Mg isotope compositions of Hawaiian lavas

CHRISTOPHER DEFELICE[1]*, YAN HU[2], SHUI-JIONG WANG[2+], SHICHUN HUANG[1], FANG-ZHEN TENG[2]

[1]University of Nevada, Las Vegas, Las Vegas, NV 89154, USA (*correspondence: defelc1@unlv.nevada.edu)
[2]University of Washington, Seattle, WA 98195, USA
[+]Current address-Indiana University, Bloomington, IN 47405, USA

Hawaiian volcanoes evolve over time from producing primitive tholeiitic lavas during the shield stage to more evolved alkalic lavas during the postshield stage. At Mauna Kea, this transition is coupled with both isotopic and geochemical variations to the postshield Hamakua and Laupahoehoe Volcanics. Specifically, postshield stage alkalic lavas have a more depleted isotopic signature, i.e., lower $^{87}Sr/^{86}Sr$ and higher $^{143}Nd/^{144}Nd$, and are more evolved with lower MgO contents than shield stage tholeiitic lavas. Do stable isotopes also fractionate between eruptive stages of Hawaiian volcanoes? We investigate the Mg isotope systemics of 118 Mauna Kea and Mauna Loa shield and postshield lavas to explore possible Mg isotopic effects during the shield to postshield transition.

Our results show limited $\delta^{26}Mg$ variation in Mauna Kea and Mauna Loa shield stage lavas with MgO >10 wt. %, from -0.31‰ to -0.17‰, similar to the typical upper mantle estimate of -0.25‰ +/- 0.07. In contrast, there is more variable $\delta^{26}Mg$ in postshield stage lavas with MgO <10 wt.%, from -0.4‰ to -0.1‰. We observed both the highest and lowest $\delta^{26}Mg$ values in the postshield stage lavas. The lack of correlation between $\delta^{26}Mg$ and an alteration index, K_2O/P_2O_5, rules out $\delta^{26}Mg$ variation as a result of post-magmatic alteration process. It is unlikely that a single process, such as different degrees of partial melting, or a source difference between shield and postshield volcanism, can explain this postshield vs. shield $\delta^{26}Mg$ difference. Rather, the more variable $\delta^{26}Mg$ composition of postshield lavas may reflect a combined effect of several different processes, including more complex, multicomponent magmatic evolution.