Magma chamber dynamics revealed at Heise caldera, Snake River Plain

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Within the Yellowstone-Snake River Plain volcanic province, basaltic lava fields of evolved composition (SiO_2 and FeOt at 44.3-62.9% and 7.8-16.7%, respectively) contrast with the spatially dominant, compositionally restricted 'monogenetic' fields. Our work highlights the petrographic and geochemical characteristics of ~25 m of evolved basalt recovered in the Sugar City drill core, near Rexburg, ID. We contrast these basalts to primitive olivine tholeiites and rhyolites recovered within the same drill core.

Sugar City evolved basalts (SCEB) typically contain phenocrystic olivine and plagioclase, pyroxene-plag-olivine clusters, are compositionally similar to basalts from the Craters of the Moon, and display radiogenic Nd and Sr isotope signatures. Along with textural evidence, i.e., two types of globules in glass phase, major element compositions for SCEB plot within experimentally derived 2-liquid fields [1] (SiO_2=47.0-53.1; FeOt<17.3). Olivines exhibit euhedral, skeletal/hopper, and 'spongy' morphologies. It is not clear if the 'spongy' olivines represent a crystallization versus dissolution process. Some olivines record core-to-rim diffusion profiles (Fo_{82-60}), while other unzoned-olivines reach as low as Fo_{45}: high-Fo cores cannot be in equilibrium with the bulk rock composition. In total, these features are important for contrasting ascent paths and rates of ascent, and can be used to imply unique magma conditions, with possible multiple levels of storage. We use these observations to recreate the plumbing system underneath the Heise caldera and make implications about caldera life-cycles.

[1] Charlier and Grove (2012) *CMP* **164**, 27-44.