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Paper No. 3

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TEMPERATURE-PRESSURE (DEPTH) ESTIMATES OF MAGMAS FROM THE CRATERS OF THE MOON AND NEARBY LAVA FIELDS, ID, BASED ON MINERAL-MELT EQUILIBRIA: PRELIMINARY RESULTS

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The extensive and recurrent nature of basaltic volcanism in the eastern Snake River Plain is a product of the thermal renovation of the mantle and crust due to the Yellowstone hotspot. Through the application of igneous thermobarometers we attempt to provide a thermal-depth-composition framework for this most obvious legacy of that process. Among the key issues are the following: do the pressures or temperatures of magma stagnation vary with the volume or timing in an eruption sequence? Similarly, do P-T conditions of crystallization relate to major element chemistry the manifestation of liquid differentiation? The Craters of the Moon and nearby lava fields provide a unique opportunity to explore these issues since ages, volumes and bulk compositions are well characterized. Our present study expands upon earlier efforts to understand the mineral chemistry of the region (Stout et al., 1994). Our key finding is a systematic decrease in crystallization T with time (most pronounced when T is plotted vs. stratigraphic sequence); this observation is manifest in temporal decreases of plagioclase An and olivine Fo contents. The decrease in T is also a reflection of lava composition. Plagioclase T's drop from 1450 K for the early Little Prairie and Cerro Grande flows (14k-15k yr. bp), to 1207 K for the Highway flow (undated, but approx., 2.2k yr. bp), or a drop of 0.020 K/y. Olivines exhibit a similar rate of cooling at 0.016 K/y. In addition, temperature decreases as one moves from primitive olivine basalts to high-silica flows of the COM field. We tentatively conclude that these thermal differences reflect processes intrinsic to the volcanic plumbing system. Pressures were also calculated from plagioclase and (rare) clinopyroxene phenocrysts. Crystallization depths appear to vary with magma composition and vary continuously between 45 and 5 km. These data appear to support the magma plexus model of Kuntz (1992). An intriguing low-T excursion at 20 km may further indicate that at least some magmas may stall at the upper/lower crust boundary (Smith and Braile, 1994). In addition, some early lavas lie on a remarkably coherent P-T trend that is offset to higher T compared to other lavas. These more primitive flows may have been delivered by a conduit system connected to magma sources that are distinct from the conduits and sources that delivered younger, more silica-rich COM lavas.

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[T17. The Track of the Yellowstone Hot Spot: What is the Geology Telling Us About the Processes Below? II](#)

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