The 2008 eruption of Okmok volcano, Alaska: Ascent of magma into shallow intracaldera groundwater system and resulting ephemeral landforms

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Okmok volcano, a young, largely basaltic andesite caldera system in the Aleutian Islands of Alaska, erupted explosively over a 5 week period between July 12 and August 23, 2008. The eruption was predominantly phreatomagmatic, ultimately generating an estimated 0.4 km3 (bulk volume) of tephra that covered much of northeastern Umnak Island. Eruption onset was abrupt and explosive, producing a tephra column that reached 16 km above sea level in the first four hours. Subsequently, tephra emission was of variable but much lower intensity through the eruption's end. Okmok is remote and the eruption was poorly constrained by eyewitness observations. Four synthetic aperture radar images taken during the eruption, combined with post-eruption fieldwork and analysis of photography, record a complex sequence and evolution of explosion and collapse craters, and development of a several hundred meter high tuff cone.

The eruption began as ascending magma encountered shallow groundwater beneath the caldera floor, prompting multiple explosions along a crudely arcuate zone about 2 km long. At least six overlapping, 100 to 300 m diameter craters formed within, and adjacent to, a larger crater that had destroyed part of a prominent post-caldera cone. Continued venting promoted coalescence of the new craters and by day 12 only four distinct, larger craters were visible. Two of these in the center of the 2 km long zone ultimately formed distinct positive relief features (tephra cones) that served as primary vents for much of the eruption. Craters at each end of this zone appear to have hosted sporadic explosions but were not sites of continuous ash emission. These marginal craters grew further in size through the eruption by additional explosions and collapse. Both filled with water during and after the eruption. Vigorous post-eruption erosion and deposition are rapidly altering these craters and will likely, within a very short time, render them unrecognizable as part of the initial 2008 vent system. Similarly, several dozen 10 to 200 m wide collapse craters that formed north of the primary eruptive vents prominent in the weeks following the eruption were quickly degraded beyond recognition. The strong involvement of water, complex explosion histories, and rapid reworking that occurs during protracted phreatomagmatic eruptions may frequently obscure details of initial vent geometry. Documentation of this process during the 2008 eruption of Okmok volcano, Alaska, serves as a cautionary note for interpreting older phreatomagmatic deposits and landforms.