



High-speed imaging of explosive activity at Stromboli Volcano, Italy.

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Stromboli volcanic island, located in the southern Tyrrhenian Sea, hosts persistent basaltic explosive activity from a crater terrace near its summit. In the first week of September 2008, a number of vents, clustered in three areas, were characterized by specific explosion styles. Activity at the easternmost vent consisted of jet-like gas emissions, often bearing sparse ash particles with occasional low-intensity spattering, while the nearby vent of the same area produced abundant scoria spattering without any visible ash emission. On the western vent area spattering occurred, and, of two adjacent vents, one produced ash-loaded blasts with the formation of a buoyant plume, while the other produced spattering of coarse-sized scoria, the two vents often erupting simultaneously. Pulsating degassing, with no clast emission, occurred in a third vent area.

From a favorable location above the crater terrace, we recorded the above explosive activity styles at 500 frames per second by using a professional high-speed camera and lenses. The monochrome camera is also sensitive to the near-infrared spectral region, allowing discriminating hot and ambient-temperature clasts. The above set-up provided, for each of the different explosion styles, unparalleled time-resolved visual information about explosion development and pyroclast size and ejection velocity. In addition, the high-speed recordings allows parameterization of a range of dynamic processes previously poorly-reported or quantified for basaltic explosions, including in-flight deformation and fragmentation of large scoria, pre-explosion lifting of a debris plug from the vent, syn-eruptive shifting of the emission point within the same vent, and rhythmic velocity fluctuations of the erupted gas-pyroclast mixtures.