# Dynamics and Timescales of Pulsatory Volcanic Activity

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Pulsatory eruptions are the product of complex stochastic systems within which several physical processes, characterised by distinct timescales, interact. The quantification of the properties of these eruptions is essential not only for the comprehension of the mechanisms controlling their explosivity, but also for classification purposes. We quantify this periodicity based on the distribution of the repose time intervals between single explosive events in relation to magma properties and eruptive styles. A broad range of pulsatory eruption styles are considered, including Strombolian, violent Strombolian and Vulcanian eruptions. We find a general relationship between the median of the observed repose times in eruptive sequences and the viscosity of magma. This relationship applies to the complete range of magma viscosities considered in our study (102 to 109 Pa s) eruption length, eruptive style and associated plume heights, suggesting that viscosity is the main magma property controlling eruption periodicity. Furthermore, the analysis of the explosive sequences as renewal processes provides further information: dynamics of pulsatory activity can be successfully described in terms of frequency and regularity of the explosions, quantified based on the log-logistic distribution. A linear relationship is identified between the log-logistic parameters, μ and s. This relationship is useful for quantifying differences among eruptive styles from very frequent and regular mafic events (Strombolian activity) to more sporadic and irregular Vulcanian explosions in silicic systems. The time scale controlled by the parameter μ, as a function of the median of the distribution, can be therefore correlated with the viscosity of magmas; while the complexity of the erupting system, including magma rise rate, degassing and fragmentation efficiency, can be also described based on the log-logistic parameter s, which is found to increase from regular mafic systems to highly variable silicic systems.