An experimental approach to investigate seismo-acoustic markers of degassing patterns

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The analysis of geophysical patterns enables tracking the surface effects of sub-surface volcanic processes with great detail and provides a fundamental tool for the surveillance of active volcanoes. The full exploitation of geophysical data (in particular seismic and infrasonic) requires the capability of linking quantitatively fluid dynamics and degassing processes at depth with signals recorded at the surface. Nonetheless, the outcomes of the attempts made so far are still considered very uncertain because of volcanoes inaccessibility to direct observation on fundamental parameters such as plumbing system geometry and magma properties. This issue can be solved by integrating field measurements with laboratory experiments. To this extent, we developed a novel experimental device aimed to mimick volcano degassing processes with different regimes and gas flow rates, and allowing for the investigation of the related seismo-acoustic emissions. The implemented device permitted us to (i) precisely fix and control fundamental parameters such as the geometry of the structure where the two-phase analogue mixture flows, the gas flow rate (5-180x10^{-3} l/s), and the fluid viscosity (10-1000 Pas); (ii) measure micro-seismic signals in fixed locations of the analog conduit by means of an array of laboratory sensors (including one microphone, two piezo-film sensors and one accelerometer); (iii) directly observe the degassing pattern through the optically clear analog magma and define the degassing regime producing the seismo-acoustic radiations.