Geophysical Research Abstracts
Vol. 14, EGU2012-7760, 2012
EGU General Assembly 2012

Simultaneous pyroclastic and effusive venting at rhyolite volcanoes: the cases of Puyehue-Cordón Caulle and Chaitén

J.M. Castro (1), C. I. Schipper (2), and H. Tuffen (3)

(1) University of Mainz, Institute of Geosciences, Mainz Germany (castroj@uni-mainz.de), (2) ISTO-CNRS, University of Orleans, Orleans, France, (3) Lancaster Environment Centre, Lancaster University, Lancaster, UK

The recent silicic eruptions at volcán Chaiten and Puyehue-Cordón Caulle (PCC) demonstrate that ash and pyroclast production characterizes not only the vigorous initial stages of these eruptions, but can continue on for months, even during the effusive phases of activity. As we observed at PCC in January, 2012 and at Chaitén in 2008-2009, pyroclastic venting taking the form of ash jetting and punctuated Vulcanian blasts (Schipper et al. this session) occurs simultaneously with lava effusion (Tuffen et al., this session) and does so from what appears to be a common vent. This close spatial and temporal correlation implies a genetic and/or causal relation between two very different eruption styles. In this paper, we explore the chemical and physical signatures of this pyroclastic-effusive bridge, and discuss mechanisms by which silicic magma degasses to produce simultaneous, but apparently disparate eruption styles.

Geochemical and textural analyses are underway on a range of eruption products from PCC and Chaitén, including early air-fall pyroclastic obsidian and pumice lapilli, ballistic bombs collected within 2 km of the vents, and glassy lavas. Ballistic bombs display a variety of textures ranging from homogeneous glassy obsidian through breadcrusted and highly brecciated bombs with re-annealing textures (e.g., collapsed foams and rewelded obsidian fragments). Bombs from Chaitén contain abundant tuffisites, comprising planar to anastomising veins filled with variably welded juvenile ash. At Chaiten, ballistic bomb water contents ($\sim$0.3-1.2 wt.% H_2O) and H_2O/OH speciation suggest that bombs are shallowly sourced («1 km) in the conduit and experienced similar pre-ejection cooling paths to magma that would become obsidian lava. These preliminary observations suggest that bombs are aliquots of magma attempting to become obsidian lava but this development was arrested by the build up of overpressure in the conduit followed by explosive evacuation. The build up of pressure depends on the permeability of the ascending magma, which is likely a function of the density of fractures and vesicularity of magma bodies. Thus factors that affect permeable flow through fractures and interconnected bubble pathways, such as magma deformation, ascent rate and rheology (relating to degassing path and cooling), likely control the cycling of explosive episodes during effusive activity. We are currently exploring how rheological and dynamical parameters inferred from samples can be related back to eruption observations at PCC, including the frequency of explosions and effusion and degassing rates, in order to evaluate the role of pyroclastic venting on the production of dense degassed rhyolite magma (lava). That explosive activity has persisted at PCC for several months suggests that a balance is maintained between the overpressure driving magma supply and the cycles of mechanical failure that typify pyroclastic and effusive activity at the PCC vent.