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Bubble convection within magma reservoirs EMMANUELLA BOUCHE, SYLVIE VERGNIOLLE, YVES GAMBLIN, ANTONIO VIEIRA, Institut de Physique du Globe de Paris — Volcanoes are gas-rich hence small bubbles slowly rise in magma reservoirs. Under certain condition of gas flux, bubble size and reservoir height, the bubble rise is no more homogeneous: the collective buoyancy of the bubbles produces instabilities and the bubble motion becomes driven by convection. If such a convection occurs, the residence time of bubbles in the reservoir is reduced and thus eruptive activity is modified. By analogy with thermal convection, we define Rayleigh (Ra_b) and Prandtl (Pr_b) numbers for bubble convection. However, the critical Ra_b for bubble convection is hardly known from previous studies and its dependence to Pr_b is ignored. Laboratory experiments are performed with small bubbles rising in a cylindrical tank filled with viscous oils in order to quantify bubble convection and apply it to real volcanoes. Ra_b and Pr_b are acurately determined from measurement, via two hydrophones, of bubble size and gas volume fraction. Bubble velocity is obtained by PIV. Experiments show two main regimes: a steady cellular regime at low Rab and a bubble plume regime when Rab is higher. The critical Ra_b depends on the critical Pr_b for the two transitions.

Emmanuella Bouche
Institut de Physique du Globe de Paris

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