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Magma vesiculation and infrasonic activity at Stromboli

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Stromboli, Italy, is an open conduit volcano characterized by frequent explosions and persistent active degassing. During active degassing (or puffing), when the gas approaches the surface at overpressured conditions, the magma column is interested by the bursting of small gas bubbles at the magma free surface and, as a consequence, the active degassing process generates infrasonic signals. We postulated, that the rate and the amplitude of infrasonic activity is somehow linked to the rate and the volume of the overpressured gas bubbles, which are generated in the column. The hypothesis is that infrasound is controlled by the quantities of gas exsolved in the magma column and then, that a relationship between infrasound and the vesiculation process should exist. To achieve this goal, infrasonic records and bubble size distributions of scoria samples from normal explosive activity processed via X ray tomography have been compared. The cumulative distribution for both data sets follow similar power laws. However the power law is not stable but changes in different scoria clasts, reflecting when gas bubble nucleation is predominant over bubbles coalescence and viceversa. The power law also changes for the infrasonic activity from time to time, suggesting that infrasound may be controlled also by a different gas exsolution within the magma column. Changes in power law distributions are the same for infrasound and scoria indicating that they are linked to the same process acting in the magmatic system. We suggest that monitoring infrasound on an active volcano could represent an alternative way to monitor the vesiculation process of an open conduit system.