

Carbonate weathering drives magnesium isotopes in large rivers: Insights from the Yangtze River

YANG XU^{1,2}, DR. ZHANGDONG JIN SR.¹, LONG-FEI
GOU¹, ALBERT GALY³, CHENYANG JIN⁴, CHEN CHEN¹,
CHENZI LI^{1,2} AND LI DENG¹

¹Institute of Earth Environment, Chinese Academy of Sciences

²University of Chinese Academy of Sciences

³CRPG-CNRS-Université de Lorraine

⁴State Key Laboratory of Marine Geology, Tongji University,
Shanghai

Presenting Author: xuyang@ieecas.cn

Carbonate weathering regulates the short-term climate variation and carbon budget due to its fast response to hydrological processes, and needs to be well constrained to better understand the climate change at short time scale. As a new isotope method, magnesium (Mg) isotopes have great potential to trace carbonate weathering due to its sensibility to the earth surface processes. However, how river Mg isotopes respond to carbonate weathering is unclear. Global large rivers dominate weathering flux into the oceans at continental scale, but systematically spatial study on Mg isotopes in global large rivers is rare. In this study, the Yangtze River drainage basin (YRDB) was selected to test how river Mg isotopes ($\delta^{26}\text{Mg}$) to trace carbonate weathering under a wide range in lithology, geomorphology and climate. Results show that river $\delta^{26}\text{Mg}$ values show a decreasing trend from the headwater to the mainstream ranging from -1.36‰ to -0.59‰ within the YRDB. The strong negative correlations between river $\delta^{26}\text{Mg}$ and carbonate weathering rate (CWR) and intensity (CWI) show a preferential and sensitive response of riverine $\delta^{26}\text{Mg}$ to the carbonate weathering flux. In a compilation of Mg fluxes and $\delta^{26}\text{Mg}$ in global largest rivers, there is similar dominance of carbonate weathering on riverine Mg fluxes and isotopes. Therefore, we propose that river $\delta^{26}\text{Mg}$ in global large rivers can be a robust tracer of CWI. In the future, any intensifying carbonate weathering under global warming would cause Mg isotopic signature lighter in global large rivers, tending to increase riverine Mg and carbon fluxes into the oceans, regulating the global Mg cycle and carbon budget over short timescales.