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Characterizing multiple water-rock interactions in the critical zone through Sr-isotope tracing of surface and groundwater.

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Abstract

Here, we report on Sr isotopes, from shallow and deep groundwater from catchments located on granite and schist around the world. This extensive approach of Sr isotope tracing, initiated in France on areas impacted by intensive agricultural activities, was enlarged to Africa (granite-gneiss and schists 2200-700 Ma of the Congo Basin; Archaean granitoid/gneisses and sedimentary greenstone 3700-2500 Ma of the Orange River); India and Nepal (Archean granites 2500 Ma and Palaeoproterozoic granodiorite and schists 3100-1600 Ma for India; Himalaya metamorphic, silicate metasediments and gneisses 630 to 490 Ma); North America (3500 to 2500 Ma silicate rocks in the Mackenzie basin; 1000 to 70 Ma silicate rocks in the Fraser Basin in Canada and 1760 to 1430 Ma anorthosite and granite in the Laramie aquifer in Wyoming); South America in French Guiana (Archean gneiss 3400 to 2700 Ma and granite-gneiss rocks 2300 to 1900 Ma); Australia (65 Ma arenaceous and argillaceous rocks; and considering both surface and groundwater). In this extensive approach, the Sr and Mg contents are well correlated and both are partly related to agricultural and weathering inputs. The relationship between Sr- isotope and Mg/Sr ratios allows definition of the relative impact on surface and groundwater of processes occurring in the Critical Zone, mainly rain, agricultural practices and water-rock interactions.

Keywords: strontium isotope, critical zone, weathering, regolith

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