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Impact of vegetation change on the mobility of uranium- and thorium-series nuclides in soils

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The effect of land cover change on chemical mobility and soil response was investigated using short- and long-lived nuclides from the U- and Th series. Indeed, the matching of these nuclides half-live to the pedogenic processes rates make these nuclides especially suitable to investigate either time or mechanism of transfers within a soil-water-plant system. This study was carried out from the experimental Breuil-Chenue site (Morvan mountains, France). The native forest (150 year-old) was partially clear-felled and replaced in 1976 by mono-specific plantations distributed in different stands. Following this cover-change, some mineralogical changes in the acid brown soil were recognized (Mareschal, 2008). Three soil sections were sampled under the native forest and the replanted oak and Douglas spruce stands respectively. The (238U), (234U), (230Th), (226Ra), (232Th) and (228Ra) activities were analysed by thermal ionization mass spectrometry (TIMS), inductively coupled plasma mass spectrometry (MC-ICPMS) and gamma spectrometry. Significant differences in U, Th, and Ra activities were observed between the soils located under the native forest or the replanted-trees stands, mostly dominated by a large uranium mobilization from the replanted soils. Moreover, all the investigated U and Th-series activity ratios show a contrasted trend between the shallowest horizons (0-50cm) and the deepest one (below 50cm), demonstrating the chemical effect of the vegetation change on the shallow soil layers. Using a continuous open-system leaching model, the coupled radioactive disequilibria measured in the different soil layers permit to quantify the rate of the radionuclides mobilities.

Reference:
Mareschal, L., 2008. Effet des substitutions d'essences forestières sur l'évolution des sols et de leur minéralogie : bilan après 28 ans dans le site expérimental de Breuil (Morvan) Université Henri Poincaré, Nancy-I.