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Weathering behavior of REE-Y in a granitic soil profile (Case of Strengbach watershed)

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Rare earth elements and yttrium (REE-Y) can be used as tracers of bedrock weathering and soil formation. One of the aims of this study is to better understand the different phenomena which impact the REE-Y mobilization and modify the REE-Y pattern along a soil profile. Our study has been performed on a granitic soil profile and soil solutions corresponding, sampled in a forest parcel covered with spruces from the Strengbach catchment. The behavior of the REE-Y pattern are compared with previously published results. The samples were collected from 2009 to 2013 and ultra-filtered to determine the spatial and temporal influence as well as that of the colloidal and dissolved fractions on the evolution of the REE-Y patterns. The EFTi of the soil indicates that during alteration process, phosphate minerals and zircon might be dissolved and induce the formation of secondary mineral phase like xenotime in the deeper soil horizons. The ultra-filtered soil solutions from humic horizon show that the REE-Y are principally enriched in the colloidal fraction controlling the REE-Y dynamic while in the deeper soil solutions colloidal and dissolved fractions influence the REE-Y. The mobility of REE-Y is controlled by the dissolution of the zircon and phosphate minerals, the precipitation of the REE-Y(PO4) and the evolution of OC with depth. The comparative study of the soil profile, soil water extracts and soil solutions show that (Eu*/Eu)DS anomaly reflects weathering of plagioclase in the micropores and the migration of the released Eu to the macropores, the (Ce*/Ce) anomaly, is stabilized by the electron shuttling of the humic acid (aromaticity) and provides information on the redox conditions only in the deeper soil horizons depleted in humic acid and finally the HREE enrichment in the deeper soil solutions results from the partial dissolution of secondary minerals in the upper soil horizons (above 30 cm depth).