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Permeability Measurements on selected Volcanoes of the Ring of Fire: Implications for Fragmentation Behavior and Pore Texture

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For the investigation and modelling of the processes associated with explosive volcanism it is inevitable to understand the fundamental physical properties of the rock material involved. The gas permeability as one of those rock properties is a decisive measure for the eruptive style and thus the explosivity of a volcano, since it directly influences magma fragmentation behaviour. If a decompressive event (e.g. a sector collapse) affects magma with overpressurized vesicles, two possible scenarios are conceivable: (1) a permeable network has been established and the permeability of this interconnection is sufficiently high, so vesicle overpressure can be reduced efficiently by gas filtration. (2) the permeability of the network is low and gas overpressure can not be reduced within the time scale required to avoid fragmentation. In this case the expansion of pressurized gas may cause bubble wall failure and fragmentation of magma into pyroclasts.

In order to realistically simulate volcanic gas filtration processes we perform gas permeability measurements under strongly transient conditions, using a shock-tube based fragmentation bomb. In this study permeability measurements of dome rock and pumice material from selected circumpacific volcanoes (St. Augustine (USA), Colima (Mexico), Bezymianni, (Russia), Krakatau, and Kelut (both Indonesia)) are compared with permeability data of various other volcanoes of the world. On the basis of this dataset, the influence of different pore textures on the degassing efficiency is highlighted. Concurrent fragmentation threshold determinations using the same material and investigations of generated pyroclasts allow a quantification of the influence of

the sample permeability on the fragmentation threshold pressure and on the resulting pyroclast size.

This work is part of the BMBF project SUNDAARC which aims to quantify the potential risk of selected highly-explosive volcanoes by a combination of field and laboratory investigations.