

King's Bowl Pit Crater, Lava Field and Eruptive Fissure, Idaho - A Multipurpose Volcanic Planetary Analog

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### **Abstract**

King's Bowl (KB) and its associated eruptive fissure and lava field on the eastern Snake River Plain, is being investigated by the NASA SSERVI FINESSE (Field Investigations to Enable Solar System Science and Exploration) team as a planetary analog to similar pits on the Moon, Mars and Vesta. The  $2,220 \pm 100$  BP basaltic eruption in Craters of the Moon National Monument and Preserve represents early stages of low shield growth, which was aborted when magma supply was cut off. Compared to mature shields, KB is miniscule, with  $\sim 0.02$  km<sup>3</sup> of lava over  $\sim 3$  km<sup>2</sup>, yet the  $\sim 6$  km long series of fissures, cracks and pits are well-preserved for analog studies of volcanic processes. The termination of eruption was likely related to proximity of the  $2,270 \pm 50$  BP eruption of the much larger Wapi lava field ( $\sim 5.5$  km<sup>3</sup> over 325 km<sup>2</sup> area) on the same rift. Our investigation extends early work by R. Greeley and colleagues, focusing on imagery, compositional variations, ejecta distribution, dGPS profiles and LiDAR scans of features related to: (1) fissure eruptions - spatter ramparts, cones, feeder dikes, extension cracks; (2) lava lake formation - surface morphology, squeeze-ups, slab pahoehoe lava mounds, lava drain-back, flow lobe overlaps; and (3) phreatic steam blasts - explosion pits, ejecta blankets of ash and blocks. Preliminary results indicate multiple fissure eruptions and growth of a basin-filled lava lake up to  $\sim 10$  m thick with outflow sheet lava flows. Remnant mounds of original lake crust reveal an early high lava lake level, which subsided as much as 5 m as the molten interior drained back into the fissure system. Rapid loss of magma supply led to the collapse of fissure walls allowing groundwater influx that triggered multiple steam blasts along at least 500 m. Early blasts occurred while lake magma pressure was still high enough to produce squeeze-ups when penetrated by ejecta blocks. The King's Bowl pit crater exemplifies processes of a small, but highly energetic eruption that ejected blocks up to 2 m strewn over 200 m onto the lava lake surface.