The Behavior of Re & the Platinum Group Elements during Fractional Crystallization of the Kilauea Iki Lava Lake, Hawaii

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Abstract

Through the use of the isotope dilution method, concentrations of Rhodium and the Platinum Group Elements in picritic basalt from the Kilauea Iki lava lake were measured in order to improve our understanding of the behavior of these elements during volcanic events. The lava lake was formed as a result of the 1959 eruption of the Kilauea Iki volcano. Olivine was the dominant phase during eruption and fractional crystallization of the lake. The lake has a high average MgO content of approximately 15%. The basaltic studied MgO values range from 26.0 to 23.4 wt%. Osmium and Ruthenium behave as compatible trace elements with a positive correlation with MgO. Iridium did not correlate with MgO as well as osmium and rhenium but also appears to be incompatible. Rhodium, Palladium, and Platinum do not well correlate with MgO, although both Rh and Pd tend to decrease with increasing MgO, consistent with incompatible trace element behavior. The poor correlation for these elements may be an indication that their abundances are controlled by a phase other than olivine. The low abundances and variability of Re may also be the result of degassing during the eruption Kilauea volcano.

Kilauea Iki Lava Lake

- Formed during the 1959 eruption of the Kilauea Iki volcano (Figure 1).
- Located on the island of Hawaii.
- Has a high MgO content (15% MgO).
- Olivine is the dominant phase during eruption and fractional crystallization of the lake.
- The lake has a high average MgO content of approximately 15%.

Methods

- Chemical Separation
  - Metahioned and Carius Tubes cleaned in Acetone
  - Rhenium, Ru, Ir, Pt, and Pd were analyzed by Inductively Coupled Plasma Mass Spectrometry (ICP-MS).
  - Re and PGE concentrations in picritic basalts from the Kilauea Iki lava lake were measured in order to improve our understanding of the behavior of these elements during volcanic events.

Results

- Table 1: Samples examined for this study, in decreasing MgO content, their identification numbers, and measured Re and PGE concentrations.

Conclusions

- Concentrations of Re and PGE were measured in rhodochrosite from the Kilauea Iki lava lake. Rhodium (0.0004 to 1.06 ppb) and Ru (0.0034 to 2.01 ppb) displayed a good correlation with MgO content, indicating that Os, and in particular osmium, controlled these elements during fractional crystallization of the lake.
- Rhodium concentrations range from 0.0004 to 1.06 ppb, and Ru (0.0034 to 2.01 ppb) displayed a good correlation with MgO content, indicating that Os, and in particular osmium, controlled these elements during fractional crystallization of the lake.
- Rhodium and Ruthenium behave as compatible trace elements with a positive correlation with MgO. Iridium did not correlate with MgO as well as osmium and rhenium but also appears to be incompatible. Rhodium, Palladium, and Platinum do not well correlate with MgO, although both Rh and Pd tend to decrease with increasing MgO, consistent with incompatible trace element behavior. The poor correlation for these elements may be an indication that their abundances are controlled by a phase other than olivine. The low abundances and variability of Re may also be the result of degassing during the eruption Kilauea volcano.

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