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FRACTIONATION OF RARE EARTH ELEMENTS FROM SOILS OF TROPICAL LOWLAND RAINFORESTS IN SRI LANKA

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Lanthanide series elements (La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu) in the periodic table are well-known as rare-earth elements (REEs). They are useful in assessing the soil formation processes under tropical weathering and are considered highly immobile and mostly retained in the soil profile. In this study, we investigated two undisturbed soil formations in order to understand the mechanisms that are responsible for both the mobility and fractionation of REEs under tropical weathering conditions. Soil samples were collected from tropical lowland rainforests (TLRFs) of Kanneliya and Pitadeniya-Sinharaja in southern Sri Lanka. Sampling was carried out in two predefined plots of each forest. Soils were collected systematically up to 25 cm depth from the surface after removing the surface litter. Air-dried, sieved (<2 mm) and powdered soils were acid-digested with reverse aqua regia using a high-pressure microwave reaction system. REE contents were quantified by ICP-MS with appropriate quality control. The total average REE content was 147 and 154 mg/kg in two plots from Kanneliya and 28.7 and 31.2 mg/kg in Sinharaja plots. The mean REE content varied in the order Ce>La>Nd>Pr>Gd>Sm>Dy>Er>Tb>Eu>Ho>Tm>Lu in all four forest plots. Higher light-REEs (LREEs; La to Eu) with depleted Eu were significant features of forest soils. The upper-continental crust normalized REE distribution patterns also showed that LREEs are enriched in Kanneliya compared to the Sinharaja sites. These variations can be attributed to differences in primary mineralogy and degree of weathering, which controls the type and amount of secondary minerals in the soil profiles. In general, more intense weathering produced kaolinite group minerals that are preferentially retained REE, in particular LREE leading to higher fractionation of LREE/HREE. Further studies are required to investigate the soil clay mineralogy of selected TLRFs to build up relationships with already available REEs data.

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Keywords: Rare-earth elements (REEs), tropical lowland rainforest (TLRF), Upper-continental crust REEs patterns