

Using lithium isotopes to reconstruct continental weathering from bulk sedimentary records at continental margins

CHENGFAN YANG¹ AND SHOUYE YANG²

¹State Key Laboratory of Marine Geology, Tongji University

²State Key Laboratory of Marine Geology, Tongji University, Shanghai, China

Continental weathering plays a crucial role in regulating global climate. Continental margins, where high-resolution and well-dated sedimentary archives are easily accessible, are thought to be an ideal place for investigation of past weathering processes and climate changes. However, influences of hydrodynamic sorting and lithologies generally result in ambiguity when explaining geochemical proxies of bulk sediments. Several lines of evidences also demonstrate that sedimentary archives are potentially sensitive to oceanic circulation changes, which further complicates the weathering studies. Therefore, recognition of effective weathering information in sedimentary records is prerequisite for past weathering investigation at continental margins. In this study, elemental and lithium (Li) isotopic compositions of suspended particulate matter (SPM) in the Changjiang (Yangtze River) catchment and of Holocene sediments from Core MD06-3040 drilled from the East China Sea inner shelf are analyzed. $\delta^7\text{Li}$ values of SPM range from -2.8‰ to -0.8‰, systematically lower than the core sediments (-0.5 – 0.7‰), despite their similar grain sizes as indicated by Al/Si ratio. Evidenced by elevated Li/Al and $\delta^7\text{Li}$ values, we infer that estuarine flocculation and resuspension physically alter particulate chemical compositions, possibly by mineralogical differentiation. This is further supported by Li isotopic mass balance model, which quantitatively demonstrate a decline of weathering product by ~15% in core sediments, relative to the riverine SPM. This may result in underestimate of CO_2 consumption by calculating base cations' loss based on marginal sediments. Additionally, variations of terrestrial weathering products and un-weathered igneous components in marine core sediments are respectively determined by the East Asia Summer and Winter Monsoon, serving as indicators of paleoclimate. Overall, this study provides novel proxies for past weathering and paleoclimate reconstruction, highlighting processes which could physically alter weathering signals at continental margins.