

The CALIPSO Project at Soufrière Hills Volcano, Montserrat, BWI: Using Integrated Deformation Data to Constrain Magmatic Processes

Glen Mattioli » Department of Geosciences, University of Arkansas

Barry Voight » Department of Geosciences, Penn State University

Derek Elsworth » Department of Geosciences, Penn State University

Dannie Hidayat » Department of Geosciences, Penn State University

Alan Linde » Department of Terrestrial Magnetism, Carnegie Institution of Washington, DC

Peter Malin » Division of Earth Sciences, Duke University

Jurgen Nueberg » School of the Earth and Environment, University of Leeds, Leeds, UK

Selwyn Sacks » Department of Terrestrial Magnetism, Carnegie Institution of Washington, DC

Eylon Shalev » Division of Earth Sciences, Duke University

Steve Sparks » Department of Earth Sciences, University of Bristol, Bristol, UK

The staff of the MVO » Montserrat Volcano Observatory, Flemmings, Montserrat, British West Indies

The “Caribbean Andesite Lava Island Precision Seismogeodetic Observatory,” (i.e. CALIPSO) has greatly enhanced the geophysical infrastructure at the Soufrière Hills Volcano (SHV), Montserrat with installation of an integrated array of borehole and surface instrumentation at four sites. Each site has a Sacks-Evertson dilatometer, a three-component seismometer (~Hz to 1 kHz), a Pinnacle Technologies tiltmeter, and an Ashtech u-Z CGPS receiver with choke ring antenna, similar to volcano sites in western North America as part of EarthScope.

CALIPSO sensors recorded the collapse of the SHV lava dome on Montserrat in July 2003, the largest such event worldwide in the historical record (Mattioli et al., 2004). Dilatometer data show remarkable and unprecedented rapid (~600s) pressurization of a deep source. Voight et al. (2006) inferred an oblate spheroidal source with average radius ~1 km centered at 5.5 to 6 km depth. An overpressure of ~1 MPa was attributed to growth of 1 to 3% of gas bubbles in supersaturated magma, triggered by the dynamics of dome unloading.

Pyroclastic flows entering the sea may cause tsunami generation at coastal volcanoes worldwide, but geophysically monitored field occurrences are very rare. Mattioli et al. (2007) reconstructed the process of tsunami generation and propagation during the prolonged, gigantic collapse of the SHV in 2003 using a combination of data from the CALIPSO array. Mattioli (2005) also reported that periods of surface uplift recorded by GPS at SHV correspond to an inflating, while subsidence corresponds to a deflating Mogi source. Inverted depths are between 6 and 13 km, with the recent observations



favoring a deeper source. These measurements support a temporal evolution of the mid-crustal pre-eruption storage zone from 1995 to 2005.

References

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