Geophysical Research Abstracts
Vol. 16, EGU2014-6320, 2014
EGU General Assembly 2014

The link between multistep magma ascent and eruption intensity: examples from the recent activity of Piton de la Fournaise (La Réunion Island).

Andrea Di Muro
IPGP/OVPF, Le Tampon, France (dimuro@ipgp.fr)

Caldera collapses represent catastrophic events, which induce drastic modification in a volcano plumbing system and can result in major and fast evolution of the system dynamics. At Piton de la Fournaise (PdF) volcano, the 2007 eruptive sequence extruded the largest lava volume (240 Mm3) since at least 3 centuries, provoking the collapse of a small (1 km wide; 340 m deep) summit caldera. In about 35 days, the 2007 major eruption generated i) the greatest lava output rate, ii) the strongest lava fountaining activity (> 200 m high), iii) the largest SO_2 volume (> 230 kt) ever documented at PdF. This event ended a 9 year-long period (1998-2007) of continuous edifice inflation and sustained eruptive activity (3 eruptions per year on average). Unexpectedly and in spite of the large volume of magma erupted in 2007, volcano unrest and eruptive activity resumed quickly in 2008, soon after caldera collapse, and produced several closely spaced intracaldera eruptions and shallow intrusions. The post-2007 activity is associated with a trend of continuous volcano deflation and consists in small-volume (<3 Mm3) weak (< 20 m high fountains; strombolian activity) summit/proximal eruptions of moderate/low MgO magmas and frequent shallow magma intrusions. Non-eruptive tremor and increase in SO_2 emissions were interpreted as evidences of magma intrusions at shallow depth (< 2.0 km) preceding the eruptions. The 2007-2011 phase of activity represents an ideal case-study to analyze the influence of magma ascent kinetics on the evolution of volcano dynamics at a persistently active basaltic volcano. In order to track magma storage and ascent, we compare geochemical data on fast quenched glasses (melt inclusions, Pele's hairs, coarse ash fragments produced by lava-sea water interaction, glassy crust of lavas, high-temperature lavas quenched in water, matrix glasses) with the geophysical record of volcano unrest. Petro-chemical data suggest that the shallow PdF plumbing system is formed by a network of small sized magma pockets (sills). We explicitly link its formation and emptying with periodic magma recharges from deeper levels and repeated caldera collapses, which frequently affect the central cone of PdF. In spite of the large range in fountain intensity, dissolved volatiles contents are low and almost constant. Multistep ascent of magma inputs is identified as the key mechanism determining the evolution towards open system degassing and in fine controlling eruptive behavior.