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Discrete blasts in granular material yield two-stage process of cavitation and granular fountaining

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A discrete blast within granular material, such as a single subterranean explosion within a debris-filled diatreme structure, is typically considered to produce a single uprush of material. Our experiments demonstrate that apparent "debris jet deposits" can be formed by a two-stage process of cavitation and subsequent granular fountaining. Bench-scale experiments reported here demonstrate that for a range of overpressures and depths, individual, discrete, buried gas blasts open space and expel particles from the blast site in two largely decoupled stages. Expanding gas initially pierces material nearest the blast source to open a cavity above it; then a fountain of grains rises from the source into the cavity. This staged motion dynamically segregates source grains from host-material grains, and the rates of cavity opening vs. fountain rise show a power-law decay relationship with initial pressure. Our experimental analysis has implications for maar-diatreme systems, field-scale detonation experiments, and underground nuclear testing.