

Authigenic uptake accounts for the marine potassium budget

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Potassium (K) is a major cation in seawater, but its budget remains not well understood. Marine authigenic clays are assumed to have played a substantial role in regulating the seawater chemistry and Earth's climate. However, the global importance of K-rich authigenic clays for the marine K budget remains poorly quantified. Here, we investigated the K/Al ratio of particulate matter and its spatial variations along the Changjiang (Yangtze) River-Estuary-East China Sea transect, aiming to reveal the influence of authigenic uptake processes on the marine K budget. By combining our new data on the K composition of various sediment and porewater samples with previously published data, we found that the K/Al ratio of marine particulates is substantially higher than that of the riverine endmember, with the averages of 0.31 ± 0.04 and 0.25 ± 0.02 , respectively. Combined with the observation of decreasing K concentration with depth in porewater and an increasing abundance of green grains towards the shelf, we propose that these geochemical changes are caused by the authigenic uptake of K from the porewater/seawater. Our preliminary calculation suggests that when upscaled to all the river-dominated ocean margin, the global uptake flux of K is approximately $81 \pm 62 \text{ Tg yr}^{-1}$, which is comparable in magnitude to the dissolved flux coming from global rivers, highlighting the pivotal role of authigenic mineral formation in modifying the geochemistry of seawater and marine sediments.