Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.20577

Soil lithium isotopic response to land-use in a dry tropical agrosystem (Berambadi, South India)

DR. ARIJEET MITRA, PHD[1], SAMBUDDHA MISRA[2], PRISCIA OLIVA[3], JONATHAN PRUNIER[3], HUGO PRADALIER[3], CHRISTOPHE JOURDAN[4], STEPHANE AUDRY[3], LAURENT RUIZ[5,6] AND **JEAN RIOTTE**[3,7]

[1]Indian Institute of Science, Bangalore

[2]Indian Institute of Science

[3]Géosciences Environnement Toulouse, CNRS - IRD - UPS - CNES, Toulouse

[4]ECO&SOLS, Montpellier

[5]Indo-French Cell for Water Sciences, Indian Institute of Science

[6]Sol, Agro et hydrosystème, Spatialisation, INRAE, Institut Agro, Rennes

[7]IRD Montpellier

Presenting Author: jean.riotte@ird.fr

Chemical weathering of rocks and saprolite, caused primarily by root activity among which respiration-driven soil *p*CO2, is an essential source of nutrients for deep-rooted trees. The uptake of nutrients from the depth to the above-ground biomass and its subsequent recycling at the surface as litter fall might be a key for sustaining ecosystems. However, the quantification of this nutrient lift and the effect on deep weathering remain overlooked due to the hidden nature of the roots and complexity of the rhizosphere dynamics. In order to assess the possible effects of deep roots on the weathering intensity and availability of nutrients in the soils, we compared two thick weathering profiles with contrasted land-use from a dry tropical experimental watershed, Berambadi (SNO M-TROPICS, mean annual rainfall 800 mm/yr). Soil profiles consisted in Lixisols with contrasted land-use i.e., one in irrigated agriculture and the other in agroforestry with deep root system (*Tectona grandis* trees with short-cycle crops). Two scales were considered: (1) the evolution of soil properties along the whole soil profile (10m) and (2) the contrast between the root proximal environment (i.e. rhizospheric soil) and the bulk soil. We analysed the evolution of bulk soil properties up to great depth for major and trace element contents as well as lithium isotopic composition, primary and secondary mineral compositions.

In the agroforestry plot, lithium content ranged from 16 to 25ppm across the depth profile with a marked decrease at 25 cm depth and slight decrease at 500 cm. The shallow horizon was characterised by a heavy delta^{7}Li composition which is indicative of light lithium leaching and/or uptake by the shallow root system. By contrast, the deeper horizon of low lithium concentration was characterised by light delta^{7}Li composition (~4 permil lighter) which cannot be accounted for biological uptake mechanism. Rhizospheric soils had higher lithium concentration and heavier isotopic composition than the bulk soil, showing a higher weathering degree in the vicinity of the roots than in the surrounding soil. These first results indicate that deep root-related biogeochemical processes induce small-scale weathering heterogeneities in the deep critical zone that deserve further investigations.