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Constraints on Weathering Spikes by Stable Tungsten Isotope during the Past 300,000 Years

SHU LIU[1], RONG HU[1], TAO LI[2], RUIYU YANG[3] AND GAOJUN LI[1]

[1]Nanjing University
[2]Nanjing Institute of Geology and Palaeontology
[3]University of Cologne
Presenting Author: lkr2000ls@163.com

How the continental weathering fluxes have responded to the Quaternary glacial-interglacial (G-IG) climate cycles is debated, which is critical to understand the effects of climate change on weathering. With a residence time of ~4,000 years and riverine input as the dominant source[1], tungsten(W) and its stable isotope composition ($\delta^{186/184}W$) in the seawater could hopefully document the variation of weathering flux in the glacial-interglacial timescale. Here, we present a stable W isotope record of ocean sediments from ODP Site 834A at Lau Basin on a high temporal resolution during the past 300,000 years to constrain the weathering flux changes. Our record shows that while the $\delta^{186/184}W$ of seawater remained stable overall in the studied period, rapid fluctuations up to 0.1‰ occurred during major G-IG transitions. Based on a simplified mass balance model, we propose that the documented oceanic $\delta^{186/184}W$ shifts were driven by the "weathering spikes" following the glacial terminations, corresponding to 5~10 fold increase in weathering fluxes. This suggests that W isotope has the potential to investigate the relationship between continental weathering and climate change.

[1]R. Yang et al. (2022), Geochimica et Cosmochimica Acta 322, 227-243.