

Experimental craters formed by single and multiple buried explosions and implications for volcanic craters with emphasis on maars

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Craters at many volcanoes, including most maars, are formed by multiple subsurface explosions. Experiments compared the crater formed by a single large, buried explosion, with craters formed by multiple explosions with the same cumulative energy. Explosive charges were detonated in pads composed of layered aggregates, in three configurations: (1) a single large charge buried near its optimal crater excavation depth; (2) three charges, each with 1/3 the energy of the first one, buried at approximately the same depth with respect to the original pad surface; (3) the same three charges buried successively deeper. Final crater size in the multiple explosion cases is not a good indicator of the energy of individual explosions. However, crater morphology, and ejecta volume and distribution can be good indicators of explosion energy and depth. The experimental explosions also demonstrate a mechanism for formation of dilute, fine-grained pyroclastic density currents driven by the collapse of a coarse mixture and lateral expulsion of dusty gas. These results directly impact the estimate of the energy released by past maar eruptions and future hazard assessments.