Titanium Isotopic Compositions of Rocks from the Aegean Arc

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Published Ti isotopic compositions (expressed as $\delta^{49}Ti$; the deviation in ‰ of the $^{49}Ti/^{47}Ti$ ratio relative the OL-Ti standard [1]) of terrestrial rocks follow a well defined positive correlation with bulk rock SiO_2 concentrations and range between -0.05 to +0.55 ‰ [1]. This correlation has been interpreted to result from the preferential incorporation of light Ti isotopes in Fe-Ti-oxides during fractional crystallization, leaving behind a melt enriched in heavy Ti isotopes [1]. The correlation between $\delta^{49}Ti$ and bulk rock SiO_2 is linear until a SiO_2 concentration of around 68wt%. To better understand the mechanisms relevant for Ti isotope fractionation in magmatic systems, we present new Ti isotope measurements of co-genetic xenoliths from the Kos Plateau Tuff (KPT) in eastern Greece. We measured the $\delta^{49}Ti$ values of two rhyolites, three andesites, an olivine basalt, and a hornblende cumulate.

Similar to previously published data, a positive trend between $\delta^{49}Ti$ and SiO_2 content is observed in the KPT samples, ranging from -0.06 ± 0.035‰ in the magmatic hornblende cumulate to +0.66 ± 0.035‰ in the strongly differentiated rhyolites. The new data also confirm that at SiO_2 concentrations above 68 wt%, the $\delta^{49}Ti$-SiO_2 trend changes slope and becomes steeper. Modelling results suggest that either (i) more extensive crystallization of mineral phases with light $\delta^{49}Ti$ occurred at SiO_2 concentrations above around 68 wt%, resulting in a steeper increase in the $\delta^{49}Ti$ with SiO_2, or (ii) the analyzed intermediate rocks are the result of magma mixing between a rhyolitic and a basaltic melt.

Further modelling and analyses of mineral separates will help to better constrain the mechanims responsible for the fractionation of Ti isotopes in magmatic systems.

[1] Millet, M.A. et al. (2016) EPSL, 449, 197-205.