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# Titanium isotopes as proxy for the composition of the Upper Continental Crust: promises, pitfalls and outlook

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The titanium (Ti) stable isotope composition of terrestrial reservoirs has received significant amount of attention in the last decade. Amongst them, the upper crust has probably been the most scrutinised. The reason for this are two-fold: Ti isotope display very large continuous variations with magma differentiation indicators (e.g. $SiO_2$, Mg#,...) and titanium is a notoriously insoluble element, which limits potential for stable isotope fractionation related to weathering of igneous rocks into detrital sediments. As such, the Ti isotope composition of detrital sediments held significant promise as powerful novel indicator of the mafic vs. silicic character of the upper crust through time.

Indeed, Ti isotopes have been used to argue for an early start to plate tectonics, potentially soon after the end of the Hadean eon. However, this view currently stands at odds with information from other geochemical tracers. This Interpretation may however be complicated by the recognition that i) the Ti isotope composition of detrital sediments can be affected by mineral sorting during transport and deposition and ii) that patterns of Ti isotope fractionation during magma differentiation are largely dependent of tectonic setting and magma composition.

Here, we will discuss how improved understanding of the mechanics of Ti isotope fractionation in magmatic and sedimentary systems can help us gain new insights into the Ti isotope record of detrital sediments. In particular we will focus on the conditions necessary to generate large isotope fractionations in igneous rocks and where these might be found and preserved in the geological record. These considerations will re-affirm the potential for Ti isotope to provide significant insights into the bulk composition of the Upper Continental Crust through times and its relation with evolving global tectonic regime.