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Titanium isotopes of arc-derived calc-alkaline rocks

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Stable Ti isotope fractionation of igneous rocks has emerged as a powerful tool to explore magma differentiation and cumulate formation. Isotopically heavy evolved melts are reported from convergent, divergent and intraplate settings. While these heavy melts are eventually emplaced in mid- to upper crustal levels, information about their complementary cumulates that may form major isotopic reservoirs in deeper levels of the continental crust is sparse [1].

Modern (arc) crust formation is thought to take place in intra-oceanic subduction zone settings forming predominantly calc-alkaline magmas. To improve our understanding on the complex architecture and processes involved that built up island arcs and continental crust, coherent datasets on melts and related cumulates are essential.

Here we present a comprehensive Ti isotopic dataset for the liquid and cumulate lines of descent of medium K calc-alkaline to shoshonitic magmatic differentiation suites from various localities (Kos, Aegean arc, Greece; the Southern Alps, Adamello and Monzoni; Torres del Paine, Patagonia). The Ti isotopic composition of dacites and granites range between δ^{49}Ti ≈ +0.3 to +1.2‰, with heavier values for more alkaline granitic melts in agreement with published data. Mafic cumulates from related and additional localities are overall isotopically much lighter and range between δ^{49}Ti ≈ -0.15 and +0.08‰. Preliminary Rayleigh distillation modelling for arc-related Ti isotope fractionation and the approximated fraction of Ti (*f*Ti) that resides in the (modelled) melts and cumulates ($\Delta^{49}Ti_{cumulate\text{-}melt}$ ≈ -0.18) overall shows close correlation among different magmatic suites [1]. However, the preliminary Ti isotope fractionation model also indicates samples that deviate from the average differentiation trend, in particular those from cumulates that possibly experienced a more complex evolution.

We will discuss major parameters (e.g., the impact of initial magma composition, the role of melt-cumulate segregation, mineral-melt partitioning) and their implications on the formation and budget of the shallow and deep reservoirs of the continental crust.

[1] Storck, J. C., Greber, N. D., Duarte, J. F. V., Lanari, P., Tiepolo, M., & Pettke, T. (2023). Molybdenum and titanium isotopic signatures of arc-derived cumulates. *Chemical geology*, *617*, 121260.