Geophysical Research Abstracts, Vol. 7, 04987, 2005
SRef-ID: 1607-7962/gra/EGU05-A-04987

Numerical simulation of the eruptive dynamics of volatile-rich magma in magma chambers and volcanic conduits

A. Longo (1), M. Barsanti (2) and P. Papale (1)

(1) Istituto Nazionale di Geofisica e Vulcanologia, Centro di Modellistica Fisica e Pericolosità dei Processi Vulcanici, Pisa, Italy.(2) Dipartimento di Matematica Applicata, Università di Pisa, Italy.

The recently developed $gales$ numerical code for the simulation of the dynamics of multicomponent single fluid compressible to incompressible flows is applied to simulate the behaviour of suddenly depressurised volatile-rich magma in magma chambers and volcanic conduits. The physico-chemical properties of magma (density, viscosity, heat capacity, and volatile saturation) depend on local conditions in terms of pressure, temperature, and composition. Parametric studies allow the investigation of the eruption dynamics for several pre-eruptive volatile content and distribution, magma composition and viscosity, and assumed boundary conditions. Numerical results describe the evolution in time and space of magma in the chamber + conduit system, the paths of magma withdrawal, the possible occurrence of magma mixing, and allow to determine mass flow-rates and flow conditions at different times and relevant locations such as volcanic conduit base and exit. Transient dynamics in the opening eruptive phase show processes at the conduit entrance which have never been described before with numerical studies, and which are characterized by pressure oscillations with variable amplitude and 2-4 Hz frequency, as well as significant vorticity in velocity patterns. The computed relationships among magma composition and properties, boundary conditions, and eruptive dynamics are described.