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Rare-earth mobility across an interface and also beyond between selected soil clay mineral particles and roots of a selected plant interface: A view based on an experimental study.

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Some recent suggestions of the essentiality of rare-earth elements (REE) for plants have generated much interest in gathering information about processes of mineral weathering in root environments and acquisition of REE by plants from such environments. An additional recent interest on plant acquisition of metals is gaining ground in finding out the measures of plant contribution of various metals present in river water at a regional or global scale. To monitor the path of transfer of REE from a clay mineral rich soil medium to roots of a plant, a species of poplar plant (Populus eugenei) was grown, using small cuttings of stems from a previous poplar plant, in a Ca-smectite clay as a soil medium under a laboratory condition. The <2-micrometer fraction of the clay prior to the planting of the poplar had a total REE concentration of 275 ppm . In contrast , the root attached >2-micron fraction clay had a concentration of 203 ppm. The relatively low concentration for the root clay was accompanied by a slight enrichment in LREE (light rare-earth element) with a small Ce negative anomaly as compared to the equivalent fine clay fraction having no influence of the plant.

The translocation of the clay REE from the apparently rhizosphere environment to the roots was, as expected in conformity with the REE fractionation that was observed in the root clays, marked by an enrichment in HREE (heavy rare-earth element), but with some positive Ce, Eu, and Gd anomalies, for the plant roots relative to the clays attached to the roots. The total REE concentration of the plant roots was nearly 39 ppm per gram of dry material.

New stems grown from earlier (older) stems had REE concentrations of about 0.19 ppm per gram of dry material, whereas old stems from which new shoots grew (making up the new stems) had concentrations of about 0.22 ppm per gram of dry material. The new stems were found to be only slightly enriched in LREE but with a positive Eu anomaly relative to the older stems from which the new stems grew.

The leaves that grew from new stems had a REE concentration of nearly 14 ppm per gram of dry material. The new leaves, however, were HREE enriched with negative anomalies of Sm, Eu, and Gd relative to the new stems from which the leaves grew.

The REE patterns in plant organs are reflective of intercellular processes of enzyme influence coupled with reductive adsorptive mechanisms. If river waters could be found with an HREE trend for the dissolved REE, plant organs releasing such REE following decomposition could be a contributing factor to this trend in river waters.