

Geochemistry of Atmospheric Aerosols Generated from Lava-Seawater Interactions

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The prominent aerosol plume produced by lava-seawater interactions along the shoreline of Kilauea volcano, Hawaii was sampled with an airborne impactor. The concentrations of trace elements in the aerosol, normalized to their concentrations in Hawaiian basalt, showed an approximately linear log-log covariation with their emanation coefficient (an indicator of element volatility). Thus, more volatile elements were preferentially enhanced in the aerosol plume. The normalized aerosol concentrations also showed a consistent covariation with corresponding normalized concentrations in fumarolic venting from Kilauea, Kudryavy and Merapi volcanoes, even though the volcanoes are geologically dissimilar and there are different mechanisms of element volatilization occurring (lava-seawater interactions vs. magma degassing). Of particular note were atmospheric fluxes of Cu, Cd, Ni, Pb, Mn, Zn, Fe and P, which resulted in conservatively estimated regional ocean deposition rates >50 times greater than background levels. Thus, upper ocean volcanism can be an important source of both toxic and nutrient elements to the surrounding ocean. However, it appears unlikely that shallow ocean volcanism can exert a significant impact on the global ecosystem, even during the massive lava emplacements known to occur in the geologic past.