

Title:

Reconstruction of a Phreatic Explosion from Block Dispersion Modeling at King's Bowl, Idaho

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Abstract

King's Bowl (KB), located in Idaho's eastern Snake River Plain, was formed by a phreatic blast through a mostly-congealed lava lake. Blocks up to ~2m diameter were ejected from the vent to form a ballistic

ejecta blanket extending radially more than 100m. The blocks on the western side of the KB fissure are extraordinarily well exposed, as the fine fraction was blown eastward by ambient winds during the explosion. We present preliminary modeling results using the western ballistic blocks of KB to calculate the energy of the eruption, and the water volume necessary to create the blast. This work is presented in conjunction with two other 2014 AGU conference abstracts submitted by NASA SSERVI funded FINESSE (Field Investigations to Enable Solar System Science and Exploration) team members: Hughes et al., which introduces the geology of KB and Sears et al., which discusses field observation and data trends. Results of this research are extensible to steam-driven pits on other solar system bodies, including those observed on Mars, Phobos, Deimos, and the asteroids. Over 600 blocks ranging from .2 to 2m in diameter were mapped using differential GPS and measured for 3 axial lengths and vesicularity. Mass calculations were corrected using a scaling factor determined from measurements of 100 blocks at KB, coupled with targeted density measurements. The dispersed block trajectories were modeled using a fourth order Runge-Kutta solution of the equations of motion to calculate suites of possible ejection speeds and angles. The resulting characteristic vent velocities were used to calculate the kinetic energy necessary to evacuate the crater at KB; energy required for fragmentation is neglected at this time. Total mass in the kinetic energy calculations was calculated by two separate methods: 1) current volume expression of the KB crater and 2) an additive solution of the ejecta field as determined from radial transect surveys. From the kinetic energy we calculated the pressure behind the eruption, leading to the quantity of water required to create the phreatic blast.