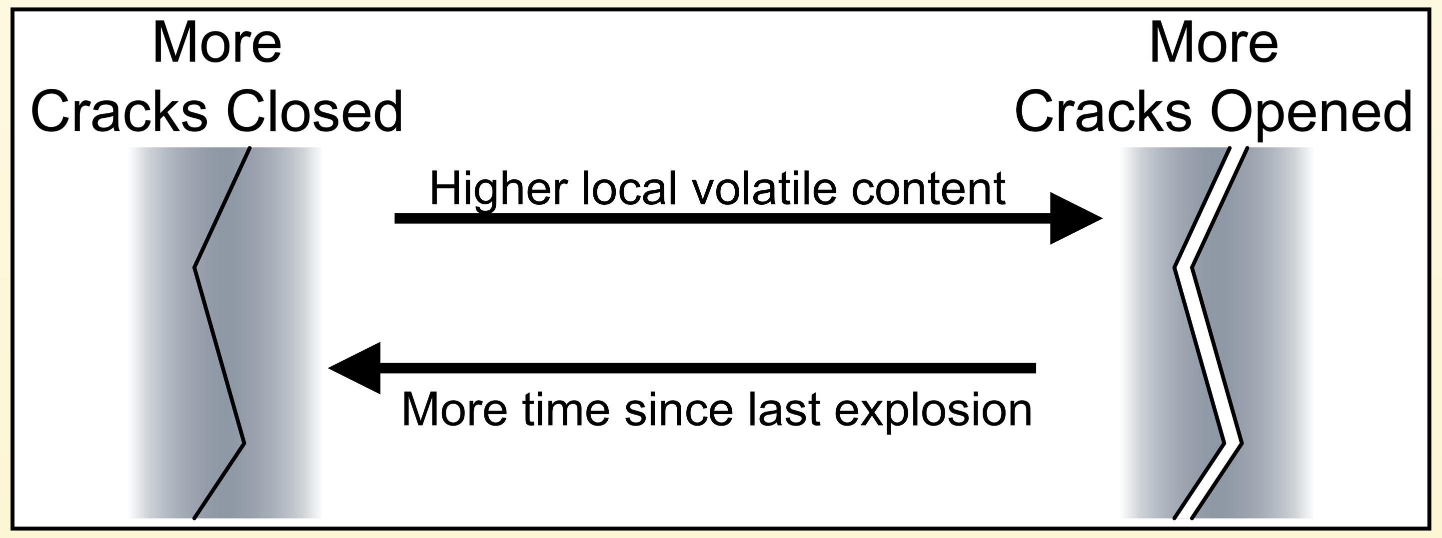


Two styles of cracks

I. Along Conduit Margins
- More stable (LP sources)
- Provide paths for gas to leak

II. Within Cap
- Random distribution
- As cap properties vary, so do cracks
- Cap forms from undercooling



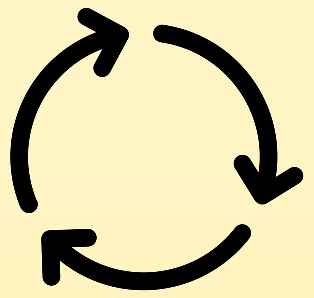


Event size correlates with repose time when t_r > 2hrs

Broadband and harmonic tremor along with aseismic degassing.

When cap seals:

- Pre-event inflation of sill (exaggerated)
- Evident in tilt data
- Cap fractures near surface to relieve pressure.



Cracks through cap are open

When cap ruptures:

- Emission size depends on depth fragmentation front penetrates into conduit.
- Largest events have VLPs
- Emissions take path of least resistance.

Questions

Magma fragmentation rates

- What process governs the different speeds of magma fragmentation and the different depths that the front reaches?
- Are local aggregations of crystals and bubbles enough to account for different VLP event styles and changes in event times?

Longer term (week-month) magma supply rate changes

- What drives changes in liquid-solid transition depth?
- What drives behavior regime changes: lava flows vs. strombolian vs. paroxysms?

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References