

## 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/km<sup>2</sup>/yr to 56 t/km<sup>2</sup>/yr and averages 36 t/km<sup>2</sup>/yr for the Changjiang main channel, while the silicate weathering rate is relatively low, ranging from 0.7 t/km<sup>2</sup>/yr to 7.1 t/km<sup>2</sup>/yr, averaging 2.2 t/km<sup>2</sup>/yr for the Changjiang main channel. In total, the chemical weathering rate for the Changjiang is around 40 t/km<sup>2</sup>/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 CO<sub>2</sub> consumption by chemical weathering for the Changjiang was addressed and CO<sub>2</sub> consumptions by silicate and carbonate weathering are estimated to be 191×10<sup>9</sup> mol/year and 646×10<sup>9</sup> mol/year, respectively. We observe that the first factor which controls the silicate weathering rate is the physical denudation rate.

## Kinetics of indirect UO<sub>2</sub> oxidation by Mn(II)-oxidizing *Bacillus* spores

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Reductive immobilization of U(VI) as U(IV)O<sub>2</sub> 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 UO<sub>2</sub> to U(VI), thereby mobilizing uranium. We are investigating UO<sub>2</sub> oxidation coupled to bacterially-catalyzed Mn(II) oxidation in order to better understand the environmental constraints controlling the stability of UO<sub>2</sub> and the kinetics of UO<sub>2</sub> 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 UO<sub>2</sub> with varying concentrations of synthetic and biogenic MnO<sub>2</sub>. In addition, we also measured the changes in O<sub>2</sub> uptake and the key parameters of the Michaelis-Menten kinetics (K<sub>m</sub> and V<sub>max</sub>) associated with bacterial Mn(II) oxidation as concentrations of synthetic and biogenic UO<sub>2</sub> varied. Biogenic MnO<sub>2</sub> produced by *Bacillus* sp. SG-1 oxidized biogenic UO<sub>2</sub> up to four times faster than synthetic UO<sub>2</sub> and more effectively than synthetic MnO<sub>2</sub>. 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<sub>max</sub> values were unaffected by UO<sub>2</sub> concentration, but the K<sub>m</sub> values increased with increasing UO<sub>2</sub>. This inhibition does not appear to be directly related to the properties of UO<sub>2</sub> itself but rather to the formation of soluble UO<sub>2</sub><sup>2+</sup> which inhibits the enzymatic Mn(II) oxidation.