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Cerium isotope composition in latosol profile developed from Zhanjiang

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Chemical weathering of silicate rocks (e.g., basalt, granite) is a critical component of the long-term carbon cycle. By consuming atmospheric CO_2 and converting it into dissolved bicarbonate ions (HCO_3^-), regulating Earth's climate over geological timescales. The Zhanjiang, Leizhou Peninsula is one of the provinces in southern China with the largest exposed area of late Cenozoic basaltic rocks. The area belongs to a tropical monsoon climate, with an annual rainfall of ~1600 mm and an average temperature of 23°C, representing a favorable environment for latosol development. Therefore, this profile has been widely used in the study of various isotopes (such as Ba, V, Fe, and Li isotopes) during chemical weathering processes.

Cerium (Ce), a redox-sensitive element, has been demonstrated to serve as an effective redox tracer in low-temperature environments. In this study, we analyze Ce concentrations and isotopic compositions in soil and bedrock samples. The profile exhibits pronounced variability in Ce concentrations (22.5–209.7wt.%) and reveals substantial Ce redistribution, evidenced by $\tau_{Th,\ Ce}$ (%) values ranging from −36.26% to 170.86%. However, the $\delta^{142/140}$Ce values display a limited range from -0.048‰ to 0.047‰, which is similar to weathered gabbro ($\delta^{142/140}$Ce =0.028 ± 0.035‰) and bedrock ($\delta^{142/140}$Ce =0.015 ± 0.046‰) within analytical uncertainty. The relatively uniform $\delta^{142/140}$Ce values observed in the Zhanjiang section suggest that cerium likely did not undergo oxidation from Ce^{3+} to Ce^{4+} during its migration. This finding provides crucial insights into the mechanisms governing the transfer of Ce from terrestrial environments to the ocean, enhancing our understanding of global Ce cycling.