Kīlauea 2008: Primitive components and degassing recorded by olivine-hosted melt inclusions and matrix glasses

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Simultaneous summit and rift zone eruptions in 2008 reflect a shallow eruptive plumbing system inundated by a bourgeoning supply of new magma from depth. Comparisons of olivine-hosted melt inclusions, host glass, and bulk lava compositions of magma erupted at both the summit and East Rift Zone demonstrate chemical continuity at both ends of a well-worn summit-to-rift pipeline. Our analysis of high-temperature summit pyroclasts shows the predominant and most primitive component erupted to be a homogenous, trace-element depleted melt, relative to prior summit eruptive products. This component is a genetic match for all post-1998 rift lava and distinct from enriched signatures of recent and historic summit lava.

These results suggest that both eruption sites share a common magma source. East Rift Zone melt inclusions (50.8 wt% SiO_2, 7.7 wt% MgO), however, are slightly more fractionated relative to summit material (50.6 wt% SiO_2, 8.4 wt% MgO). In addition, melt inclusions from summit material are sulfur enriched relative to East Rift Zone inclusions, with S concentrations typically ranging from 1200 to 1000 ppm at the summit. Melt inclusions from East Rift Zone spatter record a range of S concentrations from ~1200 to 300 ppm, only slightly elevated relative to matrix glass (~200 ppm S). Average Fluorine and Chlorine concentrations in East Rift Zone and summit melt inclusions are equivalent, indicating little to no halogen degassing concurent with sulfur degassing. Olivine core and rim compositions are also more evolved in East Rift Zone lavas, although a small population of melt inclusions and olivine hosts match compositions erupted at the summit. Olivine-hosted melt inclusions and matrix glass confirm prior models indicating that both the Kīlauea summit and East Rift Zone share a magma source and portray a history of magma degassing and minor olivine crystallization with cooling during transport over 16 km from the summit to the East Rift Zone.

Controls on groundwater geochemistry and arsenic mobilisation processes in aquifers of Eastern Europe (Pannonian Basin)

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The Pannonian Basin, found in Eastern Europe, spans Hungary, Romania, Serbia and Croatia. Groundwaters in Quaternary and Neogene sediments from this region are known to contain elevated levels of naturally occuring arsenic (see also [1]). These aquifers are utilised by the local population for drinking water with published estimates predicting ~ 750,000 people, the largest group so affected in Europe, are impacted by these high levels of As.

A range of artesian (70–800 m), thermal (400–3000 m) and pump (70–200 m) wells in Hungary and Romania were sampled to identify the general groundwater chemistry and arsenic mobilisation processes. As was predominantly in the reduced form (AsIII), and over half of all wells contained >10 µg/L As (WHO and EU limits for drinking water) [1].

Due to the complex nature of the water chemistry, cluster analysis was used to identify groups of similar groundwaters. Two dominant water groups were revealed, (A) end member waters with geochemistry controlled by thermal and marine influences, both containing low As (<10 µg/L), and (B) waters showing a mixing trend between end member waters and meteoric waters with variable As (<0.5 µg/L to 220 µg/L). Differing As concentrations between these groups imply that it is not sourced from external inputs, i.e. As rich geothermal waters, but from in-aquifer processes.

Waters in group B contained high DOC, PO_4, NH_4 and CH_4, and variable SO_4 and H_2S. Geochemical reasoning implies that As is released by reductive dissolution of As bearing Fe-oxides. Subsequent controls on the concentration of As are thought to be due to the variability of SO_4 and H_2S in the waters. Low As waters in group B have higher concentations of SO_4 and under the naturally reducing conditions within the aquifers, sulphate reduction could lower As concentrations in groundwater by the formation of As-bearing sulphides. In contrast, waters containing higher As in the same group have minimal levels of SO_4 and so As released by reductive dissolution remains in solution.

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