The role of sulfur cycling in carbonate weathering: Isotope geochemistry of sulfur in the Wujiang River catchment, Southwest China

Yingkui JIANG[1, 2], Congqiang LIU[1], Faxiang TAO[1]

[1] *The state Key Laboratory of Environmental Geochemistry, Institute of Geochemistry, Chinese Academy of Science, Guiyang 550002, China*

[2] *Graduate School of the Chinese Academy of Sciences, Beijing 100039, China*

Water samples from the Wujiang River, a typical karst river system, were analyzed for major ion concentrations and $\delta^{34}S$ values of dissolved sulfate in order to identify the sources of sulfate, quantify the sulfate export flux and understand the role of sulfur cycling in chemical weathering rate of carbonate. Spatial variations in sulfate concentration and sulfur isotopic composition of tributaries over the catchment area are obvious, allowing to decipher S sources between rocks and atmosphere. According to the variations in sulfate concentration and isotopic composition, it is inferred that sulfate ions in the upper-reach river waters may have three sources, rain water, sulfate resultant from oxidation of pyrite in coal, and sulfate from sulfide deposits. In the lower reaches, the S isotopic composition of the samples lies mainly on a mixing trend between evaporite sulfate and rainwater sulfate, the contribution of sulfate from oxidation of pyrite being lesser. A pronounced seasonal variation in both content and isotopic composition of sulfate characterizes the Wujiang River. The average sulfate concentration of the waters is 0.65 mmol/L in winter, 0.17 mmol/L higher than that in summer. River water $\delta^{34}S$ values range from -15.7‰ to 18.9‰ in winter, while the $\delta^{34}S$ values of river waters in summer vary to a lesser extent than in winter, from -11.5‰ to 8.3‰. The $\delta^{34}S$ values of the main stream range from -6.7‰ to -3.9‰ in summer, averaging 3‰ lower than in winter. This indicates that in summer, when the discharge increases, the contribution of a source enriched in light isotopes to the atmosphere or the oxidation of pyrite in coal is more important. The sulfate export flux of the Wujiang River is calculated to be about 172×10^{10} g/a, the export flux in the high-flow period accounting for 80% of the total. Sulfide oxidation (sulfuric acid production) and subsequent weathering of carbonate are important processes in the study area. We determined that in summer about 75% of the riverine sulfate in the Wujiang River could be produced by sulfide oxidation. The relative contributions from rainwater and evaporite sulfate are only 20% and 5%, respectively. As a result, the erosion rate of carbonate by sulfuric acid is on the order of 35.1 t/km^2/a (17.5 mm/ka) and the CO_2 consumption rate is reduced approximately by 3.66×10^5 mol/km^2/a.

Key words sulfur isotope; carbonate weathering; export flux; Wujiang River

Soil carbon stock of the Central-East Asia in the climate warming

Xinqing LEE, Daikuan HUANG, Wei JIANG, Zhaodong FENG, Hongguang CHENG, Qian JIANG

[1] *The State Key Laboratory of Environmental Geochemistry, Institute of Geochemistry, Chinese Academy of Sciences, Guiyang550002, China*

[2] *National Laboratory of Western China's Environmental System, Ministry of Education, Lanzhou University, Lanzhou730000 , China*

Central-east Asia at the middle latitude has experienced a trend of climate warming, which is similar to the general trend of the whole northern hemisphere since the middle 1970s. The increase in air temperature has reversed the tundra ecosystem at the high latitude from a net CO_2 sink to a source, inducing system-wide responses to the climate change. Whether the warming has disturbed the balance of soil carbon stock at the middle latitude as it has done at the high latitude, this is a question that is crucial to our understanding of feedbacks of the terrestrial carbon pool and for decision-making in the adaptation to the change. Surface soil samples were collected every 5 cents of latitude along a transect that starts from the northern slope of the Qinling Mountain south of the city Baoji in Shanxi Province, central China, and ends at the border of Mongolia with Russia, near Hanhayn Huryee of Hovsgol Nuur. Carbon content along the transect correlates significantly with the July temperature or, to a maximum extent, to the temperature from May through to September, suggesting that the carbon stocks are constrained by the temperature from, over the largest range, late spring to early autumn. While the temperature increases at the middle latitude during the recent climate warming in winter and early spring, with almost no change in other seasons. Our results indicated that under current regime and increasing magnitude of temperature, the warming has not led to the equilibrium of e soil carbon stocks at the mid-latitude.

Key words soil carbon sequestration; climate change; Central-East Asia; Mongolia; China