

Chemical weathering rates in the Changjiang Basin

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This study focuses on the chemical and Sr isotopic compositions of the dissolved load of the rivers of the Changjiang Basin which is one of the largest riverine systems in the world, covering different lithologies and submitted to various climatic conditions from its source located in the Northeastern Tibetan Plateau to the East China Sea. We report the analysis of major elements and Sr isotopic composition for samples collected in August 2006 in the main tributaries and the main Changjiang channel. Using elemental ratios and Sr isotopic compositions, we were able to distinguish the different sources explaining the variations of water chemical composition. Carbonate weathering dominates in the Changjiang watershed and its rate ranges from 17 t/km²/yr to 56 t/km²/yr and averages 36 t/km²/yr for the Changjiang main channel, while the silicate weathering rate is relatively low, ranging from 0.7 t/km²/yr to 7.1 t/km²/yr, averaging 2.2 t/km²/yr for the Changjiang main channel. In total, the chemical weathering rate for the Changjiang is around 40 t/km²/yr or 19 mm/kyr, in the same range as that observed for the Ganges-Brahmaputra system. We also paid a particular attention to decipher the different sources of protons involved in the weathering reactions and estimated that sulphuric acid plays a major role in chemical weathering reactions for some sub-basins. A first budget of the CO₂ consumption by chemical weathering for the Changjiang was addressed and CO₂ consumptions by silicate and carbonate weathering are estimated to be 191×10⁹ mol/year and 646×10⁹ mol/year, respectively. We observe that the first factor which controls the silicate weathering rate is the physical denudation rate.

Kinetics of indirect UO₂ oxidation by Mn(II)-oxidizing *Bacillus* spores

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Reductive immobilization of U(VI) as U(IV)O₂ has been widely explored as a feasible approach for remediating uranium contaminated sites. Many soil bacteria, including *Bacillus* sp., oxidize Mn(II) to Mn(IV) oxides which, in turn, chemically oxidize UO₂ to U(VI), thereby mobilizing uranium. We are investigating UO₂ oxidation coupled to bacterially-catalyzed Mn(II) oxidation in order to better understand the environmental constraints controlling the stability of UO₂ and the kinetics of UO₂ oxidation. We have conducted experiments using spores of the *Bacillus* sp. strain SG-1 to investigate changes in the oxidation rate of synthetic and biogenic UO₂ with varying concentrations of synthetic and biogenic MnO₂. In addition, we also measured the changes in O₂ uptake and the key parameters of the Michaelis-Menten kinetics (K_m and V_{max}) associated with bacterial Mn(II) oxidation as concentrations of synthetic and biogenic UO₂ varied. Biogenic MnO₂ produced by *Bacillus* sp. SG-1 oxidized biogenic UO₂ up to four times faster than synthetic UO₂ and more effectively than synthetic MnO₂. The rates of enzymatic Mn(II) oxidation as a function of Mn(II) concentration conformed to the Michaelis-Menten kinetics; rates of Mn(II) oxidation in the presence of different concentrations of U(IV) indicated a competitive type of inhibition where the V_{max} values were unaffected by UO₂ concentration, but the K_m values increased with increasing UO₂. This inhibition does not appear to be directly related to the properties of UO₂ itself but rather to the formation of soluble UO₂²⁺ which inhibits the enzymatic Mn(II) oxidation.