Behavior of PGEs and Re in Kilauea Iki lava lake, Hawaii

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Kilauea Iki lava lake, which formed during the 1959 summit eruption of Kilauea Volcano, and then crystallized and differentiated over a period of 35 years, offers an opportunity to evaluate the behavior of trace elements in a uniquely well-documented basaltic system.. A suite of core samples recovered from 1967 to 1981, of known major element composition, has been selected for analysis of 5 platinum group elements (Ir, Os, Ru, Pd, Pt) plus Re. Samples analyzed to date have compositions ranging from 2.4 to 27 weight % MgO, with temperatures prior to quench ranging from 1140^{o} C to ambient (110^{o} C). Two eruption samples have also been analyzed.

Bulk compositions of the more magnesian (MgO = 7.5 to 27%) samples reflect variation in the amount of phenocrystic olivine (Fo86-87) present. Some of this variability is found in the eruption samples, but the larger range of bulk MgO seen in core samples reflectes redistribution of olivine after the lake crusted over. Samples with MgO < 7.5% are internal differentiates of the lava lake, and include coarse-grained ferrodiabasic segregation veins, their internal differentiates, and oozes that flowed into open bore holes during drilling. These more highly differentiated samples were formed by separation of crystal-poor melt from within the olivine-phyric mush, so allow determination of the trace element compositions of formerly interstitial melts.

Variation in the PGEs is dominated by variation in the amount of olivine and chrome spinel. Os and Ru are positively correlated with MgO content for samples with 7.5 to 27% MgO, with Os ranging from 0.017 - 0.96 ppb and Ru ranging from 0.24 - 2.0 ppb. These elements are concentrated in either the olivine phenocrysts or in chromite, which is present in the lake samples only as inclusions in olivine. Surprisingly, Ir is less well correlated with MgO content than Os and Ru. Re is negatively correlated with MgO, behaving as an incompatible trace element, as would be expected. Pt and Pd are somewhat erratic, possibly reflecting the variable presence of sulfides as inclusions in the olivine phenocrysts, although Pd shows some tendency to be negatively correlated with MgO. One of the most differentiated samples analyzed to date, a borehole ooze, shows higher concentrations of PGEs, notably Pt, than would be expected for its bulk composition.