

Rubidium isotope ratios of seawater and marine sediments as the weathering proxy

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Rubidium (Rb) is an alkali metal with a large ionic radius and two isotopes: ⁸⁵Rb (72.17%) and ⁸⁷Rb (27.83%). We indicate that Rb forms inner-sphere complexes within 2:1 phyllosilicates such as illite and vermiculite. This is because hydrated Rb ions exhibit longer bond distances compared to the adsorbed ions. This process results in stable isotope fractionation, where heavy isotopes are preferentially retained in the adsorbed Rb. In marine environments, adsorption onto phyllosilicates is the dominant process (Derkowski and McCarty, 2017). Thus, Rb stable isotope ratios ($\delta^{87}\text{Rb}$) of marine sediment and seawater could reflect the mass balances between clay minerals and seawater. Since chemical weathering produces clay minerals, the $\delta^{87}\text{Rb}$ of seawater and marine sediment would be an indicator of surface weathering intensity, offering potential applications in paleoenvironmental reconstruction and material cycle analysis.

To evaluate that application, we measured $\delta^{87}\text{Rb}$ in seawater and marine sediment samples using multi-collector inductively coupled plasma-mass spectrometry (MC-ICP-MS), Tokyo University, Japan. Particularly, the

The $\delta^{87}\text{Rb}$ of the seawater show a much heavier value) than that of bulk silicate earth (-0.13‰; Wang et al., 2023) and the marine sediment, have been prepared by the Geological Survey of Japan (JMS-2; $0.02 \pm 0.03\text{‰}$). This supports the fractionation between clay minerals and seawater would weigh its $\delta^{87}\text{Rb}$, while $\delta^{87}\text{Rb}$ of marine sediment reflects the retention of lighter Rb isotope on land considering the high distribution of Rb to marine sediments relative to that in seawater.