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Compositional Evolution of the Eight Youngest Lavas Erupted at Craters of the Moon Volcanic Field, Idaho, U.S.

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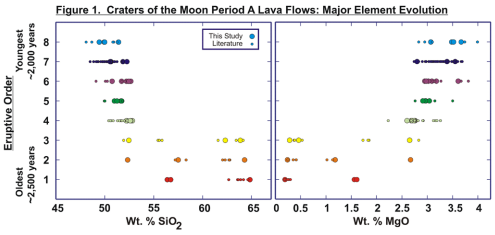

The Craters of the Moon volcanic field on the Snake River Plain in southern Idaho is the largest Late Pleistocene to Holocene lava field in the conterminous U.S. and has produced at least 60 eruptions over the past 15,000 years [1,2]. This polygenetic activity has been episodic, with centuries-long inactive intervals between active eruptive periods. Each of the eight active periods produced multiple eruptions characterized by effusive lavas with associated cinder and spatter cones and small shields, erupted along the northern end of a fissure system known as the Great Rift. The most recent active eruptive period (Period A) produced a series of eight lava flows between 2500 and 2000 years ago with volumes ranging from 0.03 to 3.4 km^3 [3]. In this study, new major and trace element and radiogenic isotope (Sr, Nd, Pb) data show this youngest series of flows exhibits broad changes (Figure 1) that reflect periodic withdrawals from an evolving magma source. The first three flows in the series are thick, blocky a'a flows with the highest silica contents and broadest compositional heterogeneity, ranging from basaltic trachyandesites to trachytes. Their chemical and isotopic characteristics reflect extensive fractional crystallization and crustal assimilation, suggesting relatively longer residence times in shallow crustal storage prior to their eruption. The latter five flows are mostly pahoehoe and trended increasingly to more mafic and primitive compositions (basaltic trachyandesites to basalts), suggesting an increasing proportion of a recharge magma from deeper in the system and shorter shallow storage times. These later eruptions were more homogenous but still show intra-flow variability reflecting incomplete magma homogenization. Seven of the eight flows were erupted within 2 km of each other on the Great Rift, but the sixth eruption in the series was sourced 3-5 km to the south of the others, and has a distinct composition that suggests assimilation of a different crustal component.

[1] Kuntz, Champion, Spiker, and Lefebvre (1986), GSA Bulletin, 97, 579-594; [2] Putirka, Kuntz, Unruh, and Vaid (2009), Journal of Petrology, 50, 1639-1665; [3] Kuntz, Spiker, Rubin, Champion, Lefebvre (1986), Quaternary Research, 25, 163-176.