Isotopic constraints on riverine sulfur sources: a global perspective

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The sulfur cycle plays an important role in global climate, via weathering reactions and aerosol forcing, and it is also intimately linked to the cycling of carbon and oxygen. However, many aspects of the modern sulfur budget are not well understood. We present new $\delta^{34}S$ measurements on aqueous sulfate from more than 50 rivers from different geographical and climatic regions. These data were measured by a new MC-ICP-MS method that requires only 10 nmol of sulfate [1], with typical uncertainties of only 0.1‰ in the isotope ratio. More than 50% of the world's freshwater flux to the ocean is accounted for in this estimate of the global riverine sulfur isotopic budget. Combined with major anion and cation concentrations, the sulfur isotope data allow us to tease apart the relative contributions of different processes to the modern riverine sulfur budget, including the oxidative weathering of pyrites, the weathering of sedimentary sulfates, and anthropogenic influences. These data yield important insights into the modern sulfur cycle and the weathering of sulfur bearing minerals, and are first order terms in balancing the modern sulfur isotope budget. The large range of sulfur isotope ratios in modern rivers has implications for our intepretation of the past changes in the sulfur isotopic composition of seawater. Secular changes in the lithologies exposed to weathering through time could play a major role in driving the variations in $\delta^{34}S$ in seawater over the Phanerozoic.

[1] Paris et al. (2013), *Chemical Geology* **345**, 50-61.