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Titanium isotopes in the critical zone: A novel tracer for surface evolution?

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Recently, titanium isotopes have received increasing attention to understand surface processes such as sediment transport and soil formation. The higly insoluble nature of this element results in its accumulation along soil profiles. So far, only a smal difference in the Ti isotopic composition between a basaltic bedrock and the bulk saprolithe of $\Delta^{49}Ti_{basalt\text{-}saprolite}$ (+0.026 ‰) has been reported [1]. However, a small fraction of titanium is known to be mobile in soil solutions. The processes and conditions leading to Ti mobility are poorly constrained, and the behavior of Ti isotopes in the critical zone are largely unknown especially the hydrosphere and biosphere remain unstudied.

We present the first Ti isotope data of surface and ground waters, together with respective bedrock and soil profile samples collected in the Strengbach catchment in France [2]. Surface and river waters have very low Ti concentrations (ppt) and light isotopic compositions compared to the bedrock and the soil profile. We also provide the first Ti isotope data of plant samples from a greenhouse experiment conducted at the University of Bern, which suggest a preferencial uptake and accumulation of heavy Ti in both plant root and shoot . Our data help to constrain the behavior and fractionation of Ti in the critical zone and reveal a promissing tool to better understand the evolution of modern and paleo surface processes and construct the biogeochemical cycle of this element.

REFERENCES

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