Degassing of magmatic columns is an unsteady, pulsatory process, characterized by fluctuations in both intensity and composition of emitted gases. This can be sometimes associated to infrasonic and seismic signals recorded at several volcanoes. However, unambiguous interpretation of geophysical data in terms of degassing dynamics is still not possible, due to our only partial knowledge of the physical processes controlling the dynamics of two-phase flows in magmas.

We performed a series of experiments reproducing magma degassing in a 6.5m tall and 0.25m large cylindrical bubbly column. The experiments coupled observations with high-speed camera and pressure sensors of the internal dynamics of the column with infrasonic waves recorded in the surrounding atmosphere outside the liquid.

Internal pressure oscillations characterize the two-phase flow dynamics for all the analyzed conditions and are marked by characteristic frequencies, which vary with the gas flow rate, the column height and the flow regime. Bubbly flow regimes are marked by monochromatic oscillations with period and amplitude increasing with gas flow rate, whereas slug flow regimes display more complex spectra with multiple peaks.

Pressure variations in bubbly flows appear dominated by gravity-driven stationary oscillations of the liquid column induced by the bubble gas hold-up clusters. In slug flow regimes, pressure variations are instead controlled by the passage and burst of the gas slug, with bottom-up propagation of pressure at different heights according to the flow rate. The frequency of the main peak of the spectrum in slug flow regimes increases with increasing gas flow rate.