Geophysical Research Abstracts, Vol. 9, 05336, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-05336

Degassing low-viscosity magma: Quantifying the transition between passive bubble-burst and explosive activity

M. R. James, S. J. Lane, and S. B. Corder

Department of Environmental Science, Lancaster University, U.K.

(m.james@lancs.ac.uk)

At many volcanoes, low magma-viscosities allow persistent degassing over a range of styles ranging from 'explosive' Strombolian activity to gas 'puffing' and passive degassing. It is generally accepted that Strombolian eruptions reflect the bursting of large bubbles (gas slugs) at the magma surface and that relatively quiescent 'puffing' indicates the presence of significantly smaller bubbles or slugs. However, despite growing numbers of geophysical measurements, a qualitative understanding of the relationship between the gas volumes involved and the energetics of the associated activity has not yet been attained.

Here, we investigate this relationship using a straightforward parameterisation based on purely static considerations of an expanding gas volume. We derive a dimensionless parameter,P^*_{slim}, which represents limiting conditions within the static model and allows different regimes of 'burst vigour' to be distinguished and quantified. For $P^*_{slim} \leq 1$, 'passive' activity is anticipated and measurable geophysical signals at burst are implied to be small. For $P^*_{slim} > 1$, no valid solution to the static model exists at the liquid surface, implying that dynamic pressurisation of the ascending gas must occur. Therefore, slugs will burst energetically, and increasingly so, with increasing P^*_{slim}.

Various physical parameters recorded during laboratory experiments and simulated with numerical models (e.g. pressure pulse magnitudes and apparatus displacements) are shown to demonstrate the same trends when parameterised byP^*_{slim}. Hence, P^*_{slim} provides a straightforward relation between measurable changes in surface burst ef-

fects and the system’s subsurface physical parameters.